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Enhancement of Post-Editing Performance: Introducing Machine Translation Post-Editing in Translator Training

Olena Blagodarna

Universitat Autònoma de Barcelona

Doctorat en Traducció i Estudis Interculturals

Departament de Traducció i d'Interpretació i d'Estudis de l'Àsia Oriental

Olena Blagodarna

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Dra. Pilar Sánchez Gijón

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List of abbreviations

ANECA – Agencia Nacional de la Evaluación de la Calidad y Acreditación

CASRO – Council of American Survey Research Organizations

CAT – Computer-Aided Translation

CBT – Competency-Based Training

DQF – Dynamic Quality Framework

EHEA – European Higher Education Area

EMT – European Master in Translation

GILT – Globalization, Internationalization, Localization, Translation

ISO – International Standard Association

LD – Levenshtein Distance

LSP – Language Service Provider

MQM – Multidimensional Quality Metrics

MT – Machine Translation

MTPE – Machine Translation Post-Editing

NMT – Neural Machine Translation

OECD – Organization for Economic Cooperation and Development

PE – Post-Editing

PL – Programmed Learning

QA – Quality Assurance

SL – Source Language

SMT – Statistical Machine Translation

TAP –Think Aloud Protocol

TAUS – Translation Automation Users Society

TL – Target Language

TM – Translation Memory

TS – Translation Studies

WPH – Words Per Hour

Abstract

The key objectives of this thesis were to explore the profile of translators involved in post-editing, to outline the scope of required competencies and skills and to suggest a valid training proposal that would enhance post-editing performance of novice post-editors in conformity with the European Higher Education Area requirements.

The thesis integrated two sequential studies: a survey-based research that yielded authentic information concerning post-editors' profiles and practices and an empirical-experimental research that put the suggested training model to the test and involved a total of 46 translation students in the final year of their Bachelor's program. To collect conclusive evidence about the applicability of the proposal across different linguistic backgrounds, the study focused on 22 participants who were students at Kharkiv National Aerospace University (Ukraine) and specialized in English-Russian translation, and 24 participants who were students at Universitat Autònoma de Barcelona (Spain) and specialized in English-Spanish translation. The suggested training model pursued acquisition of conceptual and operational knowledge by the trainees and was incorporated in a pretest-posttest experimental study. The impact of such model was examined by the evaluation of the quality of post-edited segments and throughput rates demonstrated by the participants as well as the students' attitudes to MTPE-related issues and self-evaluation of their post-editing performance before and after the training. The thesis ends with reflections upon the changes that might be brought to the proposal if neural machine translation systems were used to generate the training corpus.

The dissertation contributes to the definition of the scope of post-editors' professional expertise, offers a scalable training model and describes to what extent such model may enhance post-editing performance in undergraduate translation students.

Keywords: machine translation post-editing, post-editing competency, enhancement of post-editing performance, translator training, training model, survey, experimental study.

Resumen

Los objetivos clave de esta tesis fueron explorar el perfil de los traductores involucrados en posedición, establecer el alcance de las competencias y habilidades requeridas, y sugerir una propuesta de formación válida que mejore el rendimiento de los post-editores noveles de acuerdo con los requisitos del Espacio Europeo de Educación Superior.

La tesis integró dos estudios secuenciales: una investigación basada en una encuesta que proporcionó información real sobre los perfiles y prácticas de los post-editores, y una investigación empírico-experimental que puso a prueba el modelo de formación sugerido e involucró a un total de 46 estudiantes de traducción en el último año de su licenciatura. Para recoger pruebas concluyentes sobre la aplicabilidad de la propuesta en diferentes contextos lingüísticos, el estudio se centró en 22 participantes que eran estudiantes de la Universidad Aerospacial Nacional de Kharkiv (Ucrania) especializados en traducción inglés-ruso, y 24 participantes que eran estudiantes de la Universidad Autónoma de Barcelona (España) especializados en traducción inglés-español. El modelo de formación sugerido perseguía la adquisición de conocimientos conceptuales y operativos por parte de los participantes y se incorporó en un estudio experimental antes y después de la prueba. El impacto de dicho modelo se examinó mediante la evaluación de la calidad de los segmentos post-editados y las tasas de rendimiento demostradas por los participantes, así como las actitudes de los estudiantes hacia los temas relacionados con el traducción automática y posedición y la autoevaluación de su rendimiento antes y después de dicha formación. La tesis termina con una reflexión sobre los cambios que podrían introducirse en la formación si se utilizaran sistemas neurales de traducción automática para generar el corpus de formación.

La tesis contribuye a la definición del alcance de la experiencia profesional de los post-editores, ofrece un modelo de formación escalable y describe hasta qué punto dicho modelo puede mejorar la posedición de los estudiantes universitarios de traducción.

Palabras clave: posedición de traducción automática, competencia en posedición, mejora del rendimiento de posedición, formación de traductores, modelo de formación, encuesta, estudio experimental.

Introduction

The phases and steps of translation jobs in the GILT (Globalization, Internationalization, Localization, Translation) industry are undergoing dramatic changes provoked by massive incorporation of machine translation (MT) systems. In 2010 the view was put forward that 42% of language services providers (LSPs) offered their clients MT solutions (DePalma et al., 2010), five years later the results of the pan-Spanish survey conducted by ProjecTA research group (UAB, 2015) showed that nearly 48% of LSPs used MT in their professional workflow. The recent TAUS Machine Translation Market Report (2017) estimates the revenues from the MT market as nearly 130 million US dollars, while this figure is likely to skyrocket by 2022 and make nearly 983 million US dollars as estimated by MT Industry Report by Grand View Research (2015). Every day that the number of companies investing in translation engines grows, the demand for post-editing (PE) services rises favorably. This means that the machine translation post-editing (MTPE) model will keep increasing its importance in the years to come and will finally be used by a significant sector of the translation industry. In parallel with the MTPE industry, research is being conducted on numerous MTPE-related issues, including integration of MT with commercial CAT-tools (Beaton and Contreras, 2010), measuring the relation of PE effort to MT output quality (Guerberof, 2009; Thicke, 2011; Plitt and Masselot, 2010; Specia and Farzindar, 2010; Specia, 2011), estimating post-editors' productivity (Guerberof, 2008; O'Brien, 2011) and defining the correlation of professional experience in translation with post-editing performance rates (O'Brien and de Almeida, 2010). Besides improving return-on-investment, project throughput and output quality parameters, gradual introduction of PE practices into the industry also helps translators to no longer feel threatened by the machine and learn "to reap as much benefit as possible from what the computer gives" (Senez, 1998: 293).

Keeping these tendencies in mind, Anthony Pym (2012) propounds the view that machine translation is likely to bring dramatic changes and turn most translators into post-editors, and calls for reevaluation of existing training programs. Although such predictions might be far-fetched, training in post-editing is crucial for making MTPE viable for the needs of the translation industry (Krings and Koby, 2001: 12). To this end, more and more attention starts being paid to the PE process with a particular focus on how training in post-editing may improve current practices within the translation industry (O'Brien, 2006, 2011; García, 2010). Researchers have come up with ideas on skills and abilities that a professional post-editor should possess for efficient post-editing (O'Brien, 2011; Rico Pérez, 2012; Sánchez-Gijón, 2016). In conformity with the obtained data the courses and workshops arranged by industry stakeholders (e.g., SDL Trados, Systran or TAUS) are already offering PE training to all those interested. The training is mostly focused on MT systems types, basic notions of MT systems development, evaluation of MT systems, controlled language, pre-editing and post-editing practices, setting up an MT project, differentiation among quality levels, performing practical activities for typical errors of particular language pairs and others.

There can be no doubt that the changes listed above are bound to influence the way translators perform their professional duties, which means that academic institutions are expected to foresee possible professional changes in the field and introduce new training modules into their curricula. Meanwhile, it is worth mentioning the concern regarding the fact that the presence of machine translation contrasts with the nearly complete absence of curricula related to this issue (Piqué Huerta and Colominas, 2013).

As of today, the translation industry has not defined clear boundaries for eligibility criteria involved in job descriptions of different roles (Marinelli, 2017). It is reported that recruiters often look for profiles of linguists with coordination skills, project managers with sales skills, salespeople with project management skills, etc. In other words, there is a high demand for multi-skilled, technical savvy candidates trained in the ability to switch roles, e.g., from translator and/or project manager to business development manager and/or solution architect. In this circumstance adaptability, flexibility and curiosity are crucial in order to adjust rapidly to new market conditions and disruptive technological changes. For this reason, the European Higher Education Area (EHEA) makes it clear that to succeed in their careers, university graduates are expected to employ a range of abilities, skills, and attitudes, as well as demonstrate expertise in their respective subject-fields. Thus, the ultimate aim of academic translation training programs is adaptation of curricula to competency-based requirements and preparation of flexible and adaptable experts who are able to acquire new skills and competencies through guided and/or autonomous learning, quickly adapt to varied professional situations and thus become proactive and efficient players of the globalized world.

PE competency is a relatively new area of research and the ways in which post-editors can acquire it have been given insufficient academic attention to date. Currently, there are no widely accepted training proposals for acquisition and enhancement of such competency. However, many renowned scholars (O'Brien 2002; Rico Pérez and Torrejón, 2012; Guzman, 2007; Guerberof Arenas et al., 2012) show their interest towards research on PE skills, strategies and techniques, resources and technical means available for PE, etc. Academic environments put forth specific proposals on the introduction of MTPE modules in the classroom (Austermuehl, 2013; Doherty and Moorkens 2013; Doherty and Kenny, 2014; Martin-Mor and Piqué i Huerta, 2017), accompanied by a description of PE-related tasks and processes, central and peripheral PE skills (Rico Pérez and Torrejón, 2012).

All the above-mentioned facts triggered our interest in MTPE as a recently emerged phenomenon and the underlying concept of PE competency acquisition and enhancement. For this reason, an in-depth investigation into professional profiles of post-editors and incorporation of the obtained results into a specialized training model is undertaken. This research is a conscious effort to contribute to the adaptation of academic syllabi to address the new challenges of the translation landscape with respect to EHEA requirements.

Research objectives

Improvements in PE training are bound to bring benefits for all parties involved in MTPE, including translators, LSPs and, ultimately, translation customers. Therefore, the primary objective of this research is to create a training proposal that would result in the enhancement of undergraduate translation students' PE performance and hence contribute to PE competency acquisition. More specifically, the research focuses on the following threefold construct: to begin, first-hand information about the background, skills and working routines of language experts engaged in MTPE is collected in order to highlight the profile of a post-editor and the scope of PE expertise; next, a training proposal is drafted and implemented so as to raise subjects' awareness of PE as an operation that is a linguistic task in its own right; finally, the results of such training proposal are collected and analyzed in order to evaluate how and to what extent it contributed to subjects' PE competency development.

Besides studying the scope of PE expertise and ways to boost PE competency among novice translators, attention is also paid to providing the subjects with an understanding of what changes MT brings to the translation profession, thus helping them to accept MTPE advantages and disadvantages and to further enhance PE competency acquisition. The researcher proposes that MT will not replace translators, but it will complement them, adding human value to MTPE processes. The practical use of this work is in establishing a reference point that could serve as a clear guideline for improving PE efficiency of anyone utilizing it for academic or in-house training.

The research outcomes are expected to make contributions on the conceptual, methodological and analytical levels. On the conceptual level, we target the problem of limited first-hand data on post-editors' profiles and the scope of professional expertise as well as publicly available training proposals for PE competency enhancement. On the methodological level, a training baseline for teaching in MTPE that takes into account EHEA requirements is provided. As for the analytical level, the experimental study results are thoroughly analyzed and the evidence of the impact of the suggested training on the participants is collected.

The thesis is a conscious effort to enhance coherence between translation students' academic and professional profiles by offering them a competency-based training proposal on PE. In this way, the far-reaching goal is to make a contribution to the debates on the design of such proposals and to share our vision of this issue with the broader public.

Research design framework

There is growing support for the claim that PE training must give trainees a comprehensive vision of professional processes and tasks, PE objectives, resources, and tools, as well as help students acquire self-learning techniques (Martín-Mòr et al., 2016: 10). To pursue that aim, a descriptive study is conducted to investigate multiple facets of the translation industry and professional PE performance. The data yielded by such inquiry are used for drafting a training proposal aimed at the enhancement of the participants' competency in PE. An empirical experimental study that follows examines how and to what extent PE competency may be boosted among translation students who were not previously exposed to a PE environment. The primary objective of our training model is that the subjects adopt a functional approach to PE and improve their PE performance at the end of the training.

To collect and systematize the research data a mixed-method approach is used, which combines quantitative and qualitative methods of analysis applied at different phases and for different purposes. Such combination of approaches for collecting and interpretation of data helps to benefit from both methods and minimize the limitations of each one, as well as provides grounds for "a research design with philosophical assumptions" (Creswell and Plano Clark, 2011).

The investigation integrates two sequential studies in order to collect the relevant data on the scope of the profile and skills of post-editors, apply these findings into a training proposal and measure the efficiency of the latter. During the first phase, authentic information on post-editors profiles is gathered through a specially designed questionnaire distributed among language experts currently engaged in PE. In this way, the data on the respondents' backgrounds, PE environments and scope of instrumental and technical skills, and the factors that influence decision making in PE is obtained. The respondents who are professional translators and/or post-editors also compare the level of professional expertise and job perception in translation vs. post-editing, as well as provide the ranking of PE-related skills and competencies.

In continuation, the input yielded by the survey-based study is used to draft a training proposal that is aimed at enhancing PE competency in undergraduate translation students. The investigation is based on experimental research with the total of 46 students in the final year of their Bachelor's program with two different working language pairs (EN-RU and EN-ES), and who were not previously exposed to any PE-related experience. The choice of the subjects rests on the premises that translation competence of undergraduate students in their fourth year of university training is characterized by the sufficient level of acquired knowledge, skills, and attitudes that can be expected from novice translators who are engaged into post-editing jobs at the beginning of their professional careers. The proposal might have involved the methods used in teaching translation and/or revision due to the author's belief that some of the tasks aimed at PE competence development are very much like those used to train translators/editors, albeit not identical. The suggested training focuses on boosting subjects' PE performance, measured by PE output and throughput rates.

It is believed that the suggested proposal would make a significant contribution to PE training and give rise to further research prospects.

Thesis structure

The thesis starts with an Introduction and finishes with Conclusions, List of references, List of Tables and Figures, and Appendices. Its three parts cover the following issues: Part I deals on the theoretical premises of the research and describes the outcomes of the survey carried out among acting post-editors, Part II describes the preparation and conduct of the experimental study, while Part III is dedicated to the analysis of the training results and follow-up considerations on the scope of the training from the viewpoint of neural and/or statistical MT engines used to generate the training corpus.

Part I covers fundamental concepts that underpin our research: the expansion of MTPE model across the translation industry and the need of specialized training of language experts, the evolution of training paradigms and EHEA requirement for training programs, and the scope of professional competencies of translators engaged in post-editing on a regular basis. Chapter 1 starts with an overview of the training paradigms of the 20^{th}-21^{st} centuries with a particular focus on social constructivism as the leading approach to knowledge construction and the applied training methodologies. Such methodologies are analyzed from the perspective of a competency-based training model widely adopted for academic purposes, which incorporates generic and specific competencies. In Chapter 2 the focus of our attention moves to translator training. An overview of training objectives prescribed by the Qualifications Framework of the EHEA is outlined. Next, we examine the recent changes in the translation industry provoked by the incorporation of MTPE models, and reflect on the scope of a post-editing assignment, PE skill set and specialized training. Chapter 3 reports on the preparation and outcomes of a survey *Sharing Post-Editing Practices,* which was designed with a focus on post-editors' profiles and scope of expertise. The survey sought answers to who the post-editors are, what their working conditions are like, how they exercise their professional activities and what their opinions regarding similarities and differences between translation and post-editing are.

Part II delves into the methodology, design, and conduct of the experimental study on the enhancement of PE performance among undergraduate students. In Chapter 4 the research construct is operationalized by singling out the two key indicators of PE competency, namely adoption and application of the range of adequacy and fluency criteria to PE output, on the one hand, and throughput rates, on the other. In continuation, MTPE-related attitudes and self-evaluation are considered as complementary indicators of PE competency. The use of the mixed-method approach for the study needs is justified by its capability to facilitate collection of quantitative and qualitative data for holistic analysis of the impact of the suggested training. Before proposing a student-centered training agenda, the training objectives are set forth focusing on the pursuit of conceptual and operational knowledge. The experimental study involves undergraduate translation students in their final year of training with English-Spanish and English-Russian as their working languages. This measure is expected to provide us with conclusive evidence and to demonstrate that the suggested training could be applied across different language pairs. The chapter also describes the process of the students' recruitment, selection of the study corpus, the instruments and tools needed for the training, and the training protocol. A pilot study is conducted to ensure the validity and reliability of the proposed training model. Such steps provide us with an opportunity to test the training methodology, selected tools and instruments, suitability of corpus and training content. The pilot test sheds light on the participants' responses and potential problems that arise in the course of the experiment both from participants' and researchers' perspectives. Upon completion of this phase, the relevant changes are introduced to the study design. Chapter 5 elaborates on how the full-scale experiment was conducted.

In Part III the study outcomes are analyzed and reflected upon, and in continuation, a neural MT perspective of the study is considered. To this end, Chapter 6 summarizes the outcomes of the training proposal, examines the quantitative data on PE performance by means of descriptive and inferential analysis, and tests the associative correlation between PE throughput and PE output values. Quantitative data assessment is followed by a description and interpretation of qualitative data collected by means of questionnaires. Finally, the correlations between PE performance and attitude towards MT are scrutinized to figure out how acceptance/rejection of MT may impact PE performance. Chapter 7 focuses on follow-up assumptions on how and to what extent the training corpus generated by neural and/or statistical MT systems would influence the proposal structure and its outcomes. To this end, the corpus used for the testing purposes is machine translated by alternative neural/statistical MT engines and the obtained segments are compared and contrasted against the ones used for the experimental study needs.

The Conclusions section highlights the central hypothesis, aims and objectives of the thesis, and provides an overview of the findings. Application of the thesis outcomes is discussed, as are the limitations of the present research and future lines of investigation.

Part I. Theoretical framework

Globalization, competition and dramatic increase of content for publishing created a massive demand for translation services. Meanwhile, new software solutions, availability of data to train machine translation (MT) systems, and open-code MT systems that offer opportunities for project-specific tuning contributed to the improvement of machine translation in the recent years. In this respect, automated translation is seen as "a way to maximize the amount of information available to customers and constituencies who speak other languages" (DePalma, et al., 2006). The service offered by the machine translation and post-editing (MTPE) model consists in translating content from the source language to the target language(s) by means of machine translation with the following post-editing of the obtained output. As such, machine translation is believed to help translators work efficiently by facilitating tedious and repetitive tasks. Available data suggest that the cutting-edge technology of today makes the MTPE model a viable solution for the growing needs of the translation industry (Federico, et al., 2012; Zampieri and Vela, 2014; Zhechev, 2014; Gaspari, et al., 2015).

The synergy created by MT advances and the increase of demand for post-editing has radically altered the translation industry landscape. There is growing research on the MTPE model dedicated to its different aspects, e.g., evaluation of MT output quality, comparison of MT errors produced by different engine types, measuring and evaluation of PE effort, tools and resources, or the scope of MTPE-related competencies and skills (Specia et al., 2010; Pym, 2013; Melby et al., 2014; Teixeira, 2014; Moorkens et al., 2015). From the academic viewpoint, it is expected that the presence of MTPE-related training content in teaching plans will also increase in the nearest future, although the available evidence proves that so far the academia has not kept the pace with such changes (Piqué Huerta and Colominas, 2013). In this concern, the claim is put forward that investigation in the field of MT contrasts with the nearly complete absence of curricula for editing MT output, otherwise called post-editing (PE).

With the aim to contribute into research on the place of the emerging MTPE phenomenon inside the academic environment and on the translation industry landscape, Part I explores the requirements of the European Higher Education Area (EHEA) and its focus on preparing future professionals for the challenges of the labor market. To this end, in Chapter 1 theoretical and practical premises behind the EHEA are described with special attention being paid to the competency-based approach to teaching and learning, on the one hand, and classification, evaluation, and assessment of competencies, on the other. Chapter 2 offers an overview of the present-day scope of translators training adopted by academia. Recent shifts in translation paradigm caused by massive digitalization are analyzed, and the spectrum of new translation modalities is examined. Next, a PE assignment is specified as a particular linguistic task, which is similar to translation, but not identical, with its proper scope of available technical means, standard routines, reference materials and accompanying resources. In continuation the skill set that enabling novice translators to post-edit is explored, and how these skills may be integrated into the training curriculum. Chapter 3 is dedicated to the preparation and conduct of a survey-based study on the scope of acting post-editors' expertise. To this end first a questionnaire is designed and tested, then the questionnaire form is distributed among practicing post-editors, with subsequent analysis of the obtained results that contribute to PE competency model definition.

Chapter 1. Overview of EHEA

The current agenda of the European educational policies is predetermined by the OECD's Definition and Selection of Key Competencies (2005), the European Commission's Key Competencies for Lifelong Learning (COM 2005, 2007), and the effect of competences on the European Credit Transfer System. Some of the prominent features of these documents are dynamism and evolution of competencies (Rué 2008), ability to update, expand, or restrict them through application to new professional situations (Pérez Gómez et al., 2009a, 2009b), transferability and demonstrability (Ledford 1995).

The modern society is in constant need of highly qualified experts who possess the capacity to communicate effectively and to continually renew their competences in order to assure the constant development of the former. To enter into a competitive and fast-changing labor market university graduates are expected to demonstrate relevant knowledge, skills, and attitudes. The challenge faced by educational institutions is to balance the academic curricula in a way so that the competencies acquired by students go in line with the professional demands made on them after graduation. To respond to these challenges the European Higher Education Area (EHEA) was created as a guarantee of the three-cycle educational system, quality assurance and recognition of qualifications.

The EHEA broadly welcomes numerous declarations and communiqués that stress the need to adopt a shift in training, reschedule curricula and solidify the bond between the academy and the industry. There seems to be a universal consensus that students' competencies need to be developed to link knowledge and skills acquired at university with what society requires of them (Salamanca Convention 2001; Wellmon, 2008). The cornerstone of this transformation is the application of competency-based training to academic context (Perez Cañado, 2013; Poblete Ruiz, 2006) as a response to the increasing demand of the industry for versatile and pro-active players. Vast adoption of competency-based training as the dominant trend at all educational levels is bound to bring new challenges for learners and educators. This situation implies drafting programs and establishing learning goals on the basis of practical needs, which are relevant to the requirements of the industry. To this end, the EHEA is currently focusing its efforts on the competency-based approach to teaching and highlights advantages of lifelong learning.

Under such circumstances, a training proposal should fit within a framework of three particular categories (Hurtado Albir, 2007). It should be adapted so that, first, it could be compared and recognized at the international level, second, would meet both the demands of society and the job market, and third, would correspond to new pedagogical models. To meet the last criteria, the EHEA suggests that the curricular design should be based on competency-based training principles. This strategy goes in line with the requirements on the involvement of students in the learning process in order to provide them with the tools for self-review both during their university courses and in their professional careers.

A large number of traditional academic programs are often aimed merely at knowledge acquisition (Zabalza, 2009) due to the lack of normative planning and integrated curriculum approach. In this respect, the competency-based model is expected to instigate training programs to adapt their curricula. As a consequence, the academia starts shifting its focus from what is taught to what is learned and introduces general formative assessment and continuous feedback intrinsic to the EHEA paradigm (Barblan, 2001). To get a deeper insight into the actual requirements for training programs, hereafter we are going to examine the latest changes in training paradigms, key features of competency-based teaching and evaluation requirements.

1.1. Recent evolution of training paradigms

As previously mentioned, learner's autonomy, competency-based training, and continuous professional development occupy leading roles in the EHEA. Yet, interpretation of approaches to learning and training by some dominant teaching paradigms of the 20th-21st centuries, i.e., behaviorism, cognitivism and social constructivism have undergone changes.

The behavioral theory was centered on observable behavior and aimed at achieving predetermined patterns of conduct. Thus, the studies were mostly focused on observable and measurable features (e.g., Thorndike, 1920; Skinner, 1953). The objective of teaching programs was to modify students' behavior by providing material in small chunks, eliciting a response and giving stimuli after each answer. For the sake of discussion we may argue that although behaviorist perspective measures mental activity through its observable features, it would rather be used in formalized disciplines where problems are characterized by a high degree of certainty. This approach was criticized for not taking into account students' longing for creation and discovery, as well as simplifying the virtue of human mind and reducing it only to giving correct answers (Ramón Martínez et al., 2010: 41-43).

As reported by Pedraja (2001) behaviorism downsides gave rise to the cognitive social theory with cognitive conductivism being its principal exponent (e.g., Bruner 1966, Piaget 1969a, 1969b, 1970). The cognitive perspective was aimed at overcoming limitations of behaviorism since cognitivist school provided key tools and concepts for efficient teaching, namely spiral learning, situated learning, the importance of making "hooks" to which students gradually add new knowledge and experience (Morin, 2001). Covering a vast spectrum of cognition-related theories, conductivism stated that expertise exists in mind in the form of internal representation of external reality (Duffy and Jonassen, 2013), while learning was seen as the individual process of internal construction of the aforementioned knowledge. This being said, students were expected to transform the knowledge actively and construct alternative conceptual schemes. In other words, learners built knowledge themselves, while the teacher's role was to provide the necessary experience and create situations that would facilitate and enhance such a construction process.

Despite its learner-centered methodology, cognitive science approach seems to a certain extent incompatible with the social process perspective, currently adopted by educational psychology (Kiraly, 2000: 2). The key assumption behind the most recent educational trends is that knowledge is generated not by the individual mind independently, but rather through dynamic interpersonal and inter-subjective processes. And while the cognitive paradigm of knowledge construction focuses mostly on what is allegedly going inside the person's mind, in social constructivism paradigm knowledge is interpreted through collaboration and interpersonal activity. This recently adopted educational approach also endorses students with responsibility and authority to acquire professional competence, strive for lifelong learning and achieve autonomy that involves attitudinal dispositions (e.g. positive attitude to the learning process, willingness to commit and take on responsibility). The objective of fostering learners' autonomy is expected to inspire students to become independent learners and to process information meaningfully to support their learning process. All that is a consequence of knowledge and abilities (e.g. strategic power) that are linked to critical awareness and self-determination (Jiménez Raya, 2013).

The central theoretical premise behind the social constructivism paradigm is that the development of cognitive skills is based on experiential learning perspective which is characterized by a reduced number of verbal messages from teacher's part and an increased volume of learners' performance, who are taking an active role in knowledge construction. The search of solutions and responses happens as the result of personal discovery and is guided by students' motivation, while mental reasoning, information management, and decision-making help develop cognitive skills and emotional intelligence that allow optimization of problem-solving by means of creativity and flexibility. The most important point of this approach is that students "learn to learn" – which means they learn to reflect on learning processes and actively construct knowledge, becoming professionals who overshoot the surrounding limitations using constructive thought (Diaz-Barriga and Hernandez, 2004).

Current research on social constructivism validates the view that knowledge is created through the interaction of people and merge of content – the phenomenon that was defined by Rorty as the "conversation of mankind" (Rorty, 1979). Autonomous learning, interaction, and communication with peers along with teachers' guidance and support are particularly helpful to enhance acquisition of professional competence. For this reason, the experimental part of the research is based on the premises of social constructivism. The implications of such an approach for training proposals mean reshaping teachers' and students' roles, teaching and learning strategies and techniques as well as evaluation and assessment routines.

To contribute to the development of contemporary teaching, it is essential to rethink the way of exercising authority and reshape social interaction between educators and learners from vertical dimension to horizontal, adding constructivist approach to the curriculum (Kantun, 2005; Rojas Valenciano, 2006). The new educational strategy makes it clear that teachers should perform their role through enhancing of rather than exposition to knowledge, while students should change their attitudes from those of passive onlookers to those of active participants of the learning process who engage and comment on the processes of knowledge acquisition.

1.2. Notion of competency

The labor market requirements, learning theories and social constructivism paradigm have influenced teaching-learning scenario in a way that competences acquisition has become the foundation of the European Credit Transfer System and the European Higher Education Area (Marquez, 2005; Gregorio Guirles and Ramón, 2002; Smith, 2005, Palomino et al., 1996). Within the EHEA framework, the competencies are split into generic, which are similar for different programs, and specific, which have to do with a particular subject field.

The term *competence* (or *competency*) is defined in a number of ways, including the ones like: “necessary knowledge, skills, and capacity to perform in a profession, solve occupational problems in an autonomous and flexible manner…” (Bunk, 1994); “the ability to successfully meet complex demands in a particular context; competent performance or effective action implies the mobilization of knowledge, cognitive and practical skills, as well as social and behavioral components such as attitudes, emotions, and values and motivations…” (OECD 2005); “a dynamic combination of knowledge, understanding, skills, and abilities” (Tuning General Brochure, 2007) (for a fuller list of definition see Cano García, 2008). To harmonize the issue, the European Commission suggested defining a competence as “a combination of knowledge, skills and attitudes appropriate to a particular situation” (European Commission 2004; COM 2005: 3). Its guidelines were also delivered in the form of the European Credit Transfer System and advocated an integral definition of competencies defined as a “dynamic combination of cognitive and meta-cognitive skills, knowledge and understanding, interpersonal, intellectual and practical skills, ethical values and attitudes appropriate to a particular situation”.

There is no academic consensus on the form and meaning of the terms “competence/competences” on the one hand and “competency/competencies” on the other (Pérez Cañado, 2013). Some sources (Moore et al., 2002) define competence as a term related to work, while competencies are interpreted as attributes that underpin such work. In line with this statement, it is believed that the former involves full capacity or capability while the latter narrows the focus and applies to the description of particular abilities (Fleming, 2009). Nonetheless, Pennock-Speck (2009) defends the viewpoint that the term ‘competencies’ comprises the meaning of competence that refers to the ability to carry out tasks, strategies, and attitudes engaged in its successful completion. Additionally, the Report of the Bologna Working Group on Qualifications Framework (2012) adopts a neutral position and employs both terms interchangeably, while Rychen and Salganik (2003) precise that: "examining the usage of 'competence' and 'competency' in the literature does not reveal any hard-and-fast rules, and English dictionaries don't further elucidate how these words are distinctive […]." To avoid ambiguity in this investigation, we adopt the last viewpoint and apply the term *competency* when talking about training objectives manifestation, while preserving the original spelling for the cases of direct and indirect referencing.

Competencies are not a mere sum of knowledge, or practice, or know-how, or particular cases of theory and practice, but a complex construct that every student creates as the result of learning activities focused on a vast range of specialized knowledge (Le Boterf, 2000). Interpretation of the term 'competencies' goes beyond the combination of conceptual, procedural and attitudinal knowledge, and permits to select the right set of skills and attitudes that are indispensable to perform a particular task. Consequently, competencies require constant development and are not limited to repetitive patterns. Boshuizen develops the claim that specific competencies are seen as knowledge bank that is relevant to the special type of work the training program is aimed at (Boshuizen, 2004). The objective of an educator, in this case, is to provide favorable conditions so that such a construct could be created. Under the given circumstances competency-based programs focus on enhancing appropriate choices of resources (knowledge, procedures, attitudes, informational databases, etc.) and their application to particular objectives (Perrenoud, 2004a, 2004b).

As of today, being a mere content-specialist in the relevant field of study no longer leads to success as a workforce. Young graduates are required to continually renew their knowledge, to communicate efficiently, to work independently and in a team, etc. (Miguel Díaz, 2006). As emphasized, among the generic competencies most highly valued by potential employers are leadership, project design and management, initiative and enterprising spirit. The results yielded by the Tuning Project show that the three skills that are valued the most by workers, as well as employers, are the ability to learn, ability to analyze and synthesize, and ability to apply the knowledge in practice (Gonzáles and Wagenaar, 2003). Recent data from the professional sector suggest that applicants' most sought for qualities are the ability to communicate efficiently, to perform teamwork and exercise interpersonal skills when solving problems with a feasible approach (ANECA 2007, CHEERS 2003). In this respect overtly incorporation of generic competencies into academic curriculum is expected to boost graduates' position in the industry and help them overcome the precarious nature of the modern working life.

Current academic training programs aim at competencies development, although there is no mainstream view on competencies classification. In 1993 a dual model of competences was suggested, splitting the latter between generic and specific categories (Becker, 1993). The so-called generic competencies are the ones connected with developmental behavior and are common for different occupations and professional fields. Specific competencies are further split into three categories: instrumental (means or tools to reach the objective), interpersonal (getting on with others) and systemic (related with an understanding of the total of the issue) (Villa and Poblete, 2007). Nordhaug promotes the idea of firm-specific, task-specific and industry-specific competencies (Nordhaug, 1993), while another categorization is suggested by a group of authors (Delgado García et al., 2005) who differentiates between academic (acquisition of knowledge), disciplinary (practical use of knowledge for a particular field) and professional (communication and know-how of a specific job) competencies. There seems to be no compelling reason to argue about which of these classifications has a broader scope since all of them partially support and complement one another.

Competencies taxonomy widely adopted in higher education nowadays is the one developed by the Tuning Project experts (Tuning Educational Structures in Europe, 2007) which proposes two types of competences: cross-curricular generic and subject-specific ones (Pérez Cañado, 2013). According to the classification the generic competencies are divided into three sub-categories:

- systemic competencies (a combination of understanding, sensibility, and knowledge that is crucial for learning capacity, problem-solving, decision-making, among others);
- instrumental competencies (cognitive, methodological, technological and linguistic skills which guarantee basic abilities to analyze and synthesize, computer intelligence, etc.);

- interpersonal competencies (related to social and individual skills, e.g., leadership, teamwork skills and ability to work autonomously).

What is more, the list of transferable generic skills that provide for these competencies embraces as many as 16 sub-categories, among which are "awareness of ethical values", "planning and time management", "critical thinking", "decision-making", "innovation and creativity" and others; all entries in the list are based on a comprehensive research of resources from academia and public educational institutions (e.g., OECD, Ministry of Science and Education of Spain, etc.) (Terrón Lopez et al., 2013).

On the other hand, subject-specific competencies as defined by the Tuning Project comprise:

- disciplinary knowledge (or theoretical knowledge applied to a specific thematic field);
- academic abilities (abilities that need to be applied to such thematic field, e.g., capacity to receive, understand and transmit scientific production);
- professional competencies (know-how in the specific professional area).

Ongoing research seems to validate the view that in order to help young graduates meet societal needs it is indispensable to link students' acquired background with knowledge and skills required by the labor market (Salamanca convention 2001; Wellmon, 2008). The present research adopts the notion of competency as a flexible and complex construct made of knowledge, skills, attitudes, and values that all together enable an individual to efficiently perform (a) task(s) presumably related to one's professional field. As aforementioned, the EHEA favors the holistic type of learning with coherence between students' academic and professional profiles being its primary goal. Therefore, adoption and implementation of generic and specific competencies in academic curriculum is bound to help students deploy a set of abilities, skills, and attitudes necessary to become competent professionals.

1.3. CBT model and programmed learning

To train competitive specialists, it is necessary to expose students to multiple opportunities to perform guided and autonomous learning that will enable them to put to practice a broad range of skills and abilities while resolving practical issues. In this regard training programs are expected to provide context so that students understand, analyze, synthesize and evaluate the evidence and come to viable conclusions. In other words, the educational strategy should be aimed at enhancing students' aspirations to learn what is necessary for professional development (Zabalza, 2003).

Development of fundamental competencies that are necessary "for individuals to function proficiently in the society they live in" (Grognet and Crandall, 1982: 3) becomes of paramount importance in the context of the sustainable growth of society and economics. The link between higher education and societal needs tends to adjust students qualifications to the requirements of employers to facilitate graduates' access to the marketplace. The EHEA emphasizes the need to train employees who are able to excel in the global marketplace and provides guidance on the issues related to the introduction of key competencies required for effective career building. In line with this point, Humphreys (2005: 31) underscores the importance of "teaching students to apply academic concepts to real-world contexts," which results in students' ability to adapt the learned skills to different situations: classroom, workplace, community, etc. (AACU report, 2005). In this respect, the focus on competency-based teaching is considered one of the EHEA's priorities (Poblete Ruiz, 2006) because development of a cluster of competencies is expected to better prepare graduates for professional performance.

On the basis of the evidence currently available, it seems fair to comment that at no point competency-based training (CBT) model supports a shift from training in knowledge acquisition to training that is based only on technical and practical competencies acquisition. On the contrary, students are expected to be trained to apply and synthesize capacities and skills, as well as to act single-handedly with competence and professionalism. To that objective, the training provides multiple opportunities to perform guided and autonomous learning that enables students to put into practice their reasoning capacity while resolving practical issues. In other words, the CBT syllabus is focused on preparing graduates to become successful professionals who can meet societal needs.

Learner-centered and motivation-based approach to teaching and learning has become the pivotal point for European academia. Correspondingly, the CBT model is meant to bridge the gap between theory and practice in tertiary education and train flexible and adaptable professionals who can apply their competences to various unforeseeable and complex situations (Cano García, 2008; Pérez Gómez et al., 2009). For this reason, the EHEA adopts the contemporary educational paradigm where students are expected to learn how to learn, and academic staff – to teach them how to learn, thus facilitating continuous lifelong learning.

Competency-based training originated in the USA in the second half of the 20th century (Richards and Rogers, 2001); it was expected that students to demonstrate their progress using observable and measurable outcomes after completion of learning. Similar standards of training in higher education were foreseen in Bologna Process (1999), although causing certain confusion (Zabalza 2004) and calling for further research. Likewise, the Graz and Glasgow Declarations (2003; 2005) and the Bergen Communiqué (2005) press the case for adoption of learning outcomes and competencies as a basis for each of the three cycles of higher education. The primary goals of the CBT model may be defined as follows (Cano Garcia, 2008; Miguel Diaz, 2006; Rodriguez Esteban, 2008):

- holistic learning coherence of theory and practice that leads to concordance between students' professional and academic profiles;
- training of flexible and adaptable professionals who can apply their competencies to complex situations in a variety of real-world contexts;
- success in students' chosen career path provided by their ability to apply a complex set of skills and attitudes to resolve issues inside and outside their subject field.

The theoretical premises behind the competency-based approach to education rest on three dominant assumptions (Cano García, 2008). First, the prevailing model of knowledge society (as opposed to the information society) is underpinned with abilities to search for and select from the relevant information that is needed at each particular moment to use it for the solution of arising problems. Development of multiple competencies and skills boosts flexibility and enhance lifelong learning in the continually changing social and professional context. Second, in line with post-modernist logics, the knowledge is continually getting more complex and complicated. Consequently, the classical separation of subject and/or knowledge domains appears to become obsolete, while fragmentation is getting replaced with integrated knowledge (Morin, 2001). The suggested approach to education goes in line with such a viewpoint and offers multiple competencies development as a response to diverse contexts. Finally, the aforementioned training model is a response to an urgent need for integral education, which promotes a combination of knowledge, abilities, and attitudes along with talents and inclinations that were not in the picture. This model makes it possible to boost multiple intelligences (Gardner, 1987) that embrace not only cognitive capacities but also emotional intelligence and helps to adapt and/or perform efficient decision-making.

The present-day capacities and competencies are associated with initiative and personal creativity, which, in their turn, are linked to the concepts of autonomy, self-awareness, critical thinking, advanced cognitive and self-regulatory competencies, tolerance of ambiguity, cooperation and dialogic communication (Jiménez Raya, 2008). The urge for the development of competency-based approach implies changes not only in learning outcomes but also in methodology. To achieve results, it becomes essential to appeal to methodological plurality that favors learners' commitment and self-determination, promotes student-centered approach with emphasis on successful learning rather than on the provided teaching (McLaren et al., 2005: 27), prescribes more personalized, diversified and transparent evaluation (Miedes Ugarte and Galan García, 2006: 4), attaches importance to the amount of individual work put in by the learner.

The initiated changes call upon academic institutions to re-assess their current educational policies and move to pragmatically driven approach, which also means using new teaching and learning practices. Competency training requires a considerably more significant input than just transmitting contents. The teacher becomes a guide who is expected to share professional knowledge available to him/her, but not to impose it. Teacher's role is transformed into that of a facilitator who encourages learners and provides grounds for efficient development of professional competences. In this way the EHEA offers guidance to its graduates on how to become more efficient, to process content and develop competencies outside the academic environment. As a consequence, the ultimate objective of the university curriculum is to motivate and empower learners as well as help them embrace lifelong learning skills.

By introducing the CBT, the European academia has made a shift from the classical *ex-cathedra lecturing* (Tudor, 2006) towards a student-centered educational model based on real-world context, critical thinking and problem resolution (Pérez Gómez et al., 2009; Perrenoud, 2008). Consequently, an effort is made to overcome the traditional understanding of *knowledge as contemplation* in favor of *knowledge as operation* (Tudor, 2006; Barnett; 2001) with the aim to come up with a nuanced but unambiguous definition of what the university graduates are expected to know and perform after completion of their degrees. Nevertheless, as student-centered learning and competencies development become the key goal of the academic syllabus, the traditional lecture does not disappear. The point is that students are not expected to reproduce the information taught, but rather to apply their thinking skills, abilities to synthesize and analyze in order to process the information taught; it is considered a feasible way to foster students' independence, involvement, and autonomous learning. On the other hand, traditional lockstep lectures keep being used alongside other student-centered methods (Miguel Díaz, 2006). Following the recent methodological shifts, academic trainers assume the role of learning facilitators by active engagement of training methods that involve problem-based learning, project-oriented learning, case studies or cooperative learning, simulations, role-play, etc.

When it comes to evaluation and assessment of competencies, the constructivist standpoint focuses its attention on the processes related to learning, hypothesis-making, argumentations, reflections, and interpretations rather than the product itself (Madrid Fernández and Hughes, 2013). It is agreed among scholars (Miguel Díaz, 2006; Poblete Ruiz, 2006; Pérez Gómez, 2009) that assessment of training is process-oriented, formative and constant. Also, it should be authentic and involve the application of knowledge to real-world contexts. The teacher's role is to provide continuous feedback to the student so that the necessary re-adjustments and revisions can be made and to constantly incorporate a variety of strategies and procedures into the training process.

As emphasized before, employers seek specialists who are able to demonstrate the whole spectrum of competences. Consequently, higher education becomes more linked to the industry, which is meant to increase the efficiency of training programs as well as achieve a more transparent and accessible tertiary education system (Yániz, 2008). This shift tends to adjust students' qualifications to the requirements of employers and facilitate the access of the former to the labor market (Mackiewicz, 2002). Identification, visualization, and circulation of good practices, consolidation of curricula and dynamism of educational models become the critical challenges for the EHEA. While the student takes an active role in the learning process, the academic world is expected to make sure that learning experiences enhance competence(s) acquisition.

The psychology of learning focuses on the importance of two elements of the learning process: the teacher and the student, who work together on a program that is designed to modify the student's behavior and to a certain extent their experience (De

Cecco and Grawford, 1974; Duchesne and McMaught, 2015). The theoretical framework of the psychology of learning gave rise to the concept of programmed learning (PL) that is broadly incorporated in academic syllabi by the majority of educational institutions (Howatt, 1969; Talyzina, 1981). The research on PL conducted by field experts shows that its teaching tactics feature such characteristics as clear statement of the program objectives, reflection over these objectives and production of observable and measurable answers, logical layout of the curriculum, active engagement of the student, immediate feedback on the responses received from students and adaptability of learning to an individual rhythm of each trainee.

Further investigation in this area proves that PL builds on fundamental principles borrowed from the domains of experimental behavioral analysis of learning, cognitive theory, and personality theory. The conduct is better learned when first emitted and then reinforced, since in this way each student is continuously engaged in the process of learning. The underlying arguments of experimental behavior analysis suggest that immediate reinforcement of correct answers not only provides the student with an opportunity to repeat the answer but also boosts their activity, accelerates learning pace and motivates them (Knapper and Cropley, 2000). Students learn better if they can advance at their own pace, as learning through understanding is more transferable and remains longer than learning through memorization or formulae.

Regarding cognitive theory and personality theory the educational content should be presented in such a way that the student has a clear vision of its key lines since perceptive characteristics of the problem is a critical condition for learning. Development of cognitive skills is among key factors determining the success of any training proposal. Mental reasoning, information management, and decision-making all help develop cognitive skills and emotional intelligence and lead to optimization of problem-solving, creativity and flexibility. This result may be achieved with the help of experiential learning, characterized by a reduced number of verbal messages from teacher's part and an increased volume of learners' performance. Guided by motivation, a student takes an active part in knowledge construction, when a search of solutions and responses happens as the result of personal discovery. The most crucial point of experiential learning is that students "learn to learn" – which means they learn to reflect on learning processes, actively construct knowledge and "overshoots the surrounding limitations using constructive thought" (Hernandez Rojas and Díaz Barriga, 2004).

The combined application of CBT and PL principles and strategies enhances implementation of the *knowledge as operation* training model through methodological plurality, self-learning, and personalized evaluation. Correspondingly, the disciplinary fragmentation is expected to be replaced by knowledge integration and joint planning.

Concluding remarks

Educational paradigm has undergone significant transformations in these recent decades, which resulted in its evolution from a teacher-centered model to a learner-centered one. The efforts of the teaching staff, in this case, are focused on promoting the learning model that is linked to graduates' commitment to their self-education.

Given the fact that the ultimate objective of the present research is to collect first-hand information that would configure a training proposal on the enhancement of PE expertise among graduate students, investigation of the European Higher Education Area principles and their implication for training proposals was conducted. For this purpose evolution of academic training policies was summarized, the notions of competency, competency-based training model, programmed learning and competencies evaluation and assessment were reviewed.

Implementation of specific requirements in training is meant to impact student and teacher roles, as well as the evaluation processes. The latter culminates the teaching and learning process and gives grounds to make conclusions regarding the final results. From the perspective of the social constructivism paradigm to date academia aims at learning enhancement, while students are held accountable for their learning outcomes. Under the circumstances, training in competencies becomes of paramount importance, although a lot of debate is going on about the scope of such competencies.

Chapter 2. Scope of translator training

The joint initiative of translation industry and academia is focused on the examination of the curriculum offered by translation programs and integration of updated forms of training. As such, the critical issues get distributed along two major lines of research – the training content and its delivery. The most significant repercussion of the Bologna Process (2012) is that higher education institutions are expected to train graduates in skills and qualifications in accordance with the demands of the industry. On the other hand, it seems appropriate to consider Pym's assertion (2002: 25) that in the university context a school (as a training environment within the tertiary education sector) "cannot be reduced to a training ground for a labor market… rather than serving no more than that, we would mostly do better to adopt the perspectives on human resource development". In this concern research into the role of translator training supports the view that rather than preparing high-performing, market-ready, off-the-shelf professionals, academia should focus more on training critical, independent thinkers who are able to adapt to rapid changes in translation industry (Locke, 2017).

The assumption that conventional teacher-centered approach is no longer viable for efficient translators' training is tightly linked with a rising need of incorporating relevant skills and abilities overtly into teaching programs and addressing them explicitly at different stages of the training (Pérez Cañado 2013). Consequently, rather than delivery of coordinated teaching, the academic objectives of today strive to redirect the concept of education towards self-learning which results in the further development of autonomy in students' learning processes. On these grounds, translation trainers are faced with the task of not only enabling their trainees to acquire specific competencies and skills required for professional careers but also providing graduates with the tools to ensure that they are capable of maintaining and upgrading their competencies throughout their working lives.

With the particular reference to the field of translation, the European Standard for Translation EN 15038:2006 places emphasis on the continuous professional development of translators working for LSPs. As Olohan (2007) points out, the Standard explains that LSPs "ensure that the professional competencies required by 3.2.2 (the earlier paragraph in the Standard which specifies what is meant by "translator competence") are maintained and updated", suggesting that the responsibility for doing so falls entirely on the translator. For this reason, the focus on competencies enhancement by means of guided and autonomous learning provides an essential trajectory for translators training research since the primary objective of such training is to prepare the graduate to enter the professional market (Kelly, 2005: 20-41). Although some traditional academic programs still focus mostly on knowledge transfer (Zabalza 2009), when those who pursue a translation degree are given the role of passive recipients of knowledge, numerous studies report about the necessity not only to expose students to knowledge but also to train them in other forms of skills and competencies (Fallows and Steven 2000; Rico, 2017).

After graduation novice translators are expected to have the necessary expertise and function as fully-fledged professionals. Meanwhile, the distance between competencies that are stipulated in training plans to be acquired in the course of training, on the one hand, and requirements associated with the job itself, on the other, remains one more major challenge of translators training. For example, succeeding in today's job market requires an entrepreneurial turn of mind. Even though, current studies seem to validate the view that very often translation students have the profile of "language geeks with sketchy social skills, in which case those who are prone to be congenitally self-effacing shrink from taking risks" (Locke, 2012). These requirements and real-life scenarios may serve as an illustration of those cases when training falls short of preparing students for the realities of the translation industry. Another factor that influences market requirements is innovation in language technology and the changes it brings to enhancing translators' subject-specific competence. To this end, universities constantly adjust their syllabi so that software solutions are integrated across-the-board by highly-competent teaching staff. Nevertheless, Locke describes some cases when trainers' expertise turns out to be insufficient due to the unfamiliarity of the teaching staff with new instruments and labor market requirements, their skepticism regarding technology or insufficient facilities that complicate integration of skills and tools proficiency into their courses. In some other cases, academic institutions feel "cash-strapped" when it comes to the cost of technical supplies which makes setting up and maintaining a state-of-the-art tools lab very difficult (ibid.).

Within the framework of lifelong learning and continuous professional development, the competency-based training model enters the European educational standards with the aim of harmonizing services throughout Europe. Current reforms in higher education broadly welcome the concept of training in competencies that are of great importance for students from the perspective of successful completion of academic curriculum and career development. The research into the scope of competencies used by translators is getting momentum, although there are very few studies which address the issue of whether the training has prepared them adequately for the professional job market (Monzó, 2002; Vigier Moreno, 2007). As the latter is in constant and rapid flux, educational programs are expected to monitor arising requirements regularly to provide relevant training courses that facilitate graduates' transition from academy to a workplace.

2.1. Training objectives

To be eligible to carry out assignments in conformity with quality requirements and project scope, university graduates in translation are expected to have successfully completed relevant training programs. To prescribe expectations concerning achievements and abilities associated with academic qualifications of different levels the Qualifications Framework of the Joint Quality Initiative of the EHEA adopted Dublin Descriptors (2004). This reference document claims that graduates of Bachelor's degree should be able to demonstrate profound understanding of their professional field, to apply this knowledge to their work and manage existent problems and challenges, to summarize and interpret relevant data necessary to produce professional judgments, to transmit ideas, problems and solutions publicly, to develop the skills necessary to undertake further studies with a higher level of autonomy. Along similar lines the requirements for the graduates of the Master's degree involve higher level of proficiency in all aforementioned skills and competencies, which results in generation and bringing to life new original solutions, application of decision-making and problem solving to broader and/or multidisciplinary contexts related to the field of study, making complex judgments while bearing in mind social and ethical responsibilities, ability to communicate with different types of audiences and to pursue one's learning relentlessly. Dublin Descriptors prescribe baseline training outcomes, while the establishment of the specific skills and competencies required to achieve these goals is left up to each discipline (González and Wagenaar, 2007). Accordingly, academic training intends to enhance acquisition of a range of competencies to be deployed in the professional workflow(s).

As rightly observed by Kiraly (2000: 16), the scope of abilities employed in translation goes beyond mere source-to-target meaning transfer, since "becoming a professional translator clearly entails more than learning specific skills that allow one to produce an acceptable target text in one language on the basis of a text written in another language." The author draws a line between "translation competence" and "translator competence" stressing that the latter embraces expertise in specialized fields, proficiency with technical tools and new technologies, as well as ability to transfer meaning between linguistically and culturally different expert communities. Other definitions describe the scope of competencies required for translation as a sum of linguistic competences, or a super-competence, or a construct of different types of knowledge, skills, and attitudes, or as an ability to generate more than one target text and select the most viable option (Pym, 2003). There may be no consensus on this term within the discipline, while diverse models proposed by scholars are becoming increasingly sophisticated. In this regard, Pym (2003: 489) offers a minimalist approach and describes translation competence as "the ability to select only one viable target text from this series (of more than one viable text) quickly and with justified confidence." Moreover, the scholar rightly mentions that the term 'competence' has not yet acquired a universal definition in academic circles; researchers keep using such terms as expertise, proficiency, skill, performance, performance ability and others (ibid.) to talk about the set of factors that enable translators to perform their work efficiently. Along similar lines, Kelly (2005: 28-41) mentions that there is no unanimity in interpreting translation competency since it involves the cognitive process of translation as an activity, as well as an empirical mode of competency as stipulated by the market demand and/or educational objective for curriculum design.

Meanwhile, translation studies experts, e.g., Gile (1995), Kiraly (1995, 2000), Presas (2002), Neubert (2000), Orozco Jutorán (2000), offer multiple models of translation competencies. Along with the already developed ones, the ongoing analysis continually adds new features to this research subject to meet the needs of academic and professional environments. The overall tendency towards competency in translation as a complex structure that comprises different inter-related sub-competencies and is dominated by a strategic component has gained support.

The PACTE research group puts forward the holistic view that defines the term translation competence as the underlying system of declarative and procedural knowledge, skills, and attitudes required to translate (2014). This model comprises five sub-competences and a psycho-physiological component, accompanied with attitudinal aspects and abilities. The sub-competences embrace bilingual sub-competence (pragmatic, sociolinguistic, textual, grammar and lexical knowledge), extra-linguistic competence (knowledge about world in general and field-specific knowledge), knowledge about translation (distinctive features of the profession, translation practice, translation functions), instrumental sub-competence (related to the use of documentation resources, information and communication, translation technologies), and strategic sub-competence (efficiency of translation process, problem-solving, control of operations). It is also argued that strategic competence, instrumental competence, and knowledge of translation are the sub-competencies which are more specific for translators, as opposed to bilinguals, who as well possess knowledge of two languages and, most probably, extra-linguistic knowledge.

The model of Kelly (2005) has proved to be a valuable tool for translators training within the context of the undergraduate programs. The objective of training is described from the viewpoint of the macro-competence that embraces a set of skills, knowledge, and attitudes which professional translators use in their daily translation tasks. This macro-competence is divided into sub-competences, including communicative and textual competence, cultural competence, subject area competence, instrumental and professional competence, psycho-physiological or attitudinal competence, interpersonal competence, strategic competence. The author stresses that the sub-competencies are interrelated and each is necessary for the overall macro-competence to function correctly. Nevertheless, it is the strategic competence that coordinates how the other abilities work when performing the given task.

When defining the scope of competencies which are essential for professional translators and experts in multilingual and multimedia communication, the expert group of European Master in Translation (2017) sets out one more noteworthy example of competence in translation: a reference framework applied to linguistic tasks of wide semantic and/or professional range. In this case, the term competence is used to describe a combination of aptitudes, knowledge, behavior and know-how necessary to carry out a particular task under given conditions.

The EMT model rests on six interdependent areas of competences that overlap horizontally, in which case one and the same aptitude or skill may be equally relevant to others. The translation service provision competence has interpersonal and production dimensions. The former focuses on awareness of the social role of the translator, market requirements, principles of conducting negotiations, basics of marketing and management, compliance with specifications and professional ethics. The latter, as the name implies, is about creation and delivering of the output, application of appropriate solutions and strategies, quality control, justification of translation choices. Language competence manifests itself in the understanding of lexical and/or grammatical forms, as well as graphic conventions of SL(s) and TL(s). The intercultural competence is described from sociolinguistic and textual perspectives. In this case, recognition of function and meaning in language variations and identification of interaction rules applicable to a specific community are complemented with knowledge on documents macrostructure and coherence, peculiarities of rendering intertextuality, allusions or stereotypes, genre and rhetorical standards of composition. Ability to summarize, to recognize cultural references, to rephrase, condense and (post-)edit are also among features characteristic of the intercultural competence. To perform documentary and terminological research, to extract and process information relevant to the project, to develop evaluation criteria and wisely use tools, environments, and search engines, students are expected to master the information mining competence. Enhancement of the thematic competence results in knowledge regarding how to search for relevant thematic information and to encourage curiosity. Finally, the realm of technological competence covers the ability to use and integrate available software while continually learning about new updates, to create and manage databases and formats, to familiarize oneself with possibilities and limits of MT.

Using the above-mentioned models, academic trainers and scholars outline prioritized training objectives and legitimize particular combinations of skills, attitudes, and competencies required from the program graduates. Specialized training in translation is expected to lead to the qualification of experts in multilingual and multimedia communication, although the scope of such competencies is not definitive and may be complemented in each particular case.

2.2. Translation modalities

The origins of Translation Studies (TS) may be traced as far as the Ancient Rome, but there is no doubt that TS as a scientific subject emerged in the middle of the 20th century (Hurtado Albir, 2001). As argued by Orozco Jutorán (2000), descriptive and systematic analysis of translation as a phenomenon started its development together with first scientific journals, e.g. *Traduire* (1954) or *Babel* (1955), which triggered debates on interconnections between linguistics and translation and gave impetus to the systematization of TS (Fedorov, 1968). In 1972 Holmes published the first meta-theoretical reflection on TS, giving definition to the subject and suggesting classification along three primary fields: theoretical, descriptive and applied (Holmes, 1972). Until 1980s research in translation focused mostly on its philosophical, abstract and inductive aspects; the theories were constructed mainly on the premises of experience, induction, and observation. This trend was described as "interpretive traductology" and "hermeneutical approximation" (Neunzig, 1999: 4), or "theoretical research which focuses on the intellectual processing of ideas" (Gile, 1998: 70). Then, the 1980s witnessed growing interest towards empirical research with emphasis on cognitive paradigms, applied to facilitate translation research methods and concepts (Danks et al., 1997). While the end of the 1980s only focused on descriptive research tendencies (Toury, 1995; Hermans 1985), in the 1990s the trend got solidified with massive arrival of corpus studies (Baker, 1995; Kenny, 1998).

The last decades of the 20th century were marked by a real rise in TS research – from purely theoretical and mostly applicable to academia to fully practical and relevant for the needs of the translation industry. The investigation into translation was conducted at universities and colleges, within (inter)national conferences and symposiums, by language service providers, freelance translators, NGOs, and industries. The reason why TS research gained such importance stems from the acceptance of interdisciplinarity as its prominent feature (Snell-Hornby, 1991; Snell-Hornby et al., 1994) and the growing interest towards empirical studies focused on translation phenomenon description. With regards to and respect for innovation in TS research design(s), interdisciplinarity complicated empirical studies and became one of the reasons why there is no clear cut between empirical and conceptual domains. For example, in 1982 the first doctoral thesis that used thinking-aloud protocol (TAP) as data collection technique was published (Sandrock, 1982). That paper marked a new twist in the TS paradigm when empirical studies started application of alternatives for data collection, such as computer-assisted methods (Neunzig, 1997) or a posteriori interviews or translation diaries (Fox, 2000). Traditionally sociological tools such as tests and questionnaires (Saldanha and O'Brien, 2014: 150) start being extensively used in applied research to analyze translators' performance or skills without resorting to social theories. For the sake of discussion, it should be mentioned that there is a vast number of research and theses that voice criticism and reflection on these techniques (Gile, 1990; PACTE 2000).

The rise of the new millennium brought technology and digitalization to translation industry landscape, where the traditional translation was no longer able to keep the pace with the dramatic increase of publishable content (Casacuberta et al., 2009). Although the principal objective of translation was still defined as transferring message from the source language to target language(s), yet the components of such translation process, e.g., content, translation tools, reference materials, working environments, etc. had undergone drastic changes. Obtaining the first target language suggestions by means of machine translation in addition to other technological advances became the new reality. This phenomenon is likely to start changing the nature of translation *per se* (Austermühl, 2013: 328), especially given the constant improvement of translation engines performance. Meanwhile, the traditional understanding of translation as a text-centric activity is still prevalent today. For this reason, the industry is rife with those who promote the conventional idea that translation is just “converting text from one language into another” or replacing “natural-language strings” (Pym, 2004: 51-52).

While researchers and practitioners seem to agree on the origins of the term translation, there is a growing debate on whether and to what extent the new tasks such as localization, trans-creation, post-editing or other inter-disciplinary phenomena are related to translation. An example of such debate is the term localization which is applied to the process of adapting software-related content for a locale. The objective of this method is to put together the text and optional non-textual items that must be altered for software to work efficiently in various locales (Melby et al., 2014). This linguistic task embraces a variation of a particular language combined with cultural conventions peculiar for a selected region, its output being a text and culture- or region-specific content (graphics, music, currencies, or other functional elements). The available evidence seems to suggest that since the objective of such process lies in the combination of text and optional non-textual items that must be altered for software to work efficiently in various locales (ibid.), such task expands the limits of the traditional notion of translation. The language industry is also questioning if these new processes require special skills different from those necessary to conduct translation tasks.

Given the circumstances, the European Master in Translation expert group (2009) provides confirmatory evidence on the ambiguity of the term *translation*: it may be used to describe word-for-word transfers (e.g. 'pocket translations' which are only lexical correspondence dictionaries, devoid of context), cases of localization (of software, websites, video games), versioning (of audiovisual documents), trans-editing (of information from press agencies, newspapers, television reports), multilingual and technical writing, adaptation (of advertising), revision, summary translation, among others. According to the group's report, the ambiguity hampers the possibility to collect reliable statistical data on the volume of translation, the number of translators and their routines. Different parties will have different answers to the arising questions on similarities and differences between translation and new linguistic tasks. As a result, the role of many translation-related processes and terms used for their description is likely to remain controversial. To address the aforementioned issue, the functionalist approach is applied (Nord, 2013). The key theoretical premise behind functionalism methodology defines translation as a multimodal activity and distinguishes it from traditional text-only translation. As such, the concept of translation and its quality becomes related to the type of content, the targeted audience, availability of tools, specifications, and guidelines, and the expected effect.

Advances and innovation in the translation industry have shaped newly emerged (extra-) linguistic operations as a separate task, similar to traditional translation, yet not the same. The scope of the jobs depends on the quality of the output, text type, purpose of the target content with regards to recipients. The evolution of translational landscape provoked by the digitalization of its paradigm gave rise to new research lines in translation, ranging from purely technological, such as tools and environments for computer-assisted translation or post-editing, evaluation of MT and its quality estimation, (Specia, et al., 2010; Martín-Mòr et al., 2016) to the ones deeply ingrained in psychological processes that underlie translators' performance, such as analysis of real vs. perceived cognitive effort or self-efficacy (Koponen, 2012; Teixeira, 2014; Moorkens et al., 2015; Rossi, 2017).

A group of authors (Melby et al., 2014) made a novel contribution to the translation paradigm of today by suggesting that various definitions of translation can be conceptually placed on a landscape defined by two axes: scope (narrow-to-broad) and specifications (absolute-to-relative). In this concern it becomes of paramount importance that theorists and practitioners indicate the definition of translation applied in their research, specifying whether they are using a narrow notion of purely textual translation or a broader concept of multimodal translation since the latter includes elements beyond text and could be defined as: "… the creation of target content that corresponds to source content according to agreed-upon specifications" (O'Sullivan, 2007).

As we can see, more recent theories of translation have moved away from the notion of meaning being encoded in the text. Alternatively, they focus on transferring intended or understood meanings associated with a text by a reader or a writer. In the present research, we adopt the aforementioned "broad" approach and interpret translation as a multi-modal phenomenon that integrates a performer into the process of output production under specified conditions.

2.3. MTPE assignment

The scenario where MT output is post-edited before being delivered as a complete job (the MTPE model) is expected to lower production costs and help publish more content faster and into more languages. Under such circumstances, the post-editor is expected to check the raw MT output, spot possible errors, analyze the original content to clarify any doubts and correct the errors with regards to quality expectations expressed by the customer, making as few edits as possible.

Researchers provide various definitions for an assignment aimed at editing raw MT output to a quality that is close to or indiscernible from a standard translation-editing-proofreading process (Vashee, 2013). At the end of the 20th century the task of PE was described as "a process of modification rather than revision" (Loffler-Laurian, 1985), "adjusting the machine output so that it reflects as accurately as possible the meaning of the original text, with an emphasis on adjusting relatively predictable difficulties" (Vasconcellos, 1987: 411), "a term used for the correction of machine translation output by human linguists/editors" (Veale and Way, 1997). In the 21st century its definition goes as: "the task [of the post-editor is] to edit, modify and/or correct pre-translated text that has been processed by a machine translation system from a source language into (a) target language(s)" (Allen, 2003), "checking, proofreading and revising translations carried out by any kind of translating automaton" (Gouadec, 2007). Due to the fact that the whole process of post-editing may be arranged in different ways with regard to the project objectives, workflow and technological solutions available, the ISO 17100 definition of PE takes a middle-ground position and describes classical PE as a task “to edit and correct raw MT output” (Martín-Mòr et al., 2016: 65). It is also specified that by raw MT output the “result of machine translation” is meant, as opposed to results of translation memories suggested in CAT-tools. This definition proves that post-editing is a linguistic task in its own right, since performing a PE assignment is not identical to either translation or proofreading.

Over the last decades, the research in translation studies has involved investigation on how PE influences translation industry practices (Krings, 2001; Garcia 2010; Ramos, 2010; Tatsumi, 2010), with particular attention to cognitive processes involved (Krings and Koby, 2001: 360). As previously mentioned, there has been an inconclusive debate about whether post-editing is a form of translation, or rather a task in itself. To strike a balance, it may be helpful to analyze the cognitive operations that undermine translation and post-editing tasks. While human translation output choices are hugely grounded on (extra-) linguistic data and source language content, raw MT output, on the contrary, is the fruit of sophisticated algorithms and has to be compared with the SL content and (extra-)linguistic data for the issues of accuracy and fluency. To put it differently, the process of translation from scratch (or using a TM) presupposes that target language output is generated as the result of processing extra-linguistic and linguistic data by the translator. On the other hand, the post-editor has to work with raw MT output in the target language (TL) computed by a system without extensive contextual references. In the course of post-editing, it is checked whether the intended meaning of the source language content is rendered correctly regarding form and meaning the target language output by gradually comparing correspondence of TL output with SL linguistic data and TL/SL extra-linguistic data. Another critical factor to take into consideration when comparing [human] translation and post-editing is the expected final quality of the output, which in any case might vary depending on the type of content, target audience, context, and purpose.

Due to the recent changes in the translation industry landscape, a lot of translators start to dedicate themselves to post-editing assignments. Both activities have a lot in common, though are not identical. A translator who performs a post-editing task deals with three different texts: s/he receives the original content (source text), the raw MT output (raw MT text) and is expected to perform editions to produce the final PE output (target text). Indeed, the three-step process of PE contains the tasks related to source text processing (reading the source text entirely or in segments in search for patterns to be further reformulated in the output), raw MT output processing (detecting elements in the target text that raise doubts and, consequently, require particular attention), and target text production (Krings and Koby, 2001: 321-522). On top of that, recently more and more researchers focus their interest on ways to automatize the post-editing process (Simard et al., 2007; Vié et al., 2011).

Adequacy and fluency requirements for post-editing of high visibility content usually equal the same parameters expected of human translation, for which reason it is the translator who is supposed to be charged with a PE assignment. The aforementioned quality level is known as "publishable" and is also referred to as full PE or high-quality PE, which implies full or nearly full correspondence of the PE output to human quality. Full PE is characterized as comprehensible, accurate and stylistically fine with correct grammar, punctuation, and syntax (Massardo et al., 2016). This category suggests changing a particular word order or sentence structure to something more appropriate to make the text flow more smoothly or to increase comprehension.

To meet these quality requirements software for integrated PE that combines MT and TM features is usually used. MT-only software is more likely to be employed in cases when the content has limited visibility, and the client agrees to light PE of good-enough quality (Martín-Mòr et al., 2016). In such scenarios, the final quality criteria might be inferior regarding fluency, although the adequacy is expected to be sufficient to make the content comprehensible. For these cases stylistic and/or grammar errors are acceptable as long as the original message is transferred properly and there is no ambiguity about its content. When performing light PE otherwise qualified as "fuzzy and wide-ranging" (Allen, 2003), it is advised not to spend a long time deciding on the very best word or phrase and not to make the translation sound like a piece of original writing. As the term makes it clear, in this case, there is a reference to a "minimum" number of changes that are applied in order to produce acceptable quality. However, precise definition of the minimum number and the acceptable quality keeps being a matter of debate, and a vital issue in production as well as in teaching context.

To sum up, a post-editing assignment is a linguistic task in itself performed by translators who check the raw MT output for errors and correct them in accordance with specific output expectations. When light PE is commissioned, translators would aim at an accurate transfer of the message and correction of only those grammar issues that interfere with accuracy, while stylistic problems and terminology are not prioritized due to high throughput expectations and low-quality expectations. On the other hand, when publishable quality is expected, as happens in the case of full PE, exact meaning and accurate grammar along with more thorough terminology choices are expected.

To get a fuller picture of the scope of a PE assignment, further investigation is required on the proportion of full vs. light PE in a regular workload, as well as the range of subject fields for MTPE projects and destination of the PE output. Given the novelty of the PE phenomenon, it seems essential to inquire about the academic background, professional experience and other characteristics of those currently engaged in the production of PE output. To provide more detailed insights into a post-editor's profile and expertise, a survey is launched and its outcomes are analyzed (Chapter 3).

2.3.1. Project workflow

On a larger scale, the course of an MTPE project, as well as any translation-related process, includes pre-PE and post-PE phases (Martín-Mòr et al., 2016). The initial stage presupposes content analysis and formatting, if necessary, drafting of quotes and purchase orders, evaluation and estimation of available and required resources; all of this is usually performed by (a) project manager(s). More linguistically focused tasks at this point involve terminology management, preparation of reference materials, including TMs and databases, pre-editing of the source text and preparation and/or tuning of MT engines that may involve project managers and/or translators. After completion of the assignment, it is expected to be checked for possible linguistic and/or orthographic errors by the translator him/herself, although other linguists may also be engaged in the post-PE process. Besides conducting the final proofreading and/or revision, other tasks e.g., manipulations related to desktop publishing, graphic and/or multimedia design before the ultimate quality control can be exercised.

On a smaller scale, an MTPE project boils down to a post-editing job, which starts with obtaining the first draft translation (otherwise called raw MT output) produced by an MT engine. In some cases, the first draft translation may also be retrieved from translation memories, if the relevant content was previously translated or post-edited. MT texts are linguistically different from texts translated by human translators, so a post-editor requires skills to recognize typical "machine" errors that arise due to various reasons, e.g. wrongly analyzed syntactic structures or defects in the input text (see section 2.3.2 for analysis of MT output issues). These errors are often typological and recurring, although many of them appear "comprehensible" at first glance; their swift identification and thorough check of the MT text against the source text greatly facilitates the PE process. The essential defects, e.g., incompleteness or untranslated words, are also likely to be identified in the course of general output check. As a result, a list of unknown words can be compiled to ensure regular dictionary and system maintenance. Sometimes post-editors are also required to collect recurring MT errors and report to project coordinator and/or MT system developers (Zaretskaya, 2017).

When post-editing, the source and target texts usually appear segment by segment either in translation tools (e.g. computer-assisted translation software suites like MemoQ[1] or SDL Trados Studio[2]), or conventional text processing environments (e.g. Microsoft Word processor or Excel spreadsheet). At this stage, post-editors' performance is highly predetermined by a range of reference materials, such as style guides, PE guidelines, specific and generic project specifications that give explanations on how to tackle typical problems provoked by engagement of an MT engine and help translators decide on the scope of manual PE. Traditionally, a post-editor is also expected to solve any (extra-) linguistic issues that arise in the course of the process. Both PE tools and reference materials are discussed in more detail further (sections 2.3.3 and 2.3.4 correspondingly). A PE assignment is completed with proofreading to assure there are no errors left and that the output is idiomatic and stylistically adequate. The final check aims to make sure that the target text corresponds to the relevant quality requirements, e.g., renders the content of the source text, preserves coherence, or/and is idiomatic.

Alternatively, production of PE output may not always follow the MTPE workflow when the source content is first processed by an MT engine, then post-edited in conformity with the required quality criteria, proofread and finally delivered to the client. There is growing support to the claim that there are cases when the target output is published without previous post-editing, the phenomenon otherwise known as "unattended translation" albeit such assignment might be scheduled later (Sánchez-Gijón, 2016). In that

[1] http://www.memoq.com/en/ (Last consulted on 14.12.2016)
[2] http://www.sdltrados.com/products/trados-studio/ (Last consulted on 14.12.2016)

case, the target language content is post-edited only if, for example, it turns out to be in high demand, or the recipients complain about the incomprehensibility of the content. The simplicity of the translated content, the proximity between the source and target languages, or just the fact that it is more important to swiftly provide translation of specific content into the target language despite its poor quality are the most typical reasons for immediate post-editing not to be performed.

The conclusion can be made that the scope of MTPE project may vary among a broad range of tasks and operations, while post-editing of MT output is core to any of them. Reference materials are used to specify those MT issues that should be attended to. Production of PE output of specified quality is performed by a post-editor, who resorts to technical means. To better contextualize the post-editing process, we see it essential to focus on MT output issues, PE-related tools, systems and reference materials. To that end, Chapter 3 contains first-hand information provided by acting post-editors, which gives further insights into phases and tasks incorporated in MTPE workflow.

2.3.2. MT error typologies

To provide consistency and help overcome uncertainty when processing MT results, industry players created numerous classifications and typologies of MT-related issues, embracing terminology and lexis, grammar and syntax, orthography and regional variations. To describe MT output errors, some scholars suggest splitting them into minor, major, and “grey” categories (Green, 1982) or single word errors, errors of relation, structural or informational errors (Loffler-Laurian, 1983). Others differentiate among incorrect verb forms, mistranslation of prepositions, literal rendition of common idioms, translation of a word in one manner when the context demands another (Lavorel, 1982). It is also common to propose multiple categories including vocabulary and terminology, abbreviations and proper nouns, prepositions, determiners, verb modifiers, verb forms, tense, among others. Also, there appear recommendations that in the course of post-editing, the linguistic corrections should be limited to ‘fixing’ certain kinds of errors, i.e., grammatical and syntax errors (e.g., wrong concordance in number and/or gender, word order causing grammatical problems); misspellings and punctuation errors (e.g. missing accents, wrong capitalization) and mistranslation (e.g. wrong use of key terminology; correct sentences with a different meaning from the source) (Guzman, 2007).

The turn of the century brought upgrading and proliferation of MT engines which caused a more widespread use of MTPE models in the translation industry. Similarly, researchers and research groups got more data for analysis and description of typical MT-related problems tackled by post-editors on a daily basis. An MT error typology that was reported by Schäffer (2001) contained four categories and was tested by SAP group in its PE guidelines. Our interest to SAP experience is explained by the fact that this industrial group has been continuously investing in different MT systems for translation of their content, among which are LOGOS (used for English-Spanish and English-French) and PROMT (used for English-Russian and English-Portuguese). The post-editing guide designed to train and support translators working on SAP MT output classifies the errors into four groups: lexical errors (vocabulary, function words, terminology, polysemic words and idioms); syntactic errors (sentence and clause analysis, syntagmatic structures, word order); grammatical mistakes (tense, number, voice) and errors due to defective input text. The author rightly believes that such error typology makes post-editors aware of main types of errors and also serves as a methodological framework for further research on PE and MT. It may be true on the part of comments focusing on improving the MT systems through translation rules and better dictionary coding. To make justice to the typologies mentioned above it should be stressed that their drafting was made possible by the observations of errors detected in raw MT output samples that often bear great resemblance to each other, even between language pairs as different as English-Portuguese and English-Japanese, and thus are mostly language- and system-independent.

Another extended research typology based on the LISA QA Model (The Localization Industry Standards Association, 2009) and the GALE Post-editing guidelines (Post Editing Guidelines for GALE Machine Translation Evaluation, 2007) comprises eight categories (De Almeida, 2013: 95). Among the advantages of LISA QA model were mentioned its applicability for output in different languages, flexibility to be customized with additional subcategories and the fact that its categories do not overlap. The typology consists of eight main categories, some of which are further split into correspondent subcategories: accuracy or completeness (extra information in MT output, information missing from MT output, untranslated text); consistency; country (decimal points, quotation marks, currency symbol, date/time format); format; language (adjectives, adverbs, capitalization, conjunctions, determiners, gender, nouns, number, phrasal ordering, prepositions, pronouns, punctuation, spelling, verb tense); mistranslation; style; lexical choice. The researcher also makes a stress on minor and major severity levels assigned to the categories of LISA QA Model. The application of severity levels is described as relevant for evaluating the quality of the output and contributes to the overall assessment of the work done (ibid.: 88).

One of the most popular MT error typologies that are used as a baseline for a lot of MTPE-related research is the Translation Automation User Society (TAUS) Error typology (2013), which has been reviewed and endorsed by a large number of translation services providers, including the ones mentioned above. As reported by TAUS, the most commonly used error categories of MTPE industry are: language (grammatical, syntactic or punctuation errors), terminology (failure to adhere to a glossary or other standard terminology source), accuracy (incorrect meaning transfer, unacceptable omission or addition in the translated text) and style. The subjectivity of the last category was reduced by defining it as 'contravention of the style guide.' The typology creators argue that where an error of this type occurs, reference should be made to a specific recommendation within the target-language-specific style guide.

The EDI-TA research group (Rico Perez, 2012) devised its MT-error typology in the shape of a flexible decision tool with all types of errors falling into one of the following categories: terminology, syntax, morphology, spelling, punctuation, semantics; the last one embracing the cases of omissions, offensive, and inappropriate language. The experts also advise that translators make explicit any necessary information and fix stylistic problems as well as keep track of cohesion and coherence. The importance of the last recommendations is corroborated by the ProjecTA group members, who stress the need to single out important issues that influence the final quality of the PE output, namely lexical and terminological coherence (Martín-Mòr et al., 2016: 73). Reference materials that contain description of these categories are expected to provide explanations of what is considered an error that requires post-editing. It is suggested that the cases that most often need additional attention cover improper use of terminology (terms that do not belong either to the client's' term-base or to that of the project or domain); translation of proper names and commercial brands (depending on the document visibility and the client's policy such units may be left untranslated in the TL); abbreviations and acronyms (when the client is expected to opt for a solution for each particular case in conformity with particular industry standards); list of recommended equivalents to be systematically applied in course of PE (e.g. software action verb forms, connectors, ambiguous or polysemic lexical units).

An MT error typology elaborated in the framework of the QTLaunch-Pad project is based on the MQM annotation guidelines and the MQM annotation decision tree (version 1.4, 2014). There is a growing belief that this model addresses the problem of "one-size-fits-all metrics" by providing a baseline to declare multiple metrics rather than one (Lommel et al., 2014). The MQM typology splits all types of MT issues into accuracy, e.g., cases of omission, untranslated content, addition, terminology or mistranslation, and fluency, such as issues with typography, spelling, unintelligible content and grammar. The latter sub-category is further subdivided into syntactic and morphological issues (e.g., word order, parts of speech, agreement in person, number or gender, verbal forms) and extraneous, missing or incorrect function words. A distinctive feature of the model is the category of verity that refers to extra-linguistic truth correspondence of the original and the translation. It is important to mention that although the MQM annotation decision tree provides insight into the nature of its categories, it also contains a free text slot so that the user could describe any general issues of fluency and accuracy which cannot be categorized otherwise. The fact that the model is considered language-neutral and as such may apply to any language pair is regarded as another advantageous feature of MQM, which allows analyzing the PE outcome in different languages.

Despite the perceived differences, MT error typologies are aimed at identification and categorization of errors produced by an MT engine. As a rule, the categories are adapted for different needs, be it evaluation of the MT output quality, improvement of MT engine performance, evaluation of PE productivity or detection of strategies and techniques applied by linguists in the course of PE.

2.3.3. Tools and systems

In the past decades, technology has become an integral part of translation processes: connectivity and constant improvement of software have enhanced MT development and multiplication of resources engaged in production and editing of MT output (Martín-Mòr et al., 2016). As of today the basic categories of MT systems used in the industry and academia are rule-based, statistical or hybrid ones, spurred by the emerging neural MT paradigm in which application of deep neural networks has already yielded notable results for automatic evaluation (Sutskever et al., 2014, Cho et al., 2014, Bahdanau et al., 2015; Bojar et al., 2016).

The specially designed software may integrate one or more MT engines with the aim to provide a better version of raw output for post-editors. In these cases, the source content is translated sentence by sentence, although the system is also able to focus on segments that underlie sentence level. The obtained combination of segments is not a fully-fledged translation yet due to the high probability of MT-related errors and lack of coherence, but it makes the starting point for a PE assignment (Martín-Mòr et al., 2016). The option of translation memory searches is believed to improve translators' performance critically, so it is also possible that MT systems combine translations memory and machine translation, or MT systems are integrated directly into translation tools and/or post-editing environments. Yet, there exists an opinion that a closer look at the combination of MT systems with translation memories indicates that the differences in their nature make such integration superficial to an extent (Koehn and Senellart, 2010).

Translation software is familiar to many translators and provides a rich spectrum of additional functions (O'Brien, 2010). As argued by a group of authors, *classical PE* is performed by employing any text-editing environments, be it specially designed software like MemoQ[3] or SmartCAT[4], or generic tools like Word or Excel. On the other hand, for *integrated PE* it is crucial to use translation editing and management systems which are able to complement translation memory suggestions with segments obtained employing MT (Martín-Mòr et al., 2016). The function of working with several files simultaneously attends to the problem of repetitive MT errors (Zetzsche, 2012), so does the function that permits to conduct concordance searches and/or search-and-replace operations (Nunes

[3] https://www.memoq.com/en/ (Last consulted on 10.02.2017)
[4] www.smartcat.ai/ (Last consulted on 14.02.2017)

Vieira and Specia, 2011; Vié et al., 2011). In many cases translation environments can be integrated with Google Translate[5] services, Moses[6], Systran[7], Apertium[8] or other MT systems, can process batch tasks and perform a global search and replace operations, provide access to internal lexical resources, and suggest dynamic re-training based on previous edits. Simultaneous visualization of the original and the output, possibilities to use shortcuts and hotkeys and save the original format (ibid.), glossary checks, quality control, spell checkers, grammar and style checkers (Nunes Vieira and Specia, 2011; Vié et al., 2011; Zetzsche, 2012) could be mentioned among other available options of software used for PE projects.

Apart from generic tools and translation environments used to perform post-editing assignments, it is also worth mentioning complementary tools used for PE (e.g. a cross-platform application CheckMate[9], a terminology tool Xbench[10] or a stand-alone tool QA Distiller[11] used to find mistakes in bilingual files). The software of this category allows a wide range of simple and complex quality assurance features for many languages that help in spotting the cases of repeated words, corrupted characters, inline codes differences, wrong spaces, consistency controversies, numeric values and others. An interactive list of warnings, complete reports on the found issues, support of a broad range of input formats, clear and structured view of the terminology are among the additional features of such tools.

The scope of technical means used for post-editing is vast and continually changing. However, it is possible to group the most popular tools and systems into categories depending on the origin of TL segments, possibility to be connected directly to an MT engine and the nature of tasks performed with their help. On the other hand, the frequency with which these instruments are used in PE workflow and, hence, their importance for a post-editor is not sufficiently examined and requires further investigation.

[5] https://translate.google.com/ (Last consulted on 18.03.2017)
[6] www.statmt.org/moses/ (Last consulted on 14.05.2017)
[7] www.systransoft.com/lp/machine-translation/ (Last consulted on 10.03.2017)
[8] https://www.apertium.org/index.eng.html (Last consulted on 01.04.2017)
[9] https://okapiframework.org/wiki/index.php?title=CheckMate (Last consulted on 22.06.2017)
[10] https://www.xbench.net (Last consulted on 03.06.2017)
[11] http://www.qa-distiller.com/en (Last consulted on 14.05.2017)

2.3.4. References for decision-making

The generalized objective of MTPE reference materials is to meet quality requirements, which are often customer focused (Doherty, 2017). For this reason, Ray et al. (2013) report that the industry's research "has long shown that buyers and suppliers often disagree on what translation quality means," when the lack of agreement on definition and measurement criteria results in mismatched expectations. The authors also identify a trend for 'no accepted standards'. Given such circumstances, the primary goal of reference materials is to help translators grasp a specified level of quality for PE project output, which is expected to be error-free, or rather not to contain issues considered to be errors for a particular MTPE project. Notions of quality are often described as "boiling down to the opinion of one person over that of another" with "too much time in arbitration mode," in which case they are characterized by subjectivity (Kelly and DePalma, 2009: 1). Meanwhile, the definition of what could be classified as "good" performance versus "mediocre" or even "poor" performance keeps being of paramount importance for measuring the activity of any kind (De Almeida and O'Brien, 2010). For this reason availability of reference materials helps make decisions when working on a particular PE project.

The functionalist theory (Reiß and Vermeer, 1984; Nord, 2013) develops the claim that before performing an assignment, the translator decides on the appropriate translation strategy. The latter depends on the (extra-)linguistic features of the translation project and enables delivery of the original message to the recipient in full. Evolution and digitalization of translation paradigm have significantly influenced this process since the nature of the original materials, and translation projects have undergone significant changes. It became standard that the SL content contains elements of different genres and/or suffers constant changes even after the translation project has been launched. The translation project might be distributed among a team of translators for throughput reasons, yet the output is expected to be coherent and correctly transfer the original meaning (Martín-Mòr et al., 2016: 28).

Given the importance of throughput for timely delivery and output quality for the successful functioning of the translated content in the market (or any other environment it is produced for), there is an urgent need for effective strategies that would assure homogeneity, uniformity, and coherence of MTPE projects. As previously mentioned, to this end the translation industry provides specialized software tools that not only facilitate the source-to-target meaning transfer and quality assurance but also enable management of similar projects. What is more, the relevant reference materials (guidelines, specifications or style guides, for instance) elaborated single-handedly by TLPs, by customers or through the collaboration of all parties contain advice on how to solve particular issues while performing a PE assignment. These decision-making tools may to a certain extent facilitate or even replace the stage of previous analysis of the original content as previewed by Functionalism (ibid.: 30). The principal objective of regulatory documents available for a PE project is to make post-editors aware of quality expectations, workflow scenario and types of issues commonly found in a particular raw MT output, to provide a systematic framework for carrying out a PE assignment, define the range of corrections and edits to be made and assure the quality of an MTPE project.

The expected output quality criteria are often communicated to translators using reference materials available for the project, such as PE guidelines and rules that reflect quality requirements applicable. The aim of these materials is not only to guide and support translators in their professional workflow but also to make the PE task more accessible to them, encouraging open-minded attitude towards translation technology (Schäfer, 2003). For instance, the post-editing rules written by Belam (2003) on the basis of an English MT translation of a German text on Christmas shopping in New York focus on a number of dos and don’ts for rapid PE. The researcher advises correcting any word that has not been translated and does not resemble its TL equivalent, to retranslate any word which has been translated so wrongly as to make the sentence meaningless, to delete anything which is confusing and which does not add or detract significantly to the meaning. It is recommended not to tidy up the style, not to change a word which has been translated inaccurately, but which still has a related meaning, not to change the word order if the meaning is not affected. Language- and content-independent rules of PE have not undergone any significant changes from early days of MTPE, when translators were recommended to retain the most of raw output, think fast and abstain from time-consuming researches, make only necessary changes of ambiguities and not to worry about repetitive style (Wagner, 1985).

As suggested by Guzmán (2007), creation of clear guidelines with detailed examples of the scope and boundaries of post-editing as well as anticipation of potential issues and drafting of relevant solutions with explanations on how to treat stylistic and terminological inconsistencies are particularly crucial for decision-making in PE. Guidelines contain information regarding post-editing in a particular language pair and illustrate relevant solutions through examples. To overcome uncertainty and subjectivity when applying these documents, it is important for translators to possess “a certain degree of tolerance and ability to draw clear boundaries between purely stylistic improvements and required linguistic corrections” (Krings and Koby, 2001: 6). Concise PE guidelines usually mention only specific regulations applicable to the project and provide correspondent samples from the raw MT output. On the other hand, extended PE guidelines may add information that helps post-editors better understand the process and particular issues that require editing (Martín-Mòr et al., 2016: 71).

To facilitate understanding of the PE process, the reference materials specify the category of MT system(s) used to obtain the output, since this information may improve understanding of the nature of possible errors. References may also give detailed information on how to approach PE projects and perform decision-making on whether to post-edit or start from scratch and contain advice on the terminology applied by the client in the SL and how it should be rendered in the TL(s). Guidelines for light PE advise translators to aim for semantically correct translation to use as much of the raw MT as possible since there is no need to implement purely stylistic changes or to restructure sentence for the sake of fluency. To achieve similar or equal to human quality translators are expected to aim for grammatically, syntactically and semantically correct translation without addition or omission of information, to edit inappropriate or unacceptable content, make sure terminology and spelling are correct (Massardo et al., 2016).

Keeping in mind the importance of guidelines for coherent and homogenous PE output, description of their effect on post-editors’ performance is among major research lines (Guerberof, 2008, 2009, 2012; Plitt and Masselot, 2010; De Almeida and O’Brien, 2010; Temizoz, 2013). The analysis is focused on transparency, consistency and applicability of PE instructions. For instance, the study conducted by Flanagan and Christensen (2014) explored the usability of the TAUS guidelines drafted in partnership with the Centre for Global Intelligent Content. The researchers focused on how translation students of MA degree interpret these guidelines to produce good-enough and publishable quality output. The experiment reported difficulties in guidelines understanding, the primary reasons for which was the trainees' competency gap and the wording of the guidelines. The study conducted by Depraetere (2010) involved giving participants (MA students) minimal instructions, like "ensure that source and the target contain the same information and that the target content is grammatically correct," along with a few examples of (non-)essential edits, based on Guzmán (2007). The study objective was to find out the scope of intuitive post-editing performed by students to be able to focus more on the issues causing problems. After analysis of the results, the following conclusions were drawn: correctly transferred sentences were not edited for the sake of fluency, terminology was left unchanged despite the availability of more appropriate terms, cases of under-editing or omission of information in the PE output were numerous.

Style guides that contain information on a particular project make another category of reference materials. The issues in question may include specific cases, e.g., the equivalence of SL and TL punctuation, units of measurements, decimals points, capitalization of titles, etc. The information provided may have a more generic scope, e.g., opting for a particular verb tenses or/and active or passive voice, specific word order or narrative style that is expected to facilitate comprehension. Another category of resources – project specifications – may embrace definition and description of contracted services (for instance, machine translation with following post-editing or translation-editing-proofreading scenarios), expected delivery dates, requirements to the technical means involved, language-related requirements, e.g., compliance with the provided term-bases, glossaries and/or style-guides, the origins and special features of the source content, among others. Confidentiality clauses and/or agreements belong to one more category of regulatory documents that contribute to decision-making and quality assurance when carrying out a PE project. Such materials may contain information on non-disclosure, the liability of the parties, procedures applied to deal with potential litigations, protocols on conflict settlements, governing law principles for those cases when, for instance, the client, the LSP or/and the translator are subject to the legislation of different countries. Agreements may also contain restrictions on by-products application, such as term bases, glossaries, parallel texts and/or translation memories, among others.

Client expectations, the volume of the project, turnaround time, document life expectancy and the use of the final text all contribute to the preparation of reference materials for a particular project (Allen, 2003; O'Brien, 2011a: 4). Guerberof (2010: 35) propounds the view that specific linguistic and technical directions for a PE project should involve the following: type of MT engine, description of the ST, reference to output quality and client's expectations, scenarios indicating when to discard a segment, typical errors, changes to be avoided and guidelines on how to deal with terminological issues.

In an attempt to gather all criteria that help post-editors make informed decisions and facilitate the process of post-editing a group of authors suggest a PE decision tool (Rico Pérez, 2012), which is expected to be easy to share and replicate across projects. Its elements are grouped around PE project information and text profile; these data are complemented with two rule activation sets (text-related guidelines and language specific rules) and an example card to demonstrate typical MT issues. PE project information focuses on the essential features of the job and contains a description of the client and the content peculiarities, availability of reference materials, e.g., glossaries, particular characteristics of the MT system used, project domain and the obtained MT output quality. Text profile embraces three major categories: communication channel (e.g., business to business), the profile of the content such as marketing materials, online help, social media content, etc., and an indication of ratings for utility, time and sentiment of the output. Typical errors of the raw MT output and the rules to edit them are listed in text-related guidelines. In the framework of such tool, the decision to activate particular rules depends on the information collected in previous datasets. The cases which are not covered in text-related guidelines, e.g., the use of a specific language locale, collocation or linguistic operations with the product name belong to language-specific guidelines. The example card, as the name implies, provides real samples of raw MT output for (a) particular language pair(s) of the project in question with the required PE edits introduced. From the researchers' point of view, the responsibility to fill in the data sets, activate the rules and provide adequate examples falls on the project coordinator.

To summarize, an MTPE project may incorporate project specifications, project brief, guidelines and style-guides, term-bases and TMs, among others. However, the frequency with which these resources are available is not sufficiently examined and requires further investigation.

2.4. Post-editor's profile

The ISO 17100 (2015) defines post-editing as a professional activity within the framework of translation services, which consists in editing the raw output produced using MT. Post-editing implies a positive and open-minded attitude on the part of translator towards MT technology; at the same time, it is a linguistic process that requires translation skills.

The conditions for completion of a PE project are similar to the conditions of a translation project, where the result is obtained through processing the original input content concerning requirements for output fluency and adequacy. For this reason, the professionals who engage themselves in PE-related projects are most commonly translators. The study conducted by Mesa-Lao (2013) suggests that most translation agencies use their regular pool of freelance translators to post-edit MT outputs. Prerequisites for recruiting freelance translators include the target language proficiency level (native speakers), academic background (degree in translation or related subjects), experience as translators, experience in the subject matter, familiarity with tools and technology-related requirements. Short-listed candidates usually pass a series of tests and fill in questionnaires on their experience before being given the job. The author expresses uncertainty whether such skills are crucial for efficient PE and makes a remark that not all freelance translators make efficient post-editors (ibid.). In line with this concern Allen (2003) quite rightly points out that: "experienced translators find it more difficult to accept translations with a level of quality that is lower than what they have done for years," and many of them voice negative feelings about automation of the industry in general and MT in particular (LeBlanc 2013, 2017; Ruokonen and Koskinen, 2017). As argued by Zaretskaya (2017), negative attitude of linguists roots in insufficient knowledge about MT and erroneous beliefs regarding MT output low quality, poor rates offered for PE jobs and monotony of assignments which require focusing on errors correction instead of translation.

Expertise in post-editing prescribes a favorable perception of MT, proficiency in the subject area, and perfect command of the target language (Johnson and Whitelock, 2003). Another classification of recommended competencies necessary to become efficient post-editor prescribes the candidates to have a degree in Translation and Interpreting or related subjects, to be familiar with localization and/or technical translation, to possess advanced word processing skills, to have positive, tolerant and open-minded predisposition towards MT, to demonstrate confidence in technical expertise and be able to recognize typical or repetitive MT errors (O'Brien, 2002). A set of skills for efficient PE might also embrace word-processing and editing skills, knowledge of MT and its shortcomings, awareness of the target audience and strong command of SL and TL, advanced decision-making strategies, ability to find a balance between PE speed and inverted effort (Kenny and Doherty, 2014). To a large extent, an MT system translates the original content sentence by sentence regardless of any information that exceeds the sentence level. Under such circumstances, when performing post-editing the provided raw output should be used as a draft to produce the final translation. Correspondingly, abstinence from over-editing contributes to an increase in productivity rates and could be mentioned as one of the specific PE-related skills. Among other recommendations required to ensure good PE performance are assessment of the general quality of MT and identification of issues in the output that need to be addressed; performance of post-editing tasks with reasonable speed, so as to meet the expectations of daily productivity for this type of activity; maximal automation of processes with the help of shortcuts and/or find-replace operations; respect of guidelines, so as to minimize the number of preferential changes, which are normally outside the scope of PE. There is growing support to the claim that the leading skill that characterizes the process of post-editing is the ability to decide quickly whether a machine-translated segment can be used or whether it should be ignored (De Almeida and O'Brien, 2010; Zaretskaya, 2017).

In what concerns post-editors' SL and TL proficiency, interesting research was conducted to find out how the degree of TL proficiency affects the output quality of PE assignments (Sánchez Gijón and Torres Hostench, 2014). The experiment on post-editing from Spanish into English involved translation trainees who were native speakers of Spanish and were proficient in English as a foreign language, and native speakers of US English who were proficient in Spanish. In line with TAUS baseline guidelines, accuracy and language were the two major categories applied in PE guidelines for this project, which were respectively sub-divided into mistranslations/omissions and grammar/syntax. Other (sub-)categories of errors were not included since the experimental corpus of raw MT output did not contain any of such cases. The data gathered in the study suggests that non-native English participants performed better in correcting mistranslations (i.e., accuracy) rather than language errors. As for the throughput, it was mentioned that the best performer of the group spent more time than the rest while the worst performer was the fastest in the group. Alternatively, English native-speaking participants were reported to have corrected almost all syntax errors, the majority of mistranslations, followed by omissions and grammar. The ratio of spotted accuracy and language errors indicated a more equal level of skills than that of non-native trainees. Therefore, the experiment outcome suggests that assigning PE jobs to non-natives of the TL is not advisable unless the post-editors demonstrate more than 70% success rate in their average performance. Yet, the researchers expressed their awareness that the results lack solidity due to the insufficient number of the participants; nevertheless, the study serves as a premise for further investigation.

Apart from being a demanding linguistic job, an MTPE-related project is likely to include a set of technical tasks regardless of language pair and/or specific subject-matter, so LSPs and translators should potentially be able to understand, manage and even run any of such jobs. And while there is no doubt that (re-)working and revising the text in the target language are the essential tasks of the PE process, a professional translator/post-editor shall not limit their ability to accomplish only those tasks, since the MTPE sector is vast and varied.

A noteworthy model of skills and competencies deployed by post-editors was set forth by EDI-TA research group (Rico Pérez and Torrejon, 2012; Rico Pérez and Días Orzas, 2013). The building blocks of the model of competences deployed by post-editors are instrumental skills, linguistic skills, and core competencies, defined by the authors in terms of attitudinal and strategic competencies. Acquisition of instrumental competence implies understanding of the process of MT output production and development of tolerance toward such product. References are made to the knowledge of key features and capabilities of rule-based, examples-based, statistical engines or hybrid MT systems, terminology management, maintenance of dictionaries and translation memories, assessment of input quality, basic programming skills. Linguistic skills embrace ST and TL knowledge, familiarity with PE-related reference materials and guidelines, textual and communicative competence in at least two languages, subject-field competence and (inter)cultural competence. The attitudinal or psycho-physiological competence allows to overcome subjectivity and uncertainty when using PE project specifications and to respond adequately to clients' expectations. Strategic competence is believed to help translators reach the informed decision on PE choices, “stick stoically” (Guzmán, 2007) to the specified scope of post-editing, follow the guidelines and abstain from editing stylistic issues.

The model suggests that the translator's role does not consist only in editing the raw MT output, but also in performing different MTPE-related tasks. A closer look at the scope of instrumental competence fosters debate about whether and to what extent a translator's role in an MTPE-related project might go beyond mere segment validation (Pym 2012, Austermühl 2013) and aim at control over and management of a broader range of tasks involved into MT output production. Command of instrumental skills leads to better interaction with MT systems and PE environments and contributes to efficient decision-making on how to optimize time and resources with the aim to achieve the required quality standards. Enhancement of instrumental competence also makes it possible for translators to create, train and optimize statistical MT engines as well as to tune and improve rule-based MT engines.

Advanced instrumental skills combined with proficiency in linguistic skills make it possible for translators to prepare lexical and terminological data that properly correspond to the project requirements, as well as look for and/or draft other resources outside the reach of an MT project that might help them guarantee the expected quality of the PE output through post-editing, proofreading and quality control stages (Sánchez-Gijón, 2016). Indeed, an MT system is bound to yield better results if it is fed with the content of high quality that is provided in the form of mono- and bilingual corpus, glossaries and term-bases and is characterized by appropriate style and subject-field. Meanwhile, installation, tuning, and management of MT systems require excellent technical competence, which probably overpasses the scope of post-editor’ and/or MTPE project manager's competence (ibid.).

To summarize, the core competencies required for editing raw MT content include efficient speed and adherence to the guidelines, which regulates the scope of required changes. However, a broader range of post-editing skillset grants translators with a capacity to not only perform PE assignments but also to provide a fuller spectrum of tasks and actions involved in MTPE projects. In this case a linguist is fully capable of preparing project materials, improving the resources engaged into the project, preparing and/or modifying MT systems and, in some cases, installing and/or configuring settings of an MT engine, although the fact that the latter might be seen as a component of PE competence raises certain doubts.

2.5. Specialized training in MTPE

A qualitative shift from teaching merely contents to teaching competencies requires a considerable effort from all agents involved in this process of transformation. The global MTPE market is in constant search of translators who possess SL and TL knowledge and have a grasp of MT technology and PE practice. Increase in MT use is resulting in expanding demand for post-editing experts and entails creation and implementation of MTPE training programs for the industry and academia (O'Brien and Schäler, 2010).

To meet the growing need for large volumes of translated content and enhance PE competence in those parts where it differs from translation competency, specialized training on PE is recommended. The training is expected to introduce trainees to PE strategies and tools as well as improve one's perception of MT and its capabilities (O'Brien, 2002: 100). For PE expertise to be enhanced the emphasis is likely to focus on decision-making, problem-spotting and problem-solving with appropriate application of a wide range of translation strategies and procedures. Field experts believe that command of the source and target languages, ability to identify errors, knowledge about the cross-language meaning transfer, technical resources all contribute to the successful training in PE (McElhaney and Vasconcellos, 1988). Besides, along with improvement of PE throughput rates and output quality, there is a suggestion that students' training in PE has positive effect on their new TL vocabulary, grammatical points, and style, translation skills, test analysis skills, the grasp of register for different communicative situations, theoretical and practical aspects of using language (Belam, 2003).

As evidence shows, training in post-editing differs from training in translation (Krings and Koby, 2001:12). In this concern graduates of translation programs should be exposed to a specific range of skills inherent for MTPE, as some of the skills required of post-editors are contrary to the objectives of a translation assignment. According to the research conducted by Groves (2008), there emerges a need to educate translators in limiting their performance to error editing "rather than give into their subjective opinions or preferred translation style". On the other hand, Offersgaard et al. (2008) propose that many of the characteristics attributed to translators could also apply to post-editors. Even so, the authors take into account the fact that while translation training usually focuses on the creation of a target content of publishable quality with accuracy and equivalence being the main criteria, quality requirements in PE may vary from minimal to full PE. It is for this reason that Senez (1998) rightly commented that "a translator will always strive to disguise the fact that the text has been translated. In the case of post-editing, it is enough for the text to conform to the basic rules of the target language, even if it closely follows the source text."

Introduction of MTPE modules to translator training syllabi may not be a common practice yet (Niño, 2009: 252), although many language and translation trainers are aware of the subject. It is believed that the essential features of a training module that aims at fostering the core PE competencies should develop students' capacity to identify issues in the raw MT output that need to be addressed and to fix them appropriately. Such training is expected to boost students' ability to carry out the post-editing task with reasonable speed, to adhere to the guidelines to minimize the number of preferential changes, which are typically outside the scope of PE (De Almeida and O'Brien, 2010). Ability to identify the issues in the SL content and apply norms and special requirements to one's output in the TL lie in the heart of PE jobs (Toury, 1995; Chesterman, 1993), although criteria and requirements differ for each project and evolve due to many circumstances. In this instance, it seems hardly possible to identify and teach one-size-fits-all rules for enhancement of post-editing. For the sake of discussion, it should be said that on the whole the information about how proficiency in PE acquired is insufficient and research on how it can best be taught is scarce. On these grounds investigation of compelling arguments to corroborate improvements in students' PE performance that result in detectable and lasting effects keep staying in the focus of research on PE.

In an attempt to address the issue of specialized training in MTPE, the contribution of Dublin City University experts into the development and sharing of good practice in MTPE training paved the way for other researchers in the field (Rossi, 2017). In line with the claim that efficient teaching of MTPE requires a combination of theory and practice (O'Brien, 2002: 104-105), the theoretical part of a specialized course proposed by Sharon O'Brien (ibid.) features topics on the introduction of PE, MT technology, and controlled language authoring. Then, it is complemented with advanced terminology management and test linguistics as well as basic programming skills. The syllabus is expected to explain to students how to write macros to automatically clean up texts and familiarize them with language specific text type norms. The practical part covers a broad range of activities involved in MTPE projects, such as practicing different levels of PE; making changes to setting and comparing results of at least two different MT systems; practice with terminology management tools, dictionary coding utilities, and terminology exchange formats. To amplify the effect of the practical part of the course, it is advised to include compilation, analysis, and tagging of parallel corpora as well as opportunities to employ the acquired programming skills. Enhancement of programming skills contributes to PE experience and introduces students to how common errors of the content can be automatically fixed. The researcher also stresses that students should be encouraged to practice post-editing both within and outside course hours. The last statement shares premise with the observation that the level of comfort with post-editing is greatly increased after post-editing 100.000 words, which is usually taken to reflect the number of hours of training needed to turn someone into a proficient post-editor (Vasconcellos, 1986). Yet, the DCU proposal represents an ideal case that may not be easy to apply universally given the number of contact hours and the range of topics to be covered in translation training curriculum.

As the result of training in the aforementioned fields of knowledge and skills, BA and MA graduates are expected to know how to create the output of required quality while making use of available tools, following reference materials provided, and recovering different kinds of missing information. The knowledge of terminology exchanges formats and management tools may become useful in case when MT dictionary coding and term-base management is required. Familiarity with controlled languages and tools combined with proficiency in source and target language(s) enables post-editors to apply such rules to the content right before it is processed by an engine to obtain the raw output of better quality.

The major problem with research on enhancing PE competence is similar to the one experienced in many other language-related disciplines when teaching effects are uncertain and hard to assess (Kiraly, 2000). As a consequence, lots of trainers might keep wondering whether the changes in students’ performance over a period of time happened as a consequence of the applied teaching methods, inborn and/or previously acquired dexterity or whether such changes would have occurred anyway. The data gathered by means of classroom experience and empirical research on PE quality and productivity (ProjecTA report 2015; Guerberof, 2012, 2014) suggests that some students and translators seem to "instinctively" perform the task faster and better than others, while particular triggers of such behavior have not been explored in full so far (Sánchez Gijón and Torres-Hostench, 2014). In this respect, the scholars report about the absence of empirical studies that test the so-called intrinsic skills that might be beneficial when performing PE and call for further research in this field.

Training in MTPE entails extra advantages for translation degree graduates looking for employment opportunities mainly, but not solely, with those LSPs that implements MTPE model in their workflow. Even so, the fast pace of today's life, technological and scientific changes and labor market modifications make it impossible to predict what knowledge, professional skills and competencies will be required in ten or fifteen years. Correspondingly, after graduation novice translators will have to keep on studying as active members of emerging lifelong-learning society.

Concluding remarks

The chapter explores the issues related to translators training in the academic environment with a special focus on translators' and post-editors' profiles.

First, an overview of approaches to the definition of translation competency was conducted, that culminated in the description of training objectives pursued by academia. Then the focus of our attention moved to translation modalities, the task of post-editing, and various interpretations of this recently emerged type of professional activity. To shed light on key issues related to PE output production MTPE-related workflow, commonly used MT error typologies, software tools and systems used to enhance MTPE performance and regulatory documents applied to achieve the required quality standards were reviewed. The broad range of tasks involved in the production of the target output served as a background for description of professional skills and competencies deployed by translators working on PE projects. In the end, a sketch of the training content used for MTPE-related modules was made.

Chapter 3. Expertise in PE

This chapter is premised on the assumption that examination of the scope of PE expertise is highly beneficial for industry and academia with a view to facilitating MTPE processes and training in PE skills, and could produce a synergistic effect that would give an impetus to further research and experiment. Therefore, investigation of post-editors' subjective opinions and viewpoints becomes helpful for those experts who focus on the development of theories and tools relevant to the current needs of the industry.

In line with the objectives of this research, an empirical survey-based study *Sharing Post-Editing Practices* which aimed at investigation of multiple facets of PE expertise was conducted. Details on survey setup are provided in Section 3.1, namely, general observations that preceded survey preparation, such as data collection issues, the structure of the questionnaire, considerations on the sample and generalizability, and questionnaire piloting. Exploration of the scope of PE expertise is conducted in correspondence to four aspects of the research construct, namely respondents' profiles and experience, MTPE workflow, decision-making and contrast of translators' vs. post-editors' profiles, while Section 3.2 describes and analyzes the collected responses. The combined results contribute to updating the model of PE expertise and provide grounds for the experimental study on enhancing PE competency among novice translators (Part II).

3.1. Sharing Post-Editing Practices: survey setup

The broad variety of MT output quality levels, the wide diversity of clients' expectations and the lack of shared best practices are some of the current problems the MTPE industry is facing at the moment. With the objective to overcome these stumbling blocks, translators, translation trainers and the industry have to provide solutions that are based on the relevant and updated information. To pursue this aim we think it important to elicit responses to the most common yet insufficiently studied parameters of translators' performance in post-editing.

Operationalization of the research construct was the essential prerequisite for drafting the questionnaire. A lot of research has been conducted to study the concerns expressed by the different groups of experts engaged in MTPE (e.g., linguists, LSPs, scholars, and students). Among the major issues are the quality of the output produced by

MT engine(s) (Gaspari et al., 2015; Guerberof, 2017) and the throughput that may (not) increase as a consequence of the raw MT output (Gaspari et al., 2015; Ruokonen and Koskinen, 2017; Cadwell et al., 2017). Measuring and evaluation of post-editing (PE) effort makes another important line of investigation (Gaspari et al., 2014; Koponen, 2012; Moorkens et al., 2015; Teixeira, 2014), as well as bias and negative predisposition towards MT (Cadwell et al., 2017). In contrast, the field studies on who post-editors are, what their professional workflow is like, and what skills and competencies they employ in day-to-day activities are few.

In particular, further investigation is required for starting and closing phases of PE assignments, their scope, productivity, and metrics, not to forget about the profiles of those who perform PE. Another ongoing debate focuses on whether PE projects should be carried out by field experts who have a strong command of linguistic skills, or rather professional translators with specialized training in the subject. Although (re-)working and revising the text in the target language are without doubt the essential tasks of PE process, the data also appears to suggest that MTPE experts do not limit their ability to accomplishing those tasks only, since the professional PE sector is vast and varied. In parallel with this statement, the assumption is put forward that an MTPE project is likely to include a set of language-independent tasks, so post-editors, as well as providers of MTPE services, should potentially be able to understand, manage and even run them. In light of digitalization of translation paradigm, one more interesting avenue of exploration deals with the issue of similarities and differences between translation and post-editing.

In conformity with the objectives of the research and the theoretical overview conducted in Chapters 1 and 2, operationalization of the questionnaire is grounded on four principal aspects that underpin the concept of PE expertise, namely: (1) respondents' profiles and experience, (2) PE workflow, (3) expertise and decision making in PE, (4) post-editing vs. translation. We are conscious of the fact that a thorough study of any of these aspects could be a research topic in itself. In this concern, our survey does not claim to give exhaustive feedback on them all, but rather to analyze the first-hand experience of those who are directly involved in PE practice.

In her doctoral thesis Ana Muñoz (2014) summarized the types of surveys as seen by many leading scholars (Visauta, 1989; Rea and Parker, 2005; Hernández et al, 2010), who had set forth the following classification criteria:

- the principal research objective: exploratory, descriptive, explicative, predictive or evaluative;
- the content: focusing on facts, on opinions, or on attitudes, motivation or feelings;
- the administration processes: conducted personally, by phone, by mail or self-administered;
- the temporal dimension: transversal or synchronic surveys, on the one side, and longitudinal or diachronic surveys, on the other;
- the subject: political, social, commercial, etc.

In line with these considerations, we see our survey as a descriptive study that aims at getting more detailed information on the profiles and the scope of competence of the respondents for its further use for training purposes. The elicited responses refer to facts (years of experience, academic background, subject fields, etc.), opinions (perceived throughput rate, frequency of using specialized tools, importance of specific skills etc.) and feelings (e.g., comparison of the profiles of translator and post-editor). The survey is self-administered by means of a questionnaire, as the respondents follow the link and mark their answers without supervision. The temporal dimension of the survey is transversal, which means it collects the real-time feedbacks from post-editors, and its objective is to collect first-hand data on MTPE-related processes and profiles.

Description of the survey setup starts with justification of data collection issues. Sections 3.1.1 and 3.1.2 report on how the information was gathered and outline the survey structure. Next, the issues of sample, universe and generalizability are considered (section 3.1.3). To conclude, the questionnaire piloting is explained (section 3.1.4).

3.1.1. Data collection

A questionnaire as a research instrument yields structured and standardized outcome on “a (usually) large number of cases” (Matthews and Ross, 2010: 201), and lies at the heart of survey-based study designs (Langdridge and Hagger-Johnson, 2009: 88). It is a common practice to use the term ‘survey’ to describe the study design on the whole, while the ‘questionnaire’ is seen as an instrument used for this type of a study (Saldanha and O’Brien, 2014). Calls for attention to human agents of translation process were triggered by Robinson’s The Translator’s Turn (1991), followed by a suggestion to add a branch

'Translator Studies' (Chesterman, 2009). Since then sociological approach starts being adapted to the study of the interaction between human agents, translated output and production processes (Inghilleri, 2005; Chesterman, 2006; Wolf and Fukari, 2007; Wolf, 2011). The consensus view seems to be that the method of questionnaire is a staple of sociological investigation; nevertheless, it has also been extensively used in applied research without resorting to social theories.

The main reason behind choosing a questionnaire as our investigation tool is its capacity to obtain quantitative information on a large scale with respect to the anonymity of its participants (Rojo, 2013). Other benefits of using a questionnaire involve possibility to quantify and generalize the collected data, respondents' autonomy which might result in a higher response rate. The use of questionnaires for research purposes in translation, namely when studying translation technologies or training efficiency, was reported by a vast group of investigators (e.g., Chan, 2010; Van Dam and Zethen, 2008, 2010; Lagoudaki, 2008; Sela-Sheffy, 2005). Some of such studies are conceptual, while others have a strong empirical perspective and provide relevant details for participant-oriented research (Saldanha and O'Brien, 2014: 150), and numerous opportunities for data systematization and analysis (Kumar and Phrommathed, 2005: 130).

The questionnaire contained open and closed fact-finding questions that were used to collect structured data for further quantitative analysis. Taking into consideration the variety of issues covered by the questionnaire, we thought it appropriate to use different formats of questions to elicit a diverse spectrum of answers. To contribute to the already existing picture of the MTPE industry and create another source of publicly available information that could be of use for a broad range of industry and academic stakeholders, the questionnaire combined dichotomous questions (to ask for permission to use the respondents' data for research purpose), open-end questions (to inquire about respondents' age, country of residence or working language pairs, etc.), multiple choice questions (e.g., to define common PE throughput rates). However, the vast majority of questions provided a matrix of answer options; the relevance of each of such options was further specified either with the help of numeric rating scales (e.g., the volume of a certain types of projects), or Likert-type scales measuring e.g., the frequency of particular tasks, the importance of skills and competencies in question, or satisfaction levels of acting post-editors with their occupation. Although commonly offered rating scales consist of an odd number of points available to grade one's answer (as a rule, five or seven), when measuring frequency and importance it was decided to opt for an even number of values so that the respondents did not feel tempted to pick the mean value and by doing so to jeopardize reliability of survey results. For this very reason, an even-numbered scale is favored by some researchers as it prevents respondents from conveniently selecting the problematic mid-point on the scale and thus limits the reliability of the answers (Saldanha and O'Brien, 2014: 158). Besides, the large number of questions contained free text slots aimed at collecting personalized opinions on particular topics.

For the cases when the researcher was not sure if predefined answer categories incorporated all possible variants of answers, a free-text box was provided for informants to comment and share their ideas on particular issues. By 'informant' we mean any respondent of the survey who demonstrated more active involvement in constructing the outcome of the research and contributed not only by answering the questions, but also providing comments if necessary.

3.1.2. Questionnaire structure

Before drafting this questionnaire the CASRO (Council of American Survey Research Organizations) codes and standards for internet-based surveys were analyzed, where among other highlighted criteria the stress was placed on informed consent and research brief. Therefore, a brief with a description of the research, its title and objectives, and an invitation for those interested to request general survey results after its completion were provided at the top of the questionnaire form. The brief was followed by a line thanking the translators for participating in the questionnaire and informing them about the number of questions and the approximate completion time, which was defined after piloting the questionnaire (section 3.1.4), and was considered affordable for any professionally active individual. It is a common knowledge that the shorter is the questionnaire, the higher are the chances to avoid non-completion. As stated by Saldanha and O'Brien (2014: 154) "there is no ideal number of questions for a questionnaire"; for this reason questions number of questions was kept to the minimum for the sake of the response rate which could decrease should the questionnaire be too lengthy.

Another important prerequisite for conducting our survey was to assure that the respondents are fully informed stakeholders whose authorization for further processing of their questionnaires is free and revocable (ibid.: 150). To this end all subjects were invited to read the informed consent statement at the beginning of the questionnaire form and express their agreement to participate in the survey and provide data for further processing for research purposes only; in continuation, they were offered an incentive of sharing the survey results after their processing and publication.

To avoid misunderstandings and confusions, the questionnaire form also contained a Glossary with interpretations of special lexical units used in the questionnaire, e.g., semi-automatic PE, linguistic guidelines, segments of specified origin, fluency issues, etc. Besides, all questions that involved such lexical units contained an online link to the Glossary and the participants could easily access it at any moment when filling in the questionnaire.

The first block – *Background information* – was dedicated to respondents' background and experience. The subjects shared information about their predominant language pairs for PE projects, graduate and postgraduate background, years of experience in translation and post-editing, age, country of residence and membership in professional associations. They were asked about how often they perform translation, PE, revision, project management etc. as part of their professional activity, their average PE productivity and metrics for defining PE rates. The next sub-set of questions was focused on the total of performed PE projects and aimed at picking up the data on the percentage of manual vs. semi-automatic, and full vs. light PE jobs, as well as the prevailing domains and content types for PE projects. Although not all the obtained data were in the primary focus of our survey, the collected information contributes to the comprehensibility of the results due to the diversity of respondents' backgrounds and experiences.

The second block was focused on *MTPE workflow,* its questions covered various aspects of MTPE-related processes and routines. First, information on the ways of starting a PE project was collected (e.g. pre-editing, raw output evaluation, use of terminology extraction tools etc.), followed by the starting point of a PE task (e.g. availability of raw MT output, access to MT engines and TMs from previous projects). Then frequency of use of the most popular PE tools and systems was questioned (for instance, TM systems, PE environments, complementary tools) as well as the availability of reference materials, such as project specifications, linguistic guidelines, client style guides, etc.

The third block was called *Post-editing and decision-making*. It highlighted respondents' expertise and decision making in PE. The respondents were invited to describe the stimuli that trigger one's decision to post-edit a particular segment, such as fluency issues in a low-visibility document, absence of the possibility to fix the issue by means of (semi-)automatic operations, or availability of feedback from previous jobs, among others. To find out how the subjects themselves rank skills and abilities indispensable for successful completion of a PE job (e.g. knowledge of programming or positive attitude towards MT) they were asked to express their opinion on the importance of competencies that are frequently mentioned in a vast range of research materials on post-editors' efficiency.

Since translators and post-editors are often being contrasted and there is an ongoing debate about how much these two fields of expertise have in common, our fourth block called *Translation vs. post-editing* was aimed at the exploration of similarities and differences as spotted by language experts themselves. To this end, the informants shared their opinions regarding the most widely adopted features of translators' expertise by comparing translation and post-editing performance in terms of translation skills, textual competence, information-processing competence, and/or instrumental competence. The penultimate question invited respondents to express their attitude to the MTPE industry measuring and comparing output quality, profitability and professional demand, among others, with the same parameters of 'human' translation. The final question consisted of an open text box for personalized responses with an invitation to add any comments that are relevant to the research on PE expertise and training of novice post-editors.

The final question inquired about any survey-related observations that the respondents were willing to comment on. The closing page of the questionnaire contained a thank-you note.

3.1.3. Sample and dissemination

The most widely spread sampling methods are probability-based (or 'random sampling') and non-probability based (or 'convenience sampling'). In the first case the probability with which any member of the concerned population could have been selected and included in the sample is known; in the second case, participants are selected due to their accessibility to the researcher. Our survey combines salient features of both methodologies, since it was aimed at all those post-editors who could be reached via multiple online channels, while the responses were provided only by those who had access to the Internet, were registered on the relevant platforms or connected in any way with the partner organizations, and had time and wish to participate. Luckily enough, we believe it to be highly unlikely that in-house or freelance translators would not have access to the Internet, however time constraints could be a hurdle.

Convenience sampling and an impossibility to confirm respondents' identity may be considered as the limitations of the present study. But despite the non-probabilistic nature of the survey, the data collected from a large number of cases facilitates statistical inferences about the research construct and can also be used for developing a hypothesis or outlining general tendencies for future lines of research. The obtained answers make an interesting and valid dataset to analyze profiles and routines of a broad cross-section of translators currently engaged in post-editing. The survey results are based on 124 valid questionnaires filled in by respondents in 26 different countries which we consider as sufficient. The sampling may be considered reliable since the analyzed data belong to a wide set of translators with diversified professional background and vast geographic coverage.

In the framework of our investigation, the target population (Groves et al., 2004: 44) consisted of all professionally active translators who are engaged in MTPE-related tasks exclusively or combine them with other professional activities. Although a lot of researchers focused their surveys on translators who belong to a specific geographic area (Li, 2000; Van Dam and Zethsen, 2010; Vigier Moreno, 2010; Sachinis, 2011), in our case experience in PE was put forward as the only necessary requirement, so that to involve the maximum number of respondents irrespectively of the country of residence or the working language pair(s).

According to the new MT Industry Report by Grand View Research (2015), the MT market is expected to reach 983.3 million US dollars by 2022, while TAUS Machine Translation Market Report (2017) estimates the revenues from MT market on the level of around 130 million US dollars. However, despite the rapid development of the MTPE translation market, there is no way to measure the share of MTPE projects performed worldwide, and the number of professionals engaged in PE is still to be explored. For our investigation, such circumstances were the major hurdle for making conclusions about the universe. A similar position was voiced in the doctoral thesis by Ana Muños Miquel (2014: 167), who mentioned the absence of publicly-known official census of medical translators either in Spain or in the other countries as the reason for impossibility to measure the total population for her research needs.

To get maximal representation in terms of national and geographic coverage, the information regarding the survey was shared among the contacts of ProjecTA research group and directed to publicly available contacts of LSPs located worldwide. The Translation Automation User Society and the International Federation of Translators also kindly agreed to spread the information about the survey via their channels. The foregoing discussion implies that in contrast to other subject fields, translation studies manage to engage a much smaller number of subjects (Saldanha and O'Brien: 2014). To maximize the reach of the questionnaire and attract even more traffic from the translation community the call for participation with the link to the questionnaire form was posted in specialized groups of leading social media platforms. These measures led to extended geographic coverage of the participants and boosted response rates. However, it is impossible to estimate the latter since the questionnaire was circulated using a variety of channels, which does not provide us with information to make a claim regarding the representative coverage of the responses.

The questionnaire was Internet-mediated so that the information and links to the questionnaire could be posted on various platforms. Some researchers believe that on average web surveys get lower response rates when compared to other ways of administration, although this data is hard to prove since a combination of methods and technical channels was used to spread the link to the questionnaire among potential respondents (Vehovar and Manfreda, 2008: 184). Among the advantages of this particular channel are the possibility to reach out to 'hidden populations' or groups that are hard to identify, to increase participants' sense of privacy and ease when filling in the questionnaire, to lower the risk of 'researcher effect' (Saldanha and O'Brien, 2014: 166-167). The Survey Monkey online survey tool that facilitated data collection and processing was deployed for questionnaire distribution. The selected web-based survey solution allowed on-line administration of the questionnaire to multiple participants, collection and summary of the data in numeric and graphical formats. What is more, the Survey Monkey tool used for the survey purposes made it easy for the researcher to get an update on the response rate on a daily basis.

As previously mentioned, the results of the survey are fully applicable to our aim – collection of data for a training proposal that would enhance PE competency in novice translators, as well as help to unveil the emerging profile of MTPE expert. Reliability and validity of the questionnaire as well as avoidance of errors associated with the applied research method were assured by the pilot testing outcomes.

3.1.4. Piloting

As argued by Groves et al. (2014: 259), the objective of the piloting phase is to make sure that the questionnaire goes in line with content standards (i.e., the questions are asking what they are supposed to ask), cognitive standards (i.e., the respondents understand the questions consistently, have enough information to answer them, and are willing and able to give the answer), and usability standards (the questionnaire is easy to complete). Following the best practices adopted in the field (Fowler, 1995; Kumar and Phrommathed, 2005: 135-138; Hernández et al., 2010: 225-229), the piloting helped us to make sure that the wording of the questionnaire was clear, precise and up to the point, the vocabulary as simple and unambiguous, each question is aimed at investigation of one issue at a time; the questions are free from bias or prejudice and are not drafted in negative form.

The questionnaire contained 25 questions of different complexity, and a progress indicator was included to inform the respondents about how much was left. To avoid the situations when the respondents would not provide answers to all required questions otherwise called 'nonresponse error', the Survey Monkey tool was configured in a way that the participants could submit their answers only if all required fields were filled in. In this way we spared ourselves from the dilemma of whether to eliminate or not those questionnaires where the participants may not have answered all questions, reducing the response rate. The progress bar of the top of each block of questions showed how much of the total was filled in.

The piloting of the questionnaire was arranged in April 2015 with the help of five linguists who had 1-3 years of experience in PE. The testing team members were asked to assess such questionnaire parameters as the time required to fill it in, clarity and comprehensibility of wording, the usability of results. Rasinger (2013: 70-71) stresses that a questionnaire should start with more straightforward questions, and the whole structure should somewhat look like a story with its beginning and end. As confirmed by the testing team, the questions order was logical and the link between questions was made evident by providing titles of the blocks. The wording of the questionnaire was clear, accessible and simple since it was aimed at a broad multinational community of professionals engaged in PE, for which reason the total number of questions did not undergo any changes for the full-scale phase.

We fully agree with the statement that "no single research study can provide all of the necessary evidence that a scale has reached the 'gold standard' of construct validity" (Langdridge and Hagger-Johnson, 2009:104). Nevertheless, pilot testing of the questionnaire proved the practical benefit of the questionnaire design, since the survey outcomes measured what they purported to measure – i.e., multiple aspects of PE practices. In particular, the questionnaire output provided us with a comprehensive overview of key PE skills and functions, as well as shed light on post-editors' personal and professional background.

Participants were not rewarded for investing their time and effort in our study, the only incentive being the possibility for those interested in the survey results to get general feedback on its completion. The questionnaire form administered to the participants is presented in Appendix I (Link I.1).

3.2. Sharing Post-Editing Practices: survey outcomes

The full-scale survey was launched in January 2016 and lasted three months in total. As aforementioned, apart from the introductory and closing sections, the questionnaire included two clauses to ensure ethical validity of the collected data, followed by four blocks with questions that aimed at unveiling respondents' profiles, discovering the key features of MTPE workflow, disclosing post-editors' expertise and decision-making processes and finally analyzing similarities and differences between post-editing and translation.

To begin, it is important to highlight that all 124 respondents granted the researcher with their consent to participate in the survey and to provide data for further processing for research purposes only, as can be seen in Table 1:

Q. 1: I agree to participate in the survey and provide data for further processing for research purposes only

Answer options	Response percent	Response count
yes	100%	124

Table 1. Informed consent

Since none of the respondents got any financial remuneration for the time and effort dedicated to our survey, we suggested an incentive for their participation and inquired whether they would like to receive generalized feedback on the survey once it is completed (with an invitation for those interested to leave their contact details). When answering this question, 106 participants expressed their interest in obtaining the results, while 18 abstained. The percentage of responses is shown in Table 2:

Q.2: I would like to receive an email with the general results of the survey

Answer options	Response Percent	Response count
yes	86%	106
no	14%	18

Table 2. Sharing the feedback on survey results

3.2.1. Block 1: Respondents' profiles and experience

Q 3. How old are you (full years)?

The starting point of the first block of the questionnaire was a question concerning respondents' age: we thought it important to inquire about this demographic parameter in order to have a more complete picture of how old the experts currently engaged in the MTPE industry are. This parameter might also indicate to the age group of potential attendees interested in academic and/or in-house training on PE competence enhancement, which is the major aim of this research. It turned out that the scope of the participants' age was between 22 years old and 77 years old. Due to the vast range of data, it was decided to split all responses into categories with the margin of 10 years (e.g. group 1 for those aged 20-29, group 2 for those aged 30-39, etc.). As the results show (Table 3), a substantial group of survey participants are translators in their early/late thirties, followed by the age groups of 40-49 y.o. and 50-59 y.o. This data goes in line with the fact that MTPE market started its rapid growth only in the last decades, although it has been present on the landscape of translation industry for much longer.

Approximate Answer options	**Response Percent (round-off)**	**Response count**
20-29 y.o.	17%	21
30-39 y.o.	28%	35
40-49 y.o.	20%	25
50-59 y.o.	21%	26
60-69 y.o.	10%	12
70-79 y.o.	4%	5

Table 3. Respondents' ages

Q.4: Your current country of residence

Before embarking on research regarding MTPE processes we thought it important to get a general understanding of where the participants of the survey are from. To find out this information we collected responses on their current country of residence (Figure 1). The obtained piece of data shows that our informants were based in a large number of countries since there was no strong intention to conduct this survey with pure European focus and the link to the questionnaire was spread worldwide. Yet, quite logically, the larger local representation was from Spain, where the researcher was located: 17 participants mentioned this country as their current whereabouts. Israel was reported as the country of current residence by 13 respondents, France and Germany where the home for 12 respondents each, and 10 participants informed to be actually living in Russia. As already mentioned, in total the survey involved 124 participants from 26 countries located on 4 continents.

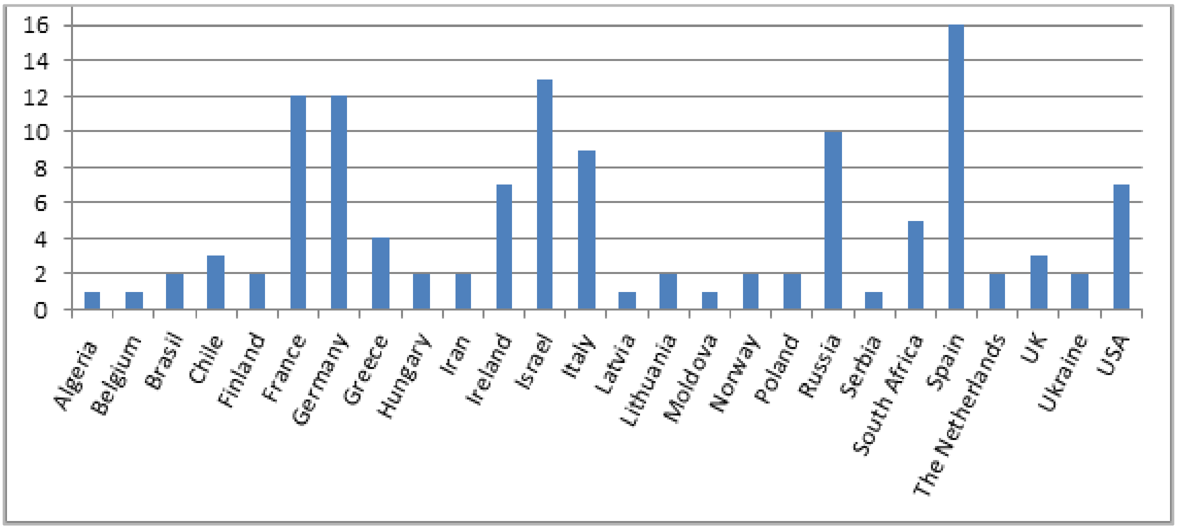


Fig 1. Respondents' current countries of residence
(the vertical axis represents the number of respondents)

Q.5: Are you a member of any translators' association? (if yes - please specify which one)

The point of our next question was to inquire if the respondents have membership in any translators' associations or federations and to specify their responses (Table 4):

Answer options	**Response Percent (round-off)**	**Response count**
yes	37%	40
no	63%	84

Table 4. Respondents' memberships to translators' associations/federations

Among the mentioned professional unions of translators there were: SFT (France), BDÜ and ADÜ Nord (Germany), ABRATES (Brazil), ATA (USA), CIOL (UK), ITIA (Ireland), STF and NFF (Norway), SKTL (Finland), APTIC and ANETI (Spain), ITA (Italy), ITA (Israel), SATI and TINSA (South Africa), as well as internationally functioning the European Language Industry Association (ELIA) and the International Association of Professional Translators and Interpreters (IAPTI).

On the whole 37% of respondents answered positively to this question, while 63% responded negatively or abstained, which we interpreted as a 'no' (Table 4). These data can be explained by post-editors' broad geography and the fact that the majority of them are freelancers, while the LSP(s) they work for might be a member of translators federation/association or like. This conclusion is drawn from the fact that among our key partners in questionnaires distribution there was the International Federation of Translators, and yet none of the respondents mentioned IFT membership, since, most probably, they were contacted directly by the LSPs which are IFT members.

Q.6: What is (are) your working language pair(s) for PE projects?

The next question concerning respondents' professional background sheds light on their working language pair(s). There were no predetermined responses to this question due to the global focus of the questionnaire. As it turned out, 48% of respondents opted for one source language and one target language when describing their assignments; 23% translate from more than one source language into one target language; 19% translate from one source language into more than one target language, and 10% translate from more than one source language to more than one target language (Table 5):

Working languages	**Response Percent (round-off)**	**Response count**
1 SL → 1 TL	48%	54
> 1 SL → 1 TL	23%	29
1 SL → > 1 TL	19%	25
> 1 SL → > 1 TL	10%	16

Table 5. Correlation of SL(s) and TL(s)

As a follow-up, the next two graphs represent the mentioned source and target languages in the alphabetical order. The survey participants were free to mention any language pair(s) that corresponded to their professional scope and, logically, many of them opted for more than one source and/or target language, which resulted in selecting multiple options by about 52% of the participants. For this reason, we do not provide percentage value for source/target languages as the number of counts largely exceeds the number of respondents. Instead, above each column representing a language there is a digit that corresponds to the relevant number of the participants, translating to/from it on a daily basis.

The pool of source languages was made of Afrikaans, Catalan, Czech, English, French, German, Greek, Hebrew, Italian, Japanese, Norwegian, Russian, Serbian, Slovak, Spanish, Swedish and Yiddish (17 languages in total), as summarized in Figure 2. This piece of data shows that in the framework of our survey the most popular source languages for PE projects are English (55 responses), followed by German (22 responses) and Spanish (17 responses).

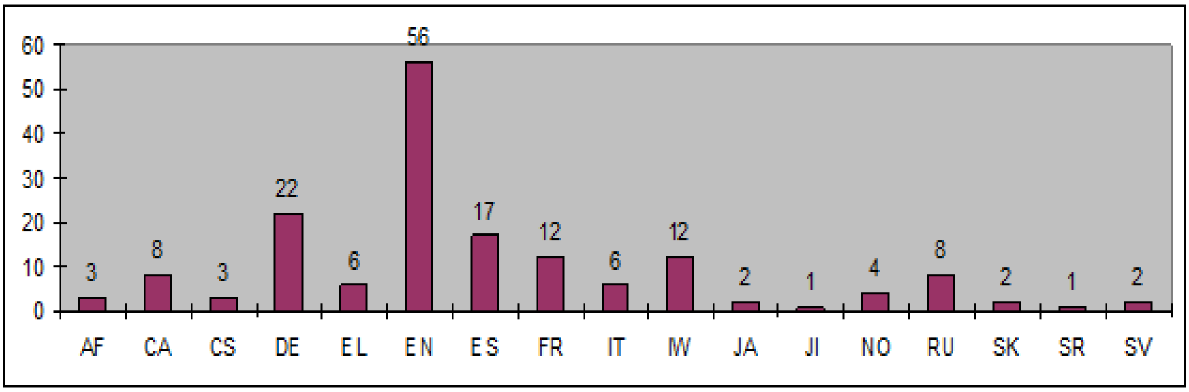


Figure 2. Respondents' source languages for PE projects
(the vertical axis represents the number of respondents)

As for the target languages, the participants mentioned the total of 26 (Brazilian Portuguese, Catalan, Chinese, Czech, Danish, Dutch, English, Finnish, French, German, Greek, Hebrew, Hungarian, Italian, Latvian, Lithuanian, Persian, Polish, Portuguese, Russian, Serbian, Slovak, Spanish, Swedish, Ukrainian and Yiddish). The obtained breakdown on responses relevant for our survey (Figure 3) reveals the popularity of target languages with 21 responses for English, 17 for French, 16 for Spanish, and 15 for German.

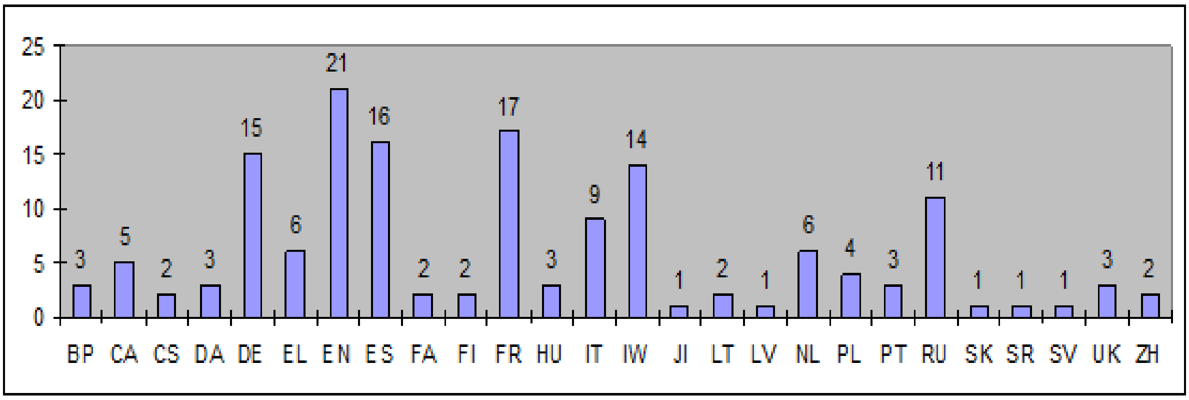


Figure 3. Respondents' target languages for PE projects
(the vertical axis represents the number of respondents)

Q.7: Please indicate your academic background (graduate and postgraduate studies - please specify your major, academic institution and graduation year)

It is a common knowledge that those involved in post-editing are mostly linguists with an academic background, and the prevailing amount of their professional workflow consists of translation and post-editing jobs. It is also true that those who do not have a special degree in translation-related programs for a number of reasons including the ones beyond their control, also opt for careers in translation. Quiet reasonably some sectors of industry would rather turn to a post-editor who, apart from linguistic competence is an expert in other fields relevant for each particular project, it is important to get an updated picture on the profile of professionals engaged in PE. In this concern, we decided to focus our interest on the respondents' specializations, graduate and postgraduate studies and to ask them to specify their major(s) and the year of graduation from the relevant academic institution. No predefined answer boxes were provided since the researcher fully understood the probable variety and unpredictability of the participants' backgrounds due to a number of reasons. As aforementioned, not all those engaged in translation industry have a degree in Translation: lots of translators are coming from adjacent (e.g. Modern languages, Philology, etc.) or rather remote majors (e.g. Science, Legal studies, etc.). What is more, it is becoming common that the need for lifelong personal and professional development results in constant updating of skills and competencies by means of specialized and/or postgraduate courses, which adds to the probability of a good variety of responses to this question.

As expected, the data on participants' academic backgrounds turned out to be very diverse and broad-ranging, as some respondents reported to have done two or more degrees within the time limit of 5 to 40 years. To be able to order and classify the answers it was decided to split the obtained results into four basic categories in conformity with the major specialization that resulted in Bachelor or Master degree (or equivalent) and was mentioned as the first completed academic course (for this reason we paid attention to the specified year of graduation). On the one hand, such generalization is due to different geographical locations of the respondents and, consequently, different educational systems and qualifications; on the other hand, the age composition of the participants (22-77 y.o.) implies that younger respondents might consider to start and/or complete additional specialized and/or post-graduate courses in the upcoming years so that their educational portfolio might grow in future. Answers to this question provided us with the general cut-off of educational and professional inclinations and interests of those involved in MTPE industry, although such research technique does not pretend to be extensive.

The 'graduation year' criterion was included into the question for informational purposes, i.e. to illustrate the variety of profiles of our respondents, while the major aim of the question was to generalize academic tendencies among post-editors. Closer inspection of obtained data reveals that the respondents indicated a vast area of graduation years, starting with the mid-1960s and till the present day. To mention but a few, Respondent 22 reported to have graduated from the University of Pennsylvania with the major in English Literature in 1964, Respondent 71 was awarded the MA in Translation from the French University of Massachusetts in 1970, and Respondents 17 and 129 both graduated in 1976 with the BSc degree in Agriculture from the University of Salford and the MA degree in Applied Linguistics by the University of Warsaw respectively. On the other hand, as we have seen in the previous question, 25% of all survey participants are aged between 22 and 32, which explains relatively recent graduation years of many of them, for instance Respondents 66 and 67 (MA in Scientific and Technical Translation, Haute Alsace University) or Respondent 96 (BA in Translation and Interpretation, Comenius University, Slovakia) who all graduated in 2015-2016.

Table 6 gives an overview of respondents' initial academic background. In conformity with the above-mentioned selection criteria, the category "Translation" was made of those who completed translation-related majors (BA, MA or their equivalents) as their first university qualification (55%). This category united 68 respondents from Germany (the University of Hildesheim, Munich Institute of Languages and Translation), Ireland (Dublin City University), the Netherlands (Zuyd University of Applied Sciences), Spain (University of Barcelona, University of Salamanca, Autonomous University of Barcelona, University of Vic), Chile (UCINF University), Uruguay (University of the Republic of Uruguay), France (Jean-Moulin University, Grenoble Alpes University, Haute Alsace University), Austria (University of Vienna), Portugal (Catholic University of Lisbon), Greece (Ionian University, National University of Athens), the USA (University of Washington, University of Massachusetts), the UK (University of Exeter, Queen Mary University of London), Japan (University of Osaka), Slovakia (Comenius University), Israel (Hebrew University of Jerusalem) and Italy (SSML Carlo Bo, University of Genoa) who all reported to have completed degrees in such fields as Translation, Translation Studies, Specialized Translation, Translation and Interpreting, Translation and New Technologies, etc.

The category "Philology/Linguistics" was designed for those respondents who did not mention any translation-related majors, but reported to have been awarded their first university qualification (BA, MA or their equivalents) in such disciplines as Linguistics, Modern Languages, Language and Literature, Applied Linguistics, Philology, Scandinavian Studies etc. (22%). This category included graduates from University of Turin (Italy), University of Clermont-Ferrand (France), University of Frankfurt (Germany), University of Warsaw (Poland), University of Alcalá (Spain), University College of Southeast Norway (Norway), University of Pennsylvania and Harvard University (USA), Hebrew University of Jerusalem (Israel), Moscow State Pedagogical University (Russia), Lithuanian University of Educational Sciences (Lithuania), and others.

A group of 12 respondents (10%) reported to have completed their initial academic training in the domain of Natural and Exact Sciences, so one more sub-category was designed for these purposes. Among the degrees that our respondents mentioned as their first qualification, there were Industrial Maintenance, Electronic Engineering, Production Engineering, Chemistry, Physics, Agriculture etc. The universities that awarded such degrees were Weizmann Institute of Science and Tel-Aviv University (Israel), the City of London University and University of Salford (UK), Andrés Bello Catholic University (Venezuela), Leningrad Polytechnic Institute (Russia), and others.

The last sub-category was destined for those respondents whose initial academic experience did not fully correspond either to "Philology/Linguistics" or to "Natural and Exact Sciences". This category was titled "Social Sciences" and united 13% of respondents (16 participants) who have completed their academic training in the disciplines that either belong to the field of Humanities (e.g. Law or History), or involve rigorous Science-related subjects (e.g. Business Administration or Financial Journalism). Those participants who reported to have completed this kind of studies were from Israel (Tel-Aviv University), France (Marc Bloch University), Russia (Moscow State University, Kazan Innovative University), Saudi Arabia (King Faisal University) and the USA (University of Taxes).

Approximate answer categories	**Response percent (round-off)**	**Response count**
Translation/Interpretation	55%	68
Philology/Linguistics	22%	28
Social Sciences	13%	16
Natural and Exact Sciences	10%	12

Table 6. Respondents' academic backgrounds

To further zoom in on academic tendencies among those post-editors who completed education in different major fields a more detailed breakdown on multi-vector combinations of academic degrees was needed. For example, Respondent 51 graduated as Industrial Engineer from UCAB (Venezuela) in 1975, and complemented that degree with specialization in French-to-Spanish Legal Translation in 2006; Respondent 90 graduated in Geography from Tel-Aviv University in 1994 and in 2009 got a diploma in Translation from Beit Berl College; Respondent 101 reported to have graduated from Moscow State Technical University with the major in Space Engineering in 1992 and then completed the Degree in Business Studies at the American Institute of Business and Economics (Moscow, 1997); Respondent 108 was awarded a Diploma in Engineering (France), got a Ph.D. in Chemistry (USA) and a Certificate in Specialized Translation (France), although unfortunately s/he did not mention either the institution or the year of graduation. For the sake of discussion, it should be mentioned that such cases of 'a wide range of interests' were rather scarce and lie beyond the scope of this research.

Q. 8: Years of experience in translation

Q.9: Years of experience in PE

In the next two questions, we inquired about respondents' experience (in years) in the field of translation and post-editing. It is a common knowledge that those involved in post-editing are mostly translators who combine and complement their workflow with translation and post-editing jobs. Yet, this time the focus of our interest was on the number of years the respondents have worked in the relevant fields, with the aim to compare the data and find out the general tendencies in the labor market. For the sake of demonstrativeness and after analysis of the available data we decided to group the respondents' experience into the categories with 3-year margin. In this way, five categories of experience were created: from 1 to 3 years, from 4 to 6 years, from 7 to 9 years, from 10 to 12 years and for all those who have been in translation/post-editing for more than 12 years. The obtained results support our previous findings regarding the relative novelty of PE-related activities and provide a deeper insight into the correlation of translation vs. post-editing jobs performed by the respondents, specifying their experience for each category. As can be seen in Table 7, the category '≤ 3 years of experience' yielded 9% of responses for translation and 47% for post-editing; the category '4-6 years of experience' got 21% of responses for translation and 28% for post-editing; 26% of respondents selected the category '7-9 years of experience' to illustrate their experience in translation, while only 16% did so in concern with PE; the category '10-12 years of experience' yielded 26% of responses for translation and 6% for post-editing; finally, the category '≥ 12 years of experience' yielded 18% of responses for translation and 3% for post-editing.

Options	**Translation**		**Post-editing**	
	Response percent (round-off)	Response count	Response percent (round-off)	Response count
≤ 3 years	9%	11	47%	58
4-6 years	21%	26	28%	35
7-9 years	26%	32	13%	16
10-12 years	26%	32	7%	9
≥ 12 years	18%	23	5%	6

Table 7. Respondents' experience in translation/post-editing

Using the obtained information we graphically represented the changing tendencies regarding respondents' experience in the fields of translation and PE (Figure 4). As can be seen, experience in translation is prone to grow in line with the age of the informants, yet the tendency characterizing PE experience is more heterogeneous. To inquire whether the correlation between the years of translation experience and years of post-editing experience is statistically significant, the distribution of discrete quantitative values in this dataset was defined as non-parametric, and Spearman's rank-order correlation coefficient was tested. The results yielded by the test equaled 0,5467 (i.e., ≥ 0,5), which suggests a positive correlation between both subsets of data. Even so, it is worth mentioning that despite the availability of MTPE-related modules in the training programs of the last decade, younger participants did not demonstrate a tendency to be more involved in PE than older participants. Another particular feature of the cross-section of the linguists involved in PE is that their experience in PE was less or on seldom occasions equaled the number of years dedicated to translation. On the basis of the above, it might be possible to speculate that as of today linguists do not feel like renouncing on translation assignments for the sake of MTPE-related projects, the finding that is important to consider when drafting translation training programs.

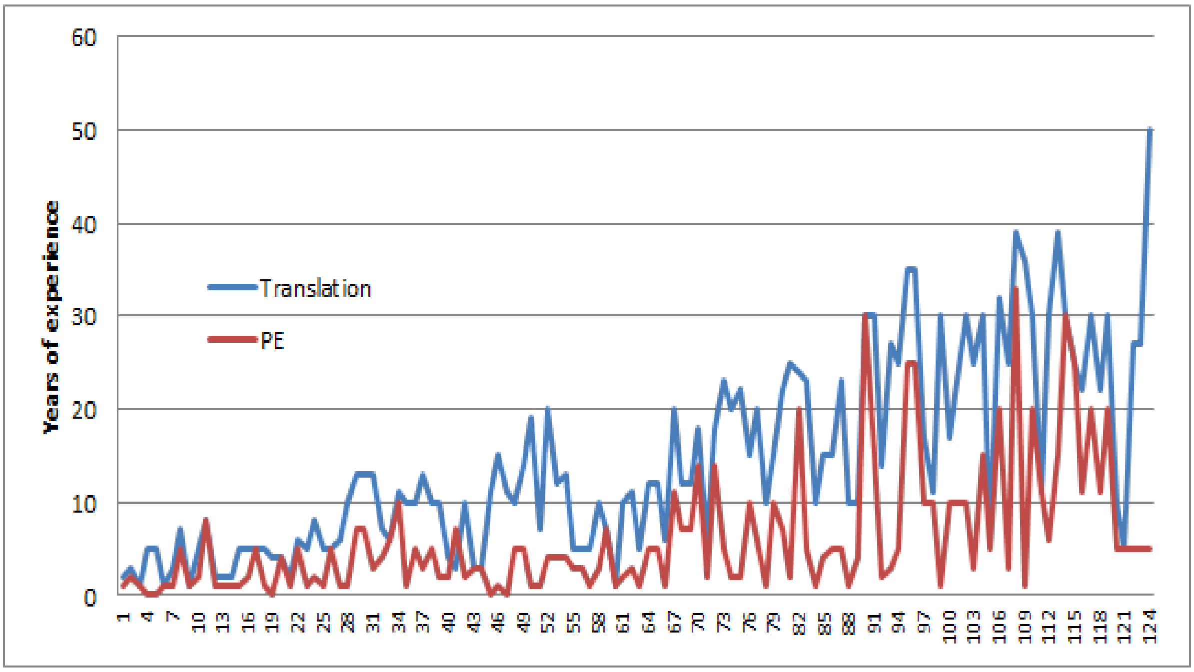


Figure 4: Correlation of years of experience in translation and post-editing (the vertical axis represents the respondents)

Q.10: How often do you perform the following tasks in your professional activity?

Having clarified the profiles of survey participants and the general tendencies regarding their PE experience we moved on to the next question on regularity of most typical tasks associated with post-editors' professional experience. The respondents were asked to indicate the frequency of such activities as, e.g., translation, post-editing, revision/proofreading or projects management (the relevant details are provided in Table

8). It seems that the most common practice for the majority of routines includes translation, revision and proofreading on a daily basis. At least 20 participants selected each of the offered Likert scale values to describe the frequency with which they perform PE jobs, while revision and proofreading of post-edited materials turned out to be less frequent activities. Project management of both translation and PE projects was reported as the least frequent activity by nearly half of all respondents.

Answer options	**never/very seldom**	**sometimes**	**often**	**very often/ always**	**Response count**
Translation	8	17	31	68	124
Revision / proofreading of translated jobs	18	39	27	40	124
Translation projects management	66	26	15	17	124
Full / light PE	22	39	34	29	124
Revision / proofreading of PE jobs	37	47	20	20	124
PE projects management	82	21	9	12	124

Table 8. Regularity of translation/PE-related tasks in the respondents' workflow

The comments to this question suggest that among other activities to complement their workflow survey participants are also engaged in creation of glossaries and style guidelines, simultaneous and consecutive interpreting, design of original bilingual corpus, management of reference material, quality management, language and translation training, teaching, terminology extraction (Informants 39 and 72).

Q. 11. What is your average PE productivity (words per hour and/or words per day)?

The questionnaire also inquired about the average PE productivity of the respondents as defined in terms of words per hour and/or words per day. We fully understand that the issue of average post-editing speed is rather premature since so far this parameter hugely depends on the combination of different factors, such as the quality of the raw MT output, the domain, source and target languages, quality expectations, etc. Nevertheless, investigation of these data can serve as a starting point for discussion on the average PE speed definition and will be of use for future research. As Table 9 shows, the relative majority of respondents opted for the average PE speed of 500 - 700 WPH / 4 000 - 5 500 WPD (23% of the sample).

Answer options	Response Percent (round-off)	Response count
less than 300 WPH / 2 500 WPD	14%	17
300 - 500 WPH / 2 500 - 4 000 WPD	19%	24
500 - 700 WPH / 4 000 - 5 500 WPD	23%	29
700 - 900 WPH / 5 500 - 7 000 WPD	19%	24
900 - 1000 WPH / 7 000 - 8 500 WPD	18%	22
more than 1000 WPH / 8 500 WPD	7%	8

Table 9. Respondents' average productivity for PE projects

These results prove that although so far there seems to be no absolute advantage of PE speed as perceived by the respondents over 'human translation' speed (the average of 300 - 500 WPH / 2 500 - 4 000 WPD), yet there is an expanding tendency of PE being more productive.

Q.12: What are your PE rates based on?

The next question concerned the metrics used to decide on PE rates. The respondents had to choose from the most typical options, namely: number of TT or ST words, number of edits, hourly or daily rate. A free text-box was also provided for any relevant comments. Closer inspection of the data (Table 10) show the metrics 'number of ST words' and 'hourly/daily rate' got a relatively even distribution among four available categories, while the metrics 'number of TT words' shows a tendency towards being used 'sometimes' (as reported by 29 informants) and 'never/very seldom' (as reported by 54 informants). The distribution of choices for the metric 'number of edits' suggests its relevant unpopularity, since more than the half of respondents (81 out of 124) said they 'never/very seldom' apply it.

Answer options	never/ very seldom	someti mes	often	very often/ always	Response count
number of TT words	54	29	23	18	124
number of ST words	32	27	37	28	124
hourly/daily rate	28	34	37	25	124
number of edits	81	23	11	9	124

Table 10. PE rates metrics

The survey participants also provided additional comments in the free-text field to give more explanations on how PE rates are calculated: Informant 83 confessed to be using the number of characters (including the blanks) as metrics, although did not precise if it was applicable for the source or target text; Informant 111 did not apply any rates and worked as an internal employee for a translation agency; Informants 104 and 117 said that their metrics were often based on Blue/TER scores and peer reviews.

Q.13: Out of all your PE projects, what percentage do manual PE jobs account for and what percentage do semi-automatic PE jobs account for?

To further examine PE trends we focused our attention on manual PE jobs as opposed to semi-automatic PE jobs performed by the respondents. Manual PE was reported by 42 participants as the most frequent option for PE workflow (happening in >90% of all PE projects); while the opposite scale value (<10% of all PE projects) quite logically was ticket by 53 respondents to describe the frequency of semi-automatic PE projects. A more detailed breakdown of values can be seen in Table 11:

Answer options	<10%	10%-30%	30%-50%	50%-70%	70%-90%	>90%	Response count
manual PE jobs	20	11	16	20	15	42	124
semi-automatic PE jobs	53	18	13	15	13	12	124

Table 11. Correlation between manual PE jobs and semi-automatic PE jobs

Q.14: Out of all your PE projects, what percentage do full PE jobs account for and what percentage do light PE jobs account for?

Similar tendencies were traced in the next question which focused on the percentage of full vs. light PE jobs performed by survey participants. The analysis of available data reveals that the relative majority (52 participants) admitted to be performing light PE in >10% of projects. As shown in Table 12, the prevailing tendency of performing mostly full PE jobs was reported by 25 participants who said 70%-90% of their projects are full PE, and 39 participants who believe that >90% of their workflow consists of full PE tasks:

Answer options	**<10%**	**10%-30%**	**30%-50%**	**50%-70%**	**70%-90%**	**>90%**	**Response count**
Full PE jobs	15	16	17	12	25	39	124
Light PE jobs	52	23	10	15	11	13	124

Table 12. Correlation between full and light PE jobs

Q.15: Which fields do you provide PE for?

The point of the question was to find out information about subject domains that are common for MTPE projects. For this reason, the respondents were asked to indicate the frequency with which they perform projects that belong to different fields of specialization. The count of these responses goes beyond 124 units since each respondent was free to choose multiple subject-fields, as such no percentage values are provided at this point (Table 13). Having combined the results for 'often' and 'very often/always' sub-categories we see that the major industry sector that employs MTPE turns out to be IT/Software/Websites/E-commerce (the total of 47 participants), followed by Social Sciences and Heavy Industry/Engineering (the total of 40 and 42 participants respectively). The highest values for 'never/very seldom' sub-category indicate that MTPE model was used the least in such sectors as Real Estate/Construction, Economics/Finance and Natural Sciences (79, 71 and 74 participants respectively).

Answer options	**never/ very seldom**	**sometimes**	**often**	**very often/ always**	**Response count**
Real estate/Construction	79	27	11	7	124
Economics/Finance	71	27	17	9	124
Law	58	34	18	14	124
Advertising/Marketing	52	38	20	14	124
Tourism/Entertainment	58	33	19	14	124
IT/Software/Websites/E-commerce	53	24	18	29	124

Health/Medicine	55	36	17	16	124
Heavy Industry/Engineering	67	15	25	17	124
Natural Sciences	74	24	10	16	124
Social Sciences	57	27	19	21	124

Table 13. Correlation between regularity of PE task in different subject fields

The comments box provided examples of other subject fields for PE projects, among which the respondents mentioned special/higher education materials and online blogs with articles and advice on life 'hacks' (Informants 35, 78 and 81).

Q.16: Out of all your PE projects, what percentages do the following content types account for?

To find out the proportion between post-editing done for documents with restricted access (e.g. annual reports, company turnover, etc.), on the one hand, and publicly available documents (e.g. FAQs, user manuals, on-line help, etc.), on the other, the respondents were asked about the percentage each of these content types accounts for. The well-defined tendency demonstrated by 55 answers showed that less than 10% of PE projects contained low-visibility content. As for high-visibility content, 22 and 43 respondents said they deal with it in 70%-90% and more than 90% of projects respectively, thus demonstrating a relative prevalence of this content type for commissioning PE (Table 14):

Answer options	**<10%**	**10%-30%**	**30%-50%**	**50%-70%**	**70%-90%**	**>90%**	**Resp. count**
Documents with restricted access (low-visibility content)	55	26	14	14	12	3	124
Publicly available documents (high-visibility content,)	22	10	12	15	22	43	124

Table 14. Correlation between high-visibility and low-visibility content for PE

3.2.2. Block 2: MTPE workflow

This subset of questions aimed at the description of the respondents' workflow in terms of tasks, tools, systems, and reference materials employed in the course of PE.

Q.17: When starting a PE project, you ...

At first, the respondents indicated the most typical ways to prepare for a PE project (Table 15 provides the breakdown of the responses):

Answer options	**never/ hardly ever**	**some-times**	**often**	**almost always/ always**	**Resp. count**
do (semi)-automatic pre-editing of MT input (e.g. with controlled language rules or spell-check)	60	27	18	19	124
do (semi)-automatic post-editing (e.g. search-replace operations)	24	62	25	13	124
evaluate raw output to determine whether it should be post-edited or translated from scratch	24	48	29	23	124
use tools to extract terminology and manage terminological databases and TM(s)	70	34	13	7	124
report to your IT team about the most recurrent errors in raw MT output	67	30	15	12	124
report to your IT team about the most recurrent errors in source content	78	25	15	6	124

Table 15. Starting point(s) of PE projects

Somewhat surprisingly the categories 'never/hardly ever' were marked by sub-groups of at least 60 participants for such answer options as (semi)-automatic pre-editing of MT input (e.g. with controlled language rules or spell-check), usage of terminology extraction tools, terminological databases, translation memories management, providing feedback to IT team(s) on recurrent errors with MT output and/or source content. However, the scenarios of (semi)-automatic post-editing and raw output evaluation showed higher values for being used 'sometimes' (as selected by 62 and 48 participants accordingly), the results that were reinforced by 25 and 29 respondents who stated that the aforementioned preparation procedures 'often' happen in their PE workflow. Informant 105 who translates into Lithuanian remarked that since the target language is characterized by a lot of flexions and multiple grammar cases, automatic PE only made sense if special algorithms for search-replace operations are created for each particular MT output file. Informant 111 regularly performed online searches to verify content, such as dates, places, names mentioned in the output, and Informant 109 made use of DRAE (Diccionario de la

Real Academia Española) to clarify specific word usage in relation to structural context when translating to English, describing this resource as 'invaluable'.

Q.18: What is the starting point of your PE tasks?

As a follow-up, the participants were asked to share the details regarding the starting point of a PE job: we were interested in how frequently such resources as source text file(s), raw MT output file(s), previous TM(s) or access to MT engine appear in the regular workflow. Table 16 demonstrates that the most common way to start a PE assignment is when post-editors get source text file(s) and file(s) with raw MT output (54 respondents marked this option as 'almost always/always' and 35 as 'often', which makes 89 answers in total). The scenario when post-editors are provided with a source text file(s) and a TM(s) fed with a mix of raw MT segments, previously translated segments and/or post-edited segments (otherwise called 'segments of specified origin') was the one which the total of 74 participants defined as happening 'often' and 'almost always/always' (25 and 49 answers respectively), the fact that indicates high probability of this solution. A considerable number of the participants gave 'never/hardly ever' as their answer to the options when post-editors get an ST file and access to an MT engine and/or an ST file and a TM fed with raw MT segments. The least popular scenario was to provide post-editors with an ST file and a TM with segments of unspecified origin, as confirmed by the group of 75 participants who chose 'never/hardly ever' as their answer.

Answer options	**never/ hardly ever**	**some-times**	**often**	**almost always/ always**	**Resp. count**
You get a ST file and access to an MT engine	64	25	16	19	124
You get a ST file and raw MT output	9	26	35	54	124
You get a ST file and a TM fed with raw MT segments	62	31	17	14	124
You get a ST file and a TM with segments of specified origin	24	26	25	49	124
You get a ST file and a TM with segments of unspecified origin	75	22	17	10	124

Table 16. Frequency of PE tasks starting points

Q.19: What percentage of your PE projects involve the use of following tools/systems?

To continue, tools and systems used in MTPE workflow were investigated (Table 17). Quite surprisingly it turned out that 85 respondents use specialized PE tools (e.g. PET, DQF, etc.) in less than 10% of projects; the same is true for 64 respondents who reported to be using complementary tools (e.g. quality control tools, archive managers, etc) in the same percent of projects. No strong tendencies were observed from the data yielded in the remaining two categories: TM systems (SDL Trados, MemoQ, etc.) and generic tools (Word, Excel, plain text, etc). But if we compare the maximal and minimal value of both answer options, it becomes evident that 40 respondents said they used TM systems in more than 90% of projects as opposed to almost two times fewer number of the participants who said to be using TM systems in less than 10% of projects. As for generic tools, the equal number of the participants reported to be using them in more than 90% and less than 10% of projects (38 participants in each group), although 23 participants stated to be using such tools in 70%-90% of projects, which suggests its relative popularity among other PE-related environments.

Answer options	**<10%**	**10%-30%**	**30%-50%**	**50%-70%**	**70%-90%**	**> 90%**	**Response count**
PE environment	85	19	4	5	5	6	124
TM systems	21	15	16	13	19	40	124
Generic tools	38	9	5	11	23	38	124
Complementary tools	64	13	17	3	10	17	124

Table 17. Frequency of usage of PE tools and systems

The comments provided by the survey participants in the free-text field give a closer look at PE scenarios: Informant 103 remarked that both source and raw MT outputs are usually provided in a bilingual Word document, while Informant 42 said that the PE jobs start with an ST available as a PDF or Word document, so that s/he could maintain the original design of the document a PE is complete.

Q.20: What percentage of your PE projects include the following materials?

The last question of this block focused on what reference materials post-editors are provided with when working on a PE project and how often this is the case (Table 18). In general, the prevailing majority of respondents admitted they get project specifications (scope of work, expected quality level, delivery dates, required tools, formatting, etc.) in

70%-90% and more than 90% of cases (groups of 25 and 53 individuals accordingly). The category 'Information about source content that deals on the subject field, audience, purpose, etc.' got no salient values apart from 10%-30% of projects marked by 39 respondents. In all other categories (e.g., Linguistic guidelines with generic requirements of target content regarding terminology, semantic accuracy, lexical cohesion, spelling, etc., LSP and Client style guides, TMs, terminology databases) the tendency was focused rather on the minimal values of the scale (less than 10%). We see it particularly interesting that in the framework of our survey 75 respondents reported to be provided with PE guidelines containing instructions on and examples of editing raw MT output errors in less than 10% of projects, which confirms the conviction on insufficient work being done in the field of standardization of PE processes and tasks.

Answer options	**<10%**	**10%-30%**	**30%-50%**	**50%-70%**	**70%-90%**	**>90%**	**Resp. count**
Project specifications	18	9	11	8	25	53	124
Information about source content	17	39	15	17	18	18	124
Linguistic guidelines	37	16	13	23	14	21	124
LSP style guide with specific requirements of target content	51	20	8	15	13	17	124
Client style guide with specific requirements of target content	42	21	17	15	13	16	124
PE guidelines	75	10	13	6	10	10	124
Terminology database and/or glossary	36	17	16	20	15	20	124
Translation memory	41	22	14	10	11	26	124
Other reference materials (parallel texts, websites, etc.)	33	19	21	25	13	13	124

Table 18. Frequency of usage of references for PE

3.2.3. Block 3: Expertise and decision-making in PE

Decision-making and the scope of PE expertise have been in the focus of many research studies and reports, yet this subject is far from being explored in full. To this end, we decided to ask our respondents about their views on these issues.

Q. 21: You decide to edit a particular segment of a particular PE task ...

At first, the survey participants were suggested to decide on the frequency of a wide range of decision-making 'triggers', for instance, fluency issues in documents with public or restricted access, time constraints, availability of automatized operations, etc. (Table 19). The obtained results show that the large number of post-editors almost always/always edit segments in case of fluency issues in high-visibility documents with public access (57 individuals) and if inconsistency with expressed quality expectations is spotted (52 individuals). The frequency category 'often' was foremost chosen for fluency issues in low-visibility documents with restricted access (47 respondents), the so-called 'two (or five) seconds rule' (39 respondents) and contradiction to particular comments/feedback from previous PE tasks (37 respondents). The option 'inability to fix the issue through (semi-)automatic operation(s)' did not show any conspicuous tendencies, and time constraints were categorized as the reason that 'sometimes' influences decision-making by the relevant majority of 50 participants. Project quote/rates turned out to be the only option that showed the tendency to 'never/hardly ever' influence PE processes (52 respondents).

Answer options	**never/ hardly ever**	**some-times**	**often**	**almost always/ always**	**Resp. count**
if there is a fluency issue in a low-visibility document	19	28	57	20	124
if there is a fluency issue in a high-visibility document	17	16	24	67	124
if you exceed the "three seconds rule" (if it took you more than two/five seconds to get the gist of the segment)	19	26	49	30	124
if you are unable to fix the issue through (semi-)automatic operation(s)	29	31	30	34	124
in accordance with the time available until the project deadline	25	50	24	25	124
in accordance with quality expectations as expressed in guidelines/style guides/reference materials	17	25	24	58	124
in accordance with particular comments/feedback from your previous PE tasks	22	19	47	36	124
if the rates/project quote are high enough	52	26	23	23	124

Table 19. Decision-making in PE

When sharing their comments, Informant 63 mentioned to be focusing mostly on fixing grammar, syntax and meaning issues; Informant 106 provided a curious argument about decision-making driven by "Desire to provide high-quality a.k.a pride in what I do and the way I do it"; Informant 117 said that clients and project managers hardly ever expect inferior quality of a PE project (as compared to human translation) and for Informant 119 sentence length, register, thesaurus, syntax and accuracy were reported to be equally important.

Q. 22: Specify the relevance of the following skills/abilities for the successful completion of a PE task

Zooming in on the issues of cognitive effort in PE we then asked the participants to provide their vision of correlation between successful completion of a PE task on the one hand, and relevance of particular PE competences (e.g. knowledge of basic programming or ability to abstain from over-/under-editing) for such outcome, on the other. The vast majority of respondents attributed the value of 'very important' to the ability to make decisions quickly on whether MT output is editable (85 participants), ability to produce 'good-enough/fit-for-purpose' PE output and ability to abstain from over-/under-editing (75 participants for each answer option). A smaller group of respondents classified the knowledge of typical MT errors, ability to focus on those issues that are specified in PE instructions and positive attitude towards MTPE as 'very important' (69, 68 and 63 participants respectively); moreover, these answer options got substantial support and the value 'moderately important' from groups of 35, 38 and 33 participants accordingly. Knowledge of types of MT engines, their functional principles and shortcomings were characterized as 'moderately important' by 56 participants, which is also a noteworthy result. Alternatively, such competency as knowledge of (basic) programming was classified as 'irrelevant' by 66 respondents and 'somewhat important' by 36 respondents; the latter value was also picked by 48 respondents when defining the importance of knowledge of text-processing operations. The calculations of all values for available answer options can be seen in Table 20. Alternatively, Informant 13 stated that "when it comes to Full PE, it seems to me that none of these factors is very important; they are only important for light PE", while Informant 40 expressed a conviction that ability to adapt language terms to be appropriate for target audience and geographical location as well as being flexible and conscious about different word usages with variable meanings across different populations are among the crucial PE competences to be employed on daily basis.

Answer options	**irrelevant**	**somewhat important**	**moderately important**	**very important**	**Resp. count**
knowledge of types of MT engines, their functional principles and shortcomings	7	30	56	31	124
knowledge of typical MT errors	2	18	35	69	124
knowledge of (basic) programming	66	36	12	10	124
knowledge of text-processing operations	15	48	36	25	124
ability to focus on those issues that are specified in PE instructions	2	16	38	68	124
ability to make decisions quickly on whether MT output is editable	4	10	25	85	124
ability to produce "good-enough"/"fit-for-purpose" PE output	3	15	31	75	124
ability to abstain from over-/under-editing	0	9	40	75	124
positive attitude towards MTPE	8	18	33	65	124

Table 20. Relevance of PE competences

3.2.4. Block 4: Post-editors' vs. translators' performance

The final block of the questionnaire was dedicated to eliciting respondents' opinions on correlations between the tasks of (human) translation as opposed to post-editing with the objective to clarify the picture of the current state of play.

Q.23: Give your opinion on the level of competence of POST-EDITORS vs. TRANSLATORS by filling in the gaps with: (1) HIGHER THAN (2) EQUAL TO (3) LOWER THAN

First, the scope of competences was compared between those who perform translation and/or post-editing tasks: the participants were required to describe knowledge and skills employed in post-editing (e.g. source-to-target meaning transfer, knowledge and use of rules and norms of source/target languages, subject-matter, etc.) as 'higher than', 'equal to' or 'lower than' the knowledge and skills required for translation. Table 21 summarizes the strong tendency of evaluating both PE and translation as professional activities that require an equal level of competences from those involved:

Answer options	**1**	**2**	**3**	**Response count**
On average, post-editors' competence in translation skills (SL-to-TL meaning transfer, justification of translation choices, etc.) is ... translators' expertise	28	72	24	124
On average, post-editors' linguistic and textual competence (knowledge and use of rules and norms of a SL/TL) is ... translators' competence	29	73	22	124
On average, post-editors' research and information-processing competence is ... translators' competence	22	64	38	124
On average, post-editors' SL/TL cultural competence is ... translators' competence	17	80	27	124
On average, post-editors' subject-matter/domain-related competence is ... translators' competence	22	73	29	124
On average, post-editors' technical/instrumental competence is ... translators' competence	21	75	28	124

Table 21. Comparison of competencies (post-editing vs. translation)

The comments made in this respect confirm our data: it seemed to Informant 59 that currently "only translators take on post-editing tasks" and Informant 96 assumed "the same people are doing both translation and PE, I don't know anyone who is doing only PE".

Q.24: Give your opinion on PE vs translation (from scratch/using a TM) by filling in the gaps with: (1) BETTER THAN (2) THE SAME AS (3) WORSE THAN

The penultimate question aimed to get feedback on respondents' satisfaction levels regarding quality, productivity, profitability of and professional demand for post-editors if compared to translators. As reported in Table 22, the large constituency of the participants classified PE as 'worse than translation' for the general category 'PE output quality' (69 participants) and the specific category 'PE output fluency' (77 participants). The prevailing majority of 64 participants ticked 'equal' as their answer to the specific question regarding PE vs. translation output adequacy. Profitability of PE and professional demand for post-editors were also classified as equal to translation-related counterparts by 68 and 66 participants respectively. The only category that demonstrated the prevalence of 'better than' values was that of productivity in PE, as this option was chosen by 68 respondents.

Answer options	1	2	3	Response count
On average, PE output quality is ... translation output quality	24	31	69	124
On average, PE output adequacy (accuracy of meaning transfer) is ... translation output adequacy	18	64	42	124
On average, PE output fluency (naturalness and comprehensibility) is ... translation output fluency	24	23	77	124
On average, my productivity in words for PE tasks is ... for translation tasks	68	34	22	124
On average, the profitability of PE is ... the profitability of Translation	28	68	28	124
Professional demand for post-editors is ... professional demand for translators	21	66	37	124

Table 22. Post-editors' satisfaction levels

In the end, the participants were invited to fill in a free text field with any information they considered relevant to the recently filled-in questionnaire. The data provided by the informants concerned such aspects of PE practices as life-long learning: "I try to do a MTPE 1-2 times a year to see the development and not to remain behind the progress. By now, the MT has no sense for Lithuanian, because a very comprehensive PE is needed to make a text understandable (not fluent or human-like). The best choice for Lithuanian is still the human translation, if the text should be made for the reader, not for statistics" (Informant 105); the scope of PE competence: "My opinion is that all post-editors should have more competence than translators, but this is not always the case. I answered the questions accordingly to my experience, but this is not how I think it should be" (Informant 68) and "I think that a successful post-editor needs to be a specialist in a certain field of science/economy, etc. in addition to his/her excellence in a given language pair" (Informant 83); and comments on the answers to the questionnaire: "The accuracy of the answers are very dependent on the type of text to post-edit: I generally considered my light PE work" (Informant 88), "Regarding question #22, PE productivity and profitability are only better than that of translation as long as the PE output is not poor. I only accept PE tasks where the quality of the output is not poor, but unfortunately, this doesn't happen very often" (Informant 89). This information provides us with a deeper insight into the nature of post-editing in terms of their wish to constantly update their skills and competencies, the complexity of post-editing tasks that requires high level of expertise and inability to make generalized conclusions on MTPE issues due to multiple variations of raw output quality and, consequently, diversity of the expected final quality of the content.

The last line of the questionnaire expressed appreciation of time and effort the respondents dedicated to participating in the survey.

Concluding remarks

As MTPE industry is getting omnipresent, it becomes crucial for the academia to keep in line with increased demand for training experts in this field and, logically, to investigate how and to what extent PE competence can be enhanced in its graduates. To this end, our survey collected responses from 124 participants currently living in 26 countries on four continents. As reported by the testing team of post-editors, the survey contained no inappropriate questions. Its sample is considered sufficient due to multiple administration channels and a satisfactory period of duration (three months). The Survey Monkey tool was configured in a way so that it did not collect incomplete data. Besides, to minimize inconsistent or conflicting data the majority of questions were supplied with free-text fields for respondents to share their concerns. Such measures were taken in order to meet the basic requirements for survey results, namely reliability, validity and avoidance of errors associated with the applied research method.

Analysis of the participants' educational background revealed that the largest constituency replied to have completed a degree in translation-related major. About one-third of the participants reported to be a member of translators' association or federation, which is arguably due to their freelance status. While nearly half of the group stated to be working with just one pair of working languages, the rest showed a good variety of combinations between multiple source and/or target languages. In the framework of our survey English, German and Spanish were mentioned among the most popular source languages, and English, Spanish, French, Hebrew and German were reported among top-five target languages. This piece of data shows that English occupies the leading position as the principal source and target language.

When respondents' years of experience in translation and post-editing were compared, a clear prevalence of the former was noticed, which means that translation keeps being the most frequently performed task. It is our strong belief that such tendency is bound to change in response to the rising demand for prompt translation of continually growing amounts of content and improvements of raw MT output quality. The breakdown of responses for average PE throughput did not provide clear tendencies, although 500 – 700 WPH / 4.000 – 5.500 WPD resulted to be a slightly more popular option. The majority of post-edited documents were classified by the survey respondents as high-visibility content. Full and manual PE jobs were reported to be more widespread than light and semi-automatic PE jobs, with IT/Software/Websites/E-commerce being the leading domain for such projects.

As derived from the survey results, PE workflow usually begins with evaluation of the MT output and (semi)-automatic post-editing before starting a PE project. Then post-editors proceed to ST file(s) and the raw MT output or a TM fed with segments of specified origin, (e.g. previously translated segments and/or post-edited segments). For these purposes most often TM systems and generic tools are used. Quiet surprisingly no strong tendencies were suggested by the answers to the question regarding the reference materials included in an average PE project, although a substantial group mentioned project specifications as a resource available in more than 90% of projects.

Inquiries about decision-making processes revealed that for nearly half of the respondents quality expectations expressed in guidelines, style guides and/or reference materials and fluency issues were considered a sufficient reason to edit a particular segment in high-visibility documents with public access. On top of that, a slightly smaller but still large sub-group of respondents said they also consider editing a segment in a low-visibility document with restricted access if there is a fluency issue there. This finding might account for the fact that over-editing is often reported among post-editing tendencies demonstrated by novice and experienced translators. Insight into the skills and competences that result in efficient PE revealed abilities to focus on those issues that are specified in PE instructions, to make rapid decisions on ‘editability’ of MT output, to produce ‘good-enough/fit-for-purpose’ PE output and to abstain from over-/under-editing.

Translators’ and post-editors’ performance was defined as equal in terms of key competencies and skills. A similar tendency was traced when comparing the processes of translation and post-editing, although this time the output quality and fluency of PE were described as worse than the same parameters in translation, while productivity was mentioned as an advantage of using PE.

This non-commercial survey feeds on factual data and its output serves as a credible base for empirical research on MTPE industry and PE competences. The obtained survey outcomes help to bridge the gap between the training programs and market demands and could be of interest to all parties engaged in the translation industry of today. The information on respondents' profiles and experiences contributes to the awareness of translators' changing role in light of the emerging MTPE phenomenon. A thorough analysis of PE-related workflow provides grounds for the actualization of translators training syllabi so that the latter keep the pace with current practices. The same is true for the respondents' experience of decision-making and top skills indispensable for efficient PE. Both instructors and students could take advantage of the comparison of translators' and post-editors' profiles to improve training and make an informed decision on whether to proceed with this career. However, the ultimate objective of the survey was to collect facts and findings that would contribute to developing and implementing a specialized training proposal to boost PE competencies of novice translators.

Part II. Experimental study

This part describes the preparation, piloting and full-scale implementation of the training proposal aimed at enhancement of PE performance among undergraduate translation students who were not previously trained in PE.

Chapter 4 delves into the methodology of the experimental study, focusing on operationalization of the research construct, methodological framework, study design and piloting; Chapter 5 describes how the suggested training proposal was put in practice and specifies academic profiles of the participants, the training corpus and instruments as well as the protocol.

Chapter 4. Study methodology and design

In conformity with the statement made by Richards and Rodgers (2014), the basic framework of our training proposal comprises three elements: approach, design and procedures. The approach deals with theoretical issues and shapes methods and practices implemented in the proposal. The design links the approach to procedures and describes the key features of the training process. Procedures are characterized by specific diversity and variability and include practices, behaviors and classroom techniques that accompany and reflect the proposal application (Kiraly, 2000). At this point, teachers implement theory to pedagogical practice.

This chapter is dedicated to the development of the research construct framework, justification of the selected research methodology and discussion of the design and key phases of the study. Operationalization of the research construct (Section 4.1) pre-defines the approach to gathering data and their analysis. In this way, further clues on the appropriate methodology are obtained (Section 4.2). After justifying a mix-method approach to our investigation, we proceed to the experimental study design (Section 4.3). Application of pre-/post-test model and its integral parts are discussed, and special attention is paid to pre-requisites for drafting a training proposal. Also, the chapter provides a description of the study piloting (Section 4.4), including recruitment of the participants, preparation of study corpus, tools and instruments applied at each phase of the study, the range of materials and techniques used for training and testing purposes, the protocol, analysis of the outcomes and lessons learned. The chapter ends with concluding remarks which summarize the core features of the study methodology.

4.1. Research construct operationalization

As suggested by the term itself, empirical experimental research is centered around manipulations with variables and aims to determine the effect that one factor exerts on (an)other one(s) on condition that the former is being manipulated (Rojo, 2013: 128). The present study is focused on putting to the test the hypothesis that PE competency can be enhanced with the help of the proposed training. In other words, PE competency is treated as a dependent variable subject to treatment and change.

The complexity of PE competency as the research object places it into the category of research constructs that are to be measured indirectly due to their 'unobservable' nature (Langdridge and Hagger-Johnson, 2009: 40). Having analyzed the finding of theoretical and practical research in the field (Chapter 2), and the outcomes of the questionnaire *Sharing Post-Editing Practices* (Chapter 3), we concluded that adoption and application of the range of adequacy and fluency criteria to PE output, on the one hand, and throughput rates, on the other, may be considered the indicators of PE competency that manifests itself through PE performance. The fact that these items affect the whole process of post-editing, and can be observed and measured, explains the reason why namely these criteria are in the focus of our attention. Students' attitudes towards MTPE-related issues and self-evaluation of their performance and professionalism were operationalized too, which enabled us to get a deeper insight into the research construct.

It is believed that investigation in the field of dependent and independent variables is prone to use quantitative approaches, although qualitative approaches are fitting as well (O'Brien, 2014). As such, the present research involves not only quantification of those values that characterize subjects' PE performance and MTPE-related attitudes, but also inquires about subjective interpretation of the impact produced by the training. On the bases of the collected data, the conclusion concerning the contribution of the suggested training proposal to the enhancement of PE performance in undergraduate translation students is made, and further lines of improvement are considered.

4.2. Methodological framework

Humanities and social sciences are open-ended systems conditioned by the propensity of human beings to undergo physical and mental changes which provoke constant variations in the structure of such systems (Rojo, 2013: 106). In particular, translators' performance is affected by their physical and emotional state, cultural and linguistic interferences, professional and social contexts, among others. All these issues add complexity to translation-related investigations, as there seems to be no reliable tools or techniques to keep track of all work-related issues, external effects and behavior.

For this reason, the applied research design uses concurrent strategies which involve data collection with quantitative and qualitative approaches deployed simultaneously. Such an approach facilitates examination of the complex multi-tier phenomenon of PE competency acquisition. As such, a mixed-method approach looks like an opportunity to detect general patterns and focus on particular cases and their origins simultaneously, providing grounds for concurrent research design (Creswell and Plano Clark 2011; Rojo, 2013). One more important feature is that this approach makes it up to the researcher to identify the paradigm that approximates the particular aspect of the research construct (Mertens, 2014: 7).

A mixed-method approach benefits our research since it allows for the collection and analysis of the data from positivist and interpretive epistemological positions (Saldanha and O'Brien, 2014: 22). Positivism is based on the rationalist, empiricist philosophy; its underlying assumptions suggest that the social world can be analyzed in the same way as the natural (Mertens, 2014). This type of research is characterized by an objective and dispassionate manner in which the researcher manipulates and processes the data. As for the interpretive paradigm, the researcher adopts multiple, socially constructed realities, which predetermines the interactive epistemology of research and explicit interaction between the researcher and participants. The suggested methodology allows for the description of contextual factors (Guba and Lincoln, 1994). In this case, investigators interpret the data from a particular standpoint or situation, where the knowledge and reality make a part of the "complex world of lived experience from the point of view of those who live it" (Schwandt, 1994: 118). Despite apparent differences, merging of these paradigms is considered possible, since the lines between both are partially blurred in practice (Reichardt and Rallis, 1994). The underlying argument in favor of this approach is that integration of quantitative and qualitative data combines the best of both paradigms and overcomes their weaknesses (Saldanha and O'Brien, 2014: 201).

The major aim of the present study is to enhance PE competency of undergraduate translation students with the help of a training proposal that could be further applied in MTPE-related modules of the academic curriculum. To achieve the aforementioned goal, we see it important to draft a training proposal in conformity with EHEA requirements (Chapter 1), field studies (Chapter 2) and the findings on the scope of PE expertise (Chapter 3), to test the proposal by using it in academic environment, and to evaluate its efficiency with the help of pre-/post-test model.

Keeping in mind these objectives, application of a mixed-method approach goes in line with the research needs, such as to collect, interpret and apply different categories of data when drafting a specialized training program; to measure the training effect from quantitative and qualitative perspective; and to get a comprehensive idea of the impact produced by the training and consider lines of improvement. Using classification of mixed-method research designs by Creswell and Plano Clark (2011: 70), our experimental study combined the characteristics of sequential explicative and convergent parallel research designs. For this reason, the primary focus of the investigation is aimed at the quantitative phase, while the qualitative phase is seen as secondary and contributes to the explanation of the other one. Collection of both types of data is conducted simultaneously, and data convergence (or divergence) is investigated and interpreted afterward.

4.3. Experimental study design

Learner-centered and motivation-based approach to teaching and learning has become the pivotal point for the European academia. As mentioned in Chapter 1, the EHEA broadly welcomes training proposals aimed at acquisition and development of autonomy, self-awareness, critical thinking, advanced cognitive and self-regulatory competencies of students. In this concern methodological plurality of the CBT model encourages trainees' commitment and self-determination while emphasizing successful learning and the importance of more personalized and diversified syllabus on the one hand, and transparent evaluation, on the other. One more important detail to keep in mind when drafting a training proposal is its relevance to the real market needs and industry requirements. The same principle is true when evaluating the training outcomes, since which should be authentic and involve the application of knowledge to real-world.

Under such circumstances, the instructor provides feedback continuously to facilitate self-reflection and experiential learning. Another observation on drafting a training proposal (Martínez, 2006) is that its preparation is only possible after the definition of available resources, opportunities, constant evaluation of students' progress and target groups of subjects, further discussed in Section 4.4. These measures are expected to help effectively manage the development of training activities and detect whether the planned objectives are being reached.

The positivist paradigm that underlies empirical studies holds that the objective of an investigation is to develop confidence that a particular claim about a phenomenon is viable (Borg and Gall, 1989). As a result, the experimental study takes the form of an empirical test used to support (or refute) the claim, on condition of its internal and external validity and generalizability. This type of design is recommended in the situation when it is not possible to have the control group due to the circumstances that go beyond the researcher's authority (Mertens, 2014). To examine if and to what extent PE competency may be enhanced in translation students, the study makes use of pre-/post-test investigation model, when the researcher first administers a pretest to the group of the participants, then provides tutoring, and finally measures participants' performance again. As such, considerations on the training efficiency are based on the comparison of research construct indicators before and after that training and in this way measuring the impact of the latter.

4.3.1. Training goals

Teaching theories and psychology of learning, which share theoretical premises behind the concept of efficient training, stress the necessity to consider operationalization of training objectives as the starting point of any educational content. In line with the theoretical and practical data analyzed in Part I, the objective of the suggested baseline training proposal was to introduce its trainees to a general overview of the pros and cons of the MTPE phenomenon, provide students with better understanding of MTPE-related processes, and help them acquire basic skills required for efficient completion of post-editing jobs. To this end, the proposal canvasses theoretical and practical aspects of the MTPE industry and provides actual hands-on training to encourage PE competency enhancement.

The issue of measurable and observable goal(s) – i.e. when students are expected to understand and be able to demonstrate the acquired skills, knowledge and attitudes – is the cornerstone of competency-based training. To keep track of the progress made, it seems logical to incorporate testing sessions in the proposed agenda. On completion of the training, the participants are expected to showcase an understanding of the principles of MTPE by critically evaluating the raw MT output and performing post-editing. In particular, they should be able to demonstrate the following:

- confidently apply the acquired knowledge and skills to the solution of problems related to post-editing of (non-)specialized texts;

- demonstrate the ability to optimize time/effort when following post-editing routines;
- be able to identify the scope of required edits of raw MT output and make informed decisions on how to implement them.

The benefit from participation in the training is seen as twofold: the students improve their operational knowledge (raw MT evaluation, spotting MT errors and introducing the necessary edits) as well as conceptual knowledge (MT engines functioning, pre- and post-production phases of an MTPE project, the scope of expertise required of translators engaged in the field). Encouragement for advanced training in MTPE skillset and facilitation of further acquisition of knowledge and competencies in the field are also considered among the effects of the proposed training.

However, at this point, we would like to emphasize that the experimental study does not pretend to equally boost all aspects of knowledge mentioned earlier, but rather to prove our hypothesis that the PE competency can be improved through training.

4.3.2. Training principles and content

The paradigm of competency-based learning adopted by the EHEA broadly welcomes the effort of academia to overcome the traditional understanding of knowledge as contemplation in favor of knowledge as operation. The latter, in its turn, implies integration of empirical and cognitive experiences of the learner in the course of training. For this reason, the amount of theoretical material is kept to the minimum, the activities involved in the training are student-centered and provide a lot of room for autonomous experiential learning, while the instructor performs the role of an assistant.

As described in Chapter 1, the principles of programmed learning provide theoretical premises for numerous training methodologies that help students acquire knowledge and skills. It is not a teacher-free method, but the one in which objectives are clearly defined and operationalized, the material is arranged in sequence and is easily corrected autonomously. Hence, students may work on themselves, since the training content is organized logically and in small portions. Application of such model provides researchers/teachers with an opportunity to track results and continuously evaluate students. All the facts mentioned above contributed to the practical application of the PL paradigm principles in the experimental study on the enhancement of post-editing competency among undergraduate translation students.

Translators training aims at providing the trainees with opportunities to acquire a sufficient level of translator competency and helps novice translators become successful players in the labor market. To bridge the gap between the industry and academia, it is of paramount importance to take into account the skills and attitudes deployed by professional translators when drafting training agendas. To this end, in the previous part of our research (Chapter 3) the results of the survey conducted among acting post-editors were described. The primary goal of the aforementioned survey consisted in mapping the core PE skills used by translators so that an informed decision on the key focus of the training proposal could be made. Apart from that, the survey yielded information on a broad range of other PE-related issues, which are further used to scaffold the training agenda with professional PE practices.

There is growing support for the claim that a training proposal must give the trainees a comprehensive vision of professional processes and functions, resources and tools, as well as help them acquire self-learning techniques (Martín-Mòr et al., 2014: 10). For this reason, we thought it essential for the suggested training agenda to incorporate insights from the survey conducted among acting post-editors. As such, along with theoretical material on the origins of MT industry or differences between the broad and narrow definition of quality in translation, the session covers practical aspects of the professional profile of the respondents, PE workflow, decision-making strategies and the changes brought to translation profession by the rapid expansion of the MTPE model. Enhancement of PE competency by means of mental reasoning and decision-making on how to deploy the basic principles of post-editing when performing a PE assignment are considered among other efficient ways to promote experiential learning. Creation of multiple opportunities to perform guided and autonomous learning that enables students to put into practice a broad range of skills and abilities when resolving practical tasks is essential for the smooth course of training.

The experimental study starts and finishes with a testing session so as to provide the instructor with an opportunity to measure and evaluate the PE performance and MTPE-related attitudes of the students, on the one hand, and to offer students another opportunity to practice PE and to reflect over their own progress and beliefs, on the other. Keeping in mind that evaluation activities should not only provide the researcher with the proof on the training effect but also contribute to the trainee's competency, test assignments are considered as an integral part of the training proposal.

The training agenda is drafted following the principles of programmed learning. The in-class part of the training consists of three sections, while the remote training focuses on putting the acquired knowledge and skills to practice. The lead-in covers description and analysis of the profile of the respondents who are currently engaged in PE practices and covers the routines involved in MTPE. Next, the practical workshop pretends to provide the trainees with a deeper understanding of MTPE origins, the adopted quality standards and their practical applications, as well as to pinpoint the skills and competencies put to practice by PE. As a follow-up, discussion on the similarities and differences between translator and post-editor profiles is held. Finally, the students are assigned homework to be done and checked remotely.

Incorporation of the remote training session into the training proposal is influenced by the principles of autonomous learning, which are a milestone in the modern EHEA. These principles put forward the claim that students should be given an opportunity to understand, analyze and evaluate while working on themselves at their own pace. It is for this very reason that after completion of the theoretical part of the training, the students were provided an opportunity to drill their PE skills remotely over the two weeks that followed. During this time all communication between the participants and the researcher was happening through Skype and e-mail.

Tables 23.1-23.3 summarize testing and training activities and their objectives ("In" stands for the instructor; "Ss" stands for the students):

Phase	**Objective**	**Activities**
Testing session-1	Expose students to PE experience; call to reflection on their attitude towards MTPE-related issues and evaluation of their performance	In : provides Ss with testing session assignments and instructions Ss : read the instructions, perform MT evaluation and PE ; fill in the questionnaire

Table 23.1. TS 1: objectives and activities

Phase	Objective	Activities
In-class training		
Lead-in	Raise awareness regarding the professional profile of a post-editor	In: gives a PPT presentation, moderates the discussion Ss: attend the presentation; discuss post-editors' role in the industry, their profiles, experiences, MTPE working routines
Practical workshop	Introduce the basic concepts of MTPE	In: gives a PPT presentation, moderates the discussion Ss: attend the presentation, make a hypothesis on the future of the translation industry
	Discuss PE quality standards	In: provides the broad and narrow definition of quality in translation and their application in MTPE, moderates the discussion Ss: work in groups and decide on the translation quality definition that best suits the MTPE, justify their choice; apply quality standards towards MT output
	Decide on the key PE skills	In: introduces MT output evaluation criteria and PE guidelines Ss: work in groups and suggest their list of key PE skills
	Focus attention on decision-making triggers	In: collects ideas on the topic, gives a presentation, moderates the discussion Ss: attend the presentation; (in groups) range the issues that influence decision-making in PE, compare their results to the ones exposed in the presentation
	PE practice	In: provides a set of raw MT segments, gives feedback on the suggested PE output Ss: work individually, evaluate MT output quality, introduce changes where necessary, justify their decision
Follow-up	Consolidating the changing role of translator	In: collects ideas on the topic, gives a presentation Ss: share ideas on the skillset of post-editors, compare translation and PE as a professional activity, compare their perceptions with the survey results
Remote training		
Homework	Expose students to PE experience	Ss perform PE assignments and get feedback

Table 23.2. Training proposal: objectives and activities

Phase	Objective	Activities
Training session-2	Expose students to PE experience; call to reflection on their attitude towards MTPE-related issues	In: provides Ss with assignments and instructions Ss : perform an MT evaluation exercise and a PE exercise; fill in a questionnaire

Table 23.3. TS 2: objectives and activities

After drafting the training proposal, the next logical step was putting it to practice and measuring its efficiency. Yet, before moving any further, it is important to stress that enhancement of students' PE performance was not seen as the training objective *per se*, but rather as a means to further develop the subjects' competency in the field of MTPE, to contribute to understanding of the multifaceted nature of PE-related processes and tasks and in this way to expand the trainee's translation competency.

4.4. Study piloting

As mentioned in the introductory part, the objective of the research was to investigate how and to what extent PE competency may be enhanced in undergraduate translation students who were not previously exposed to post-editing. The pilot project was conducted with the aim to test the training proposal, experimental design, data collection methods, and to be able to introduce the necessary changes that would ensure smooth conduct of the full-scale experimental study (Chapter 5).

In this section description of the participants' recruitment process is provided, followed by an overview of the relevant instruments involved. Next, attention is paid to the training protocol that consists of testing and training phases performed in class or/and remotely. The review of preliminary results is followed by reflection on the training process and outcomes and consideration on further lines of improvement.

4.4.1. Participants

The choice of the target audience was made after a thorough examination of Dublin descriptors adopted by Qualifications Framework of the European Higher Education Area (2009). This reference document provides statements of conventional expectations of achievements and abilities associated with academic qualifications of different levels. As claimed in the Dublin descriptors, graduates of Bachelor's degree should be able to show profound understanding of their professional field, to apply this knowledge to their work and demonstrate competency regarding existent problems and challenges, to summarize and interpret relevant data necessary to produce expert judgments, to transmit ideas, issues and solutions publicly, to develop the skills required to undertake further studies with a higher level of autonomy. Consequently, it gives us grounds to argue that undergraduate students in their final year possess the competency that is similar to that of novice professionals in the same domain.

In particular, Translation degree graduates are expected to solve problems related to evaluation/editing of source-to-target meaning transfer in (non-) specialized target language texts along with problems associated with the lack of specialized knowledge, to use technology and documentation resources. Among other skills and competencies possessed at this level are abilities to work in a team and individually, to apply methodological principles of comprehension and interpretation of texts in the source language as well as principles of producing and evaluating texts in the target. As such, translation students in the final year of their BA training demonstrate confident knowledge and adequate use of vocabulary and grammar of the target and the source languages, ability to solve problems related to text processing and elicitation of meaning in (non-)specialized texts and to make decisions and transmit information/ideas regarding existing problems with elicitation of meaning in general (non-)specialized texts. The scope of skills and competencies as mentioned above helps graduates in Translation to meet the prerequisites of participation in the training.

To select participants with the required academic background, the syllabi of the departments of Ukrainian universities that train translators were examined (the origin of the researcher being the reason for the choice of the country). On completion of such examination, four Ukrainian national universities that offer Bachelor's degree in translation were approached. The choice of these universities, in particular, was due to the fact that all of them have the highest (IVth) level of state accreditation. In other words, these universities are officially authorized to train undergraduate, graduate and post-graduate students in a broad spectrum of majors and areas of expertise and enjoy the optimal educational standards. Another important factor was that such educational establishments train a large number of translation students with English-Russian working language pair since the majority of translation programs offer English as one of the most popular foreign languages, and the students are native speakers of Russian. Logically, the confident knowledge and adequate use of rules and norms of the target language (Russian) and the source language (English), professional and instrumental awareness of how to draft, edit, revise and evaluate texts in the target language, ability to solve problems related to production and evaluation of (non-)specialized texts in the target language were considered as the prerequisites for participation in the study. What is more, the subjects were not previously exposed to post-editing in the workplace environment, which made them perfect candidates to undertake a baseline train proposal on enhancing PE competency.

To get the permission to invite volunteers for participation in the pilot and later the full-scale projects, the researcher contacted the Department of Theory and Practice of Translation at Karazin Kharkiv National University, the Department of Applied Linguistics at National Aerospace University "KhAI", the Department of Foreign Languages and Translation at National Technical University – Kharkiv Polytechnic Institute, the Department of Foreign Philology at Kharkiv National Pedagogical University. These universities were contacted by e-mail that contained a description of the scope of the experimental project and its objectives.

Out of all universities contacted (the academic year 2016-2017), the one that agreed to cooperate was Kharkiv National Aerospace University. The fourth-year students were directly contacted by Head of the Applied Linguistics Department Dr. Ryzhkova, and the ones who volunteered were provided with brief information about the project and got the researcher's contact details (phone number and e-mail) to confirm their eagerness to participate in the project and to ask any relevant questions. To make sure the subjects meet the requirements, we examined the academic curriculum of those who expressed their eagerness to join the study and conducted an interview with the Head of the Department on all unclear issues.

To sum up, the pilot project involved volunteers with English-Russian working language pair who were in the fourth year of their undergraduate (Bachelor's) program at Applied Linguistics Department (School of Humanities, Kharkiv National Aerospace University), and had no previous experience in post-editing. The piloting was scheduled in March 2016, and the total of ten students agreed to take part in the pilot project. All of them gave their written consent to the processing of their data for research purposes, and participated in the pre-training testing session. Next, they attended the training and completed the training assignments remotely. However, only eight subjects showed up for the post-training testing session. To keep the results validity, we had to discard the data provided by two students who did not attend the final testing session from the data pool to assure coherence of the processed values.

4.4.2. Study corpus

The choice of the corpus for the study needs was predetermined by the current tendencies in the MTPE field. As confirmed by the results of our survey *Sharing Post-Editing Practices* (Chapter 3), full post-editing of publicly available content is becoming increasingly common for many subject fields, although IT/e-commerce/software-related projects are the most common ones. What is more, the study participants were familiar with the IT field in the course of their academic programs and due to the personal interest in the IT domain. For this reason, it was decided to use the segments from the freely accessible multilingual Autodesk post-editing data corpus for the experimental part of our research. This resource contains sufficient volume of segments for training and testing assignments available in the language combinations required for the study. The Autodesk files in *.xls* format feature three categories of segments: the original segments, the corresponding raw MT output, and the post-edited output, presumably provided by Autodesk language experts. In this way, the segments from the third category could be used as a 'golden standard' when performing analysis of post-editing assignments of the testing sessions and throughout the training. The essential criterion for the corpus used for the study purposes was that the segments should not contain Autodesk specific terminology since this feature of the source test was outside the scope of the study, and correspondingly the subjects were not provided with any glossary or a term-base.

Before launching the pilot project, a set of segments for training and testing was prepared (full strings are provided in Appendix III, Tables III.1.1, III.1.2 and Link III.1.3). The key objective of the selected corpus was to provide grounds for the collection of substantial data in order to track the (anticipated) progress of the trainees. As demonstrated in Table 24, the set consisted of 168 segments: each testing session involved 10 segments for MT output evaluation and 20 segments for MT post-editing, 100 segments were used for the remote training session and 8 were necessary for the in-class training session. Selection criteria for the segments quantity and quality as well as the full strings used for the training purposes are further provided in the full-scale study description (Chapter 5).

Types of task	**TS 1**	**In-class training**	**Remote training**	**TS 2**
	Nr. of segments/words			
Warming-up	10 s. / 150 w.			10 s. / 174 w.
Post-editing	20 s. / 224 w.	100 s. /1070 w.	8 s. / 89 w.	20 s. / 232 w.

Table 24. Study corpus for the piloting

To perform the assignments during the testing session and the remote training session the students used the DQF tool developed by TAUS. The advantage of this tool is its high similarity to the ones used in the industry when post-editing is carried out on randomized samples where the size can vary from phrase to paragraph, and the segments are visualized to linguists out of context. Following the structure of the original Autodesk files, the presentation order of segments was randomized. The DQF did not permit access and revisiting of earlier sentences, which is typical for the MTPE industry. Among a broad range of functionalities offered to the users of the DQF tool, the scope of our attention focused on obtaining throughput rates and spreadsheets with post-edited segments, so that the PE output could be evaluated and classified as fit-for-purpose, under-edited or over-edited.

In Table 25 a brief overview of the format and content of the pilot assignments is presented:

Assignment type	**Format**	**Content**
Testing session 1 MT evaluation assignment	.xlsx file	10 segments (EN-RU) containing the original and the raw MT output for evaluation
PE assignment	.xlsx file	20 segments (EN-RU) containing the original and the raw MT output for PE
Training PE training (in-class) PE training (remote)	.docx file .xlsx file	8 segments (EN-RU) for PE, immediate reinforcement of answers 100 segments (EN-RU) for PE
Testing session 2 MT evaluation assignment	.xlsx file	10 segments (EN-RU) containing the original and the raw MT output for evaluation
PE assignment	.xlsx file	20 segments (EN-RU) containing the original and the raw MT output for PE

Table 25. Format and content of assignment for the pilot study

4.4.3. Instruments and tools

The corpus used for training and testing purposes made part of a larger array of instruments and tools used in the course of the piloting and the full-scale study. Summarized information on their type and purpose is presented in Table 26:

Phase	Instrument type	Purpose
TS 1	Instructions	Introduce the Ss to the testing session agenda, describe its building blocks and suggest PE guidelines
	MT evaluation assignment	Practice evaluation of MT output and warm-up for the following PE assignment
	PE assignment	Collection of data on Ss' entry level of PE competency
	DQF tool	Facilitation of MT evaluation and PE assignments
	Questionnaire	Collection of data on Ss' attitudes and perceptions of MTPE-related issues
In-class training	Presentation	Visual aids to facilitate assimilation of the training content and cognitive skills development
	PE assignment	Reinforcement of decision-making skills
Remote training	PE assignment	Drill of PE skills, provide feedback on PE performance
	DQF tool	Facilitation of MT evaluation and PE assignments
	PE assignment feedback	Provide the fit-for-purpose segments approved by professional post-editors
TS 2	Instructions	Introduce the Ss to the testing session agenda, describe its building blocks and suggest PE guidelines
	MT evaluation assignment	Practice evaluation of MT output and warm-up for the following PE assignment
	PE assignment	Collection of data on Ss' achieved level of PE competency
	DQF tool	Facilitation of MT evaluation and PE assignments
	Questionnaire	Collection of data on Ss' attitudes and perceptions of MTPE-related issues

Table 26. Overview of training proposal instruments and tools

Section 4.4.2 provided a description of the assignments drafted on the basis of the selected study corpus. Hereafter, Tables 27.1-27.3 offer a brief overview of the other study-related instruments, while an in-depth analysis of the latter are examined in Chapter 5 (Section 5.3).

Instrument	Format	Content
Instructions	.docx file	○ Project specifications ○ The sequence of testing activities ○ PE guidelines
Questionnaire	GoogleForms	○ Project brief ○ Benefits for participants ○ Glossary ○ Name/department/program ○ Previous experience in translation / post-editing ○ Attitude towards the usage of MTPE ○ Attitude to the statement "Machine translated and post-edited output of less-than-maximum quality is good enough to be delivered to the client as a complete job" ○ Attitude to PE as a professional activity

Table 27.1. Experimental study instruments – TS 1

Instrument	Format	Content
In-class training		
Presentation	.pptx file	○ Raising awareness about the professional profile of a post-editor ○ Introduction of the basic concepts of MTPE ○ PE quality standards and key PE skills ○ Decision-making triggers ○ Exposure to PE expertise
Remote training		
PE feedback form	.xlsx file	○ 100 segments (EN-RU) with "fit-for-purpose" PE output to reinforce previous PE performance

Table 27.2. Experimental study instruments – Training

Instrument	Format	Content
Instructions	.docx file	○ Project specifications ○ The sequence of testing activities ○ PE guidelines
Questionnaire	GoogleForms	○ Project brief ○ Benefits for participants

		○ Glossary ○ Name/department/program ○ Previous experience in translation / post-editing ○ Attitude towards the usage of MTPE ○ Attitude to the statement "Machine translated and post-edited output of less-than-maximum quality is good enough to be delivered to the client as a complete job" ○ Attitude to PE as a professional activity ○ Comments on the perceived impact of the training

Table 27.3. Experimental study instruments – TS 2

4.4.4. Protocol

The experimental setup of the pilot project was designed with the objective to test the efficiency and effectiveness of the suggested training proposal. The initial and the closing testing sessions (further referred to as TS 1 and TS 2) were conducted in the controlled environment, where all participants performed one warming-up and one testing assignment on PE and filled in the questionnaires on the same day and in the same location. On completion of TS 1 (23/03/2016), the students assisted at the in-class training session. During the next week, they were expected to complete a training assignment autonomously and get the feedback from the instructor. The training culminated with TS 2 which was held in the end (04/04/2016).

Pre-training testing session

On March 23, 2016, TS 1 started with an introduction to the research topic. The students received instructions on how to perform the warming-up exercise and the PE assignment, and then proceeded to completion of the given tasks. Having finished the two assignments, the subjects filled in the questionnaire to share their opinions concerning MTPE-related issues and provided their written consent for participation in the study and the use of their data in the further investigation.

Training session

- *In-class training*

The in-class training session was based on the presentation (as described in Section 4.4.3). The lead-in focused on the professional profile of a post-editor and the basic concepts of MTPE, after which the students were invited to express their opinions on the emerging phenomenon of MTPE, and what the translation industry can expect in the nearest future. The practical workshop on PE involved theoretical material and exchange of opinions on quality standards adopted in translation and how they are applicable to PE, key PE skills and decision-making triggers. The students also were invited to put PE strategies to practice by performing an 8-segment long post-editing task in pairs and under the instructor's supervision. As a follow-up, the researcher made use of the survey outcomes and moderated a discussion on the changing role of the translator in the modern world. The details of the training are further provided in Chapter 5 (Section 5.4).

- *Remote training*

At the beginning of each of the two following weeks, the students received a 50-segment long PE assignment to be performed using the DQF tool. As soon as they completed each assignment, a message containing the same raw MT segments, the PE output suggested by the student, and the "golden standard" (from the Autodesk database) was sent back to them as feedback. In this way, the training participants could see for themselves the cases when post-editing of MT errors was necessary, and the ones where such edits could be classified as preferential and/or stylistic.

Post-training testing session

On April 4, 2016, TS 2 was conducted. The routine was similar to the one used in TS 1: the subjects received instructions on how to deal with the testing session assignment, performed the tasks and filled in the questionnaire. As previously mentioned, the closing testing session was conducted in the controlled environment, on the same day and in the same location as TS 1.

4.4.5. Preliminary evaluation of training outcomes

The warming-up MT quality evaluation assignment was not in the focus of our analysis since its only objective was to introduce raw MT output to the subjects. On the contrary, the PE assignment yielded two types of data regarding PE throughput and output quality. PE throughput was measured in terms of word-per hour rate (WPH). As for the PE output, at the end of each testing session all segments post-edited by the study participants were compared against the "golden standard" and assigned to one of the three MQM categories: fit-for-purpose, over-edited and under-edited segments. For the sake of brevity the cases of so-called "pseudo-editing" (when students introduced errors to the segments rather than edited them) were also considered as the cases of under-editing.

The obtained data indicated that participation in the pilot study resulted in enhancement of PE quality and throughput rates, although it did not have a noticeable impact on MTPE-related attitudes. The WPH rates, as well as the minimal and maximal PE performance values of both TSs, are shown in Table 28 (more detailed information on PE throughput and output values is provided in Appendix II, Table II.1):

PE performance	**TS 1**	**TS 2**
WPH rate Min vs. Max. values Mean value	 514 vs. 974 710,4	 868 vs. 2.581 1.482,6
Under-edited segments Min vs. Max. values Mean value	 3 vs. 8 5,8	 1 vs. 8 4,6
Fit-for-purpose segments Min vs. Max. values Mean value	 4 vs. 14 8,4	 11 vs. 18 13,6
Over-edited segments Min vs. Max. values Mean value	 1 vs. 13 5,9	 0 vs. 5 1,8

Table 28. PE output minimum, maximum and mean values (TS 1 vs. TS 2)

As demonstrated in Figure 5, the WPH rate was lower before training and increased significantly after the training, as the mean value rose almost twice in TS 2. Comparison of PE output values in both testing sessions demonstrated that the mean value of fit-for-purpose segments rose, the mean value of over-edited segments decreased significantly, while the mean value of under-edited segments showed a slight decrease.

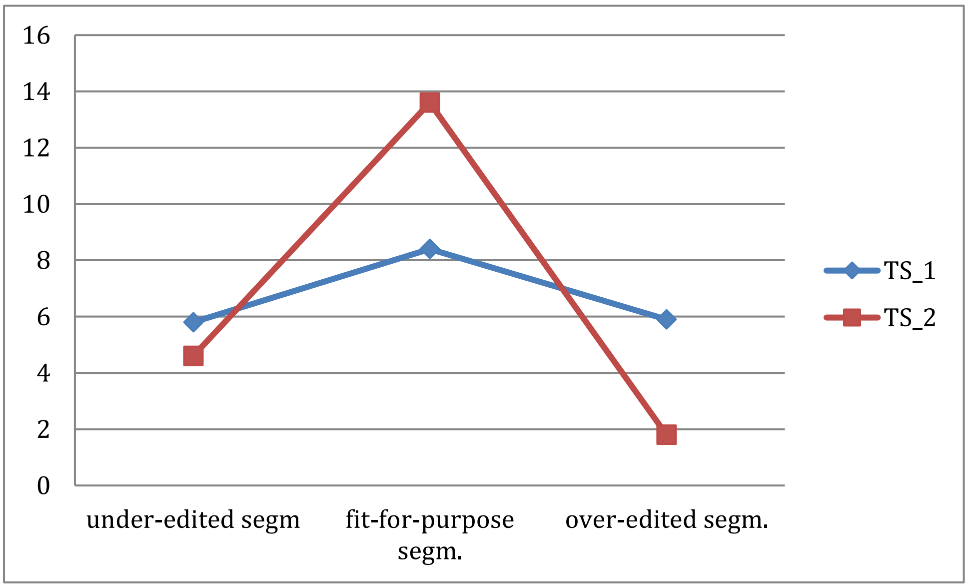


Figure 5. Correlation of PE output quality mean values before and after the training (the vertical axis represents the number of the participants)

Figure 5 represents the tendencies observed in TS 1 and TS 2 regarding the output quality. This piece of data suggests that one of the benefits of the training proposal for the given group of subjects results in the overall increase in PE output quality.

As confirmed by the questionnaire responses, all participants were fourth-year students of Applied Linguistics Department aged between 19 and 20. The question on whether they had taken any MTPE-related modules previously was answered negatively by 7 out of 8 students (87%), although the one who gave a positive answer did not provide any further explanation to the question asking to specify the module title and its duration. When asked about previous experience in translation and post-editing projects, 100% of participants responded negatively. In both TSs the majority (7 out of 8 students) described their attitude to the use of MT in the translation and localization industry as 'rather positive'.

A detailed breakdown on the students' responses to the questionnaire is provided in Appendix II, Table II.2; hereafter the collected data is presented in the form of diagrams (each combining the answers to one and the same question before and after the training). When asked about their attitude towards MT, the majority were positive in both testing sessions. However, there was one student who ticked the option 'rather negative' in TS 1;

also, there was one student who described their attitude towards MT as 'very positive' in TS 2 (Figure 6):

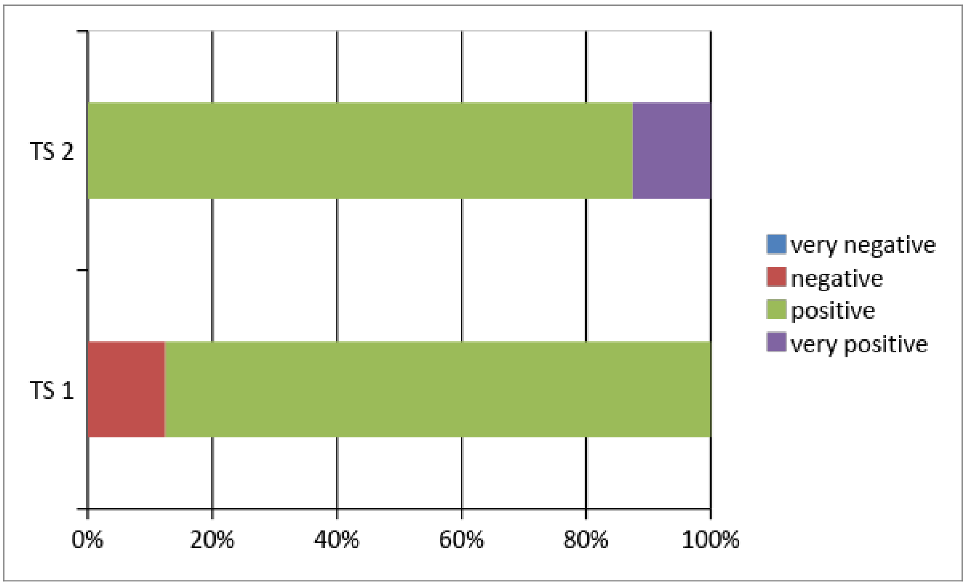


Figure 6. What is your attitude regarding the usage of MT in the translation/localization industry? (the vertical axis represents the percentage distribution of the participants)

When asked to express their opinion on whether machine translated and post-edited output of 'less-than-maximum' quality is good enough to be delivered to the client as a complete job, the results of both testing sessions coincided (three students chose "I agree", three – "I disagree" and two – "I strongly disagree") (Figure 7):

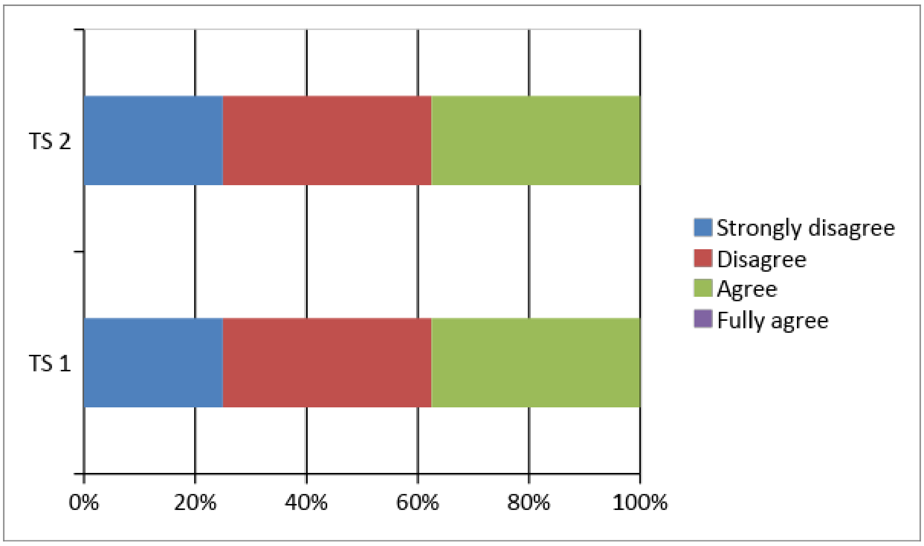


Figure 7. Do you agree with this statement "Machine translated and post-edited output of less-than-maximum quality is good enough to be delivered to the client as a complete job?" (the vertical axis represents the percentage distribution of the participants)

The last question inquired whether the subjects would consider PE as their regular professional activity. In TS 1 three students reported to have no interest in PE, one student was positive about PE jobs, and four students said they might consider including PE jobs into their workflow if needed. Alternatively, in TS 2 one student provided a negative answer, three students were positive about using PE jobs, and four students said they might consider including PE into their professional workflow if needed (Figure 8):

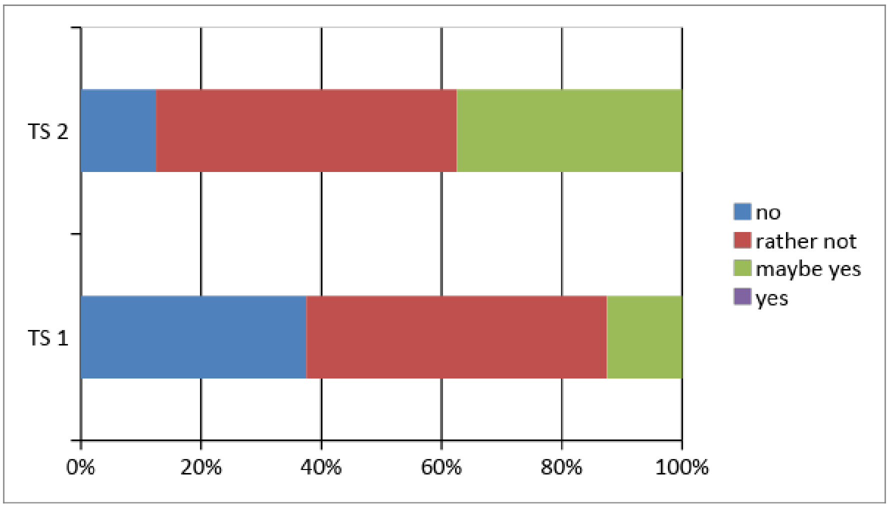


Figure 8. As a novice translator, would you be interested in performing PE jobs on a regular basis? (the vertical axis represents the percentage distribution of the participants)

When answering the TS 2 questionnaire, the subjects also shared the perceived impact of the training proposal by leaving their comments in the available free-text box. In this way they got an opportunity to describe the effect (if any) of participation in the experimental study, such as acquired knowledge, skills and/or attitudes. To summarize, the majority considered MT to be a useful time- and effort-saving tool for translators that nevertheless could not be used without human interference. As expected, the students reported to be aware of the MTPE model even before the beginning of the pilot test. Nevertheless, they admitted that on the whole such experience contributed to a more profound understanding of the concept, since the quality of raw MT turned out to be quite high, the availability of MT output - indeed helpful.

As noted by Doherty (2017), few studies provide detailed information on evaluation and evaluators, and descriptions of guidelines and operational definitions used in the assessment of translation quality are scarce. The same is true in the assessment of training proposals. On the other hand, bias can compromise the validity and reliability of assessment, and contaminate conclusions of any evaluation-related research. Various types of biases, such as professional, language, cultural, and universal biases (Dardenne and Leyens, 1995; MacCoun, 1998; Baron, 2010) were analyzed in many disciplines. To minimize the threat of bias, the effects discerned in the experimental study are examined using the previously operationalized variables (Section 4.1). Therefore, when evaluating the training effect, the focus of attention was aimed at comparison of PE output quality, throughout and attitude towards MTPE-related issues before and after the training. The impact of the training as perceived by the participants made another source of information for further discussion. Finally, analysis of the available data yielded information about how and to what extent the offered training program contributes to the development of PE competency in translation students.

The primary criterion for evaluating the effectiveness of our PE training proposal was the correlation of subjects' PE performance parameters before and after the training. Due to the complexity of the research construct, we saw it appropriate to use a mixed-method approach for measuring the overall feasibility of the suggested proposal. The conducted pilot study provided an opportunity to test methodology, the relevance of assignments and questionnaires, the selected tools, suitability of corpus, as well as the study constraints.

The analysis of quantitative and qualitative data before and after the training yielded information regarding the acquisition of PE competency by the participants and helped us to measure the efficiency of the proposal.

Concluding remarks

The pilot project shed light on potential problems that arose in the course of its implementation, such as the failure of the participants to appear at both testing sessions and the consequent reduction of the data pool available for the analysis. Unfortunately, participant drop-out is one of the most common issues happening in experimental studies and could not be remedied with the means available to the researcher. Nevertheless, the overall tendency towards an increase of PE throughput and improved PE output quality suggested the training efficiency and appropriateness of the corpus, tools, and methods involved in the experimental design. As a result, a preliminary conclusion was made that the suggested training proposal contributes to enhancing PE competency in undergraduate translation students, which proves our initial hypothesis, and the overall design and the instruments are appropriate and do not require significant changes.

To further solidify the applicability of experimental results and their scientific robustness, some improvements were proposed for the full-scale experimental study:

- to amplify the scope of qualitative values and to investigate if any signs of progress were noticed by the participants, an inquiry about subjects' convictions of their perceived PE performance was added to the questionnaire;
- in the part of quantitative values, it was decided to complement the descriptive analysis with inferential and associative statistical analysis, and to visualize the collected values with the help of boxplot diagrams so as to derive further insights from the obtained quantitative data;
- description of qualitative values provided by the questionnaire in both TSs was not sufficiently informative either since it did not reflect the changes/permanency of attitudes as demonstrated by each particular subject. For the sake of a more fine-grained examination, a different approach should be adopted that permits to track the changes of attitude (in any) of each student before and after the training;
- the quantitative and qualitative values could be cross-referenced to complement the comprehensive nature of the experimental research.

Chapter 5. Experimental study conduct

The full-scale research on the enhancement of expertise in PE followed the pretest-posttest model, which proved its effectiveness during the study piloting. In line with the latter, the experimental study consisted of three phases: the pre-training testing session (TS 1), the training session which, in its turn, combined in-class and remote training, and the post-training testing session (TS 2).

The classrooms for testing and training were equipped with a sufficient number of desktop computers for all participants and an OHP, which made it easier for the researcher to demonstrate all tasks, links and reference materials on the whiteboard. The measurements were made before and after exposing the subjects to the training proposal.

To facilitate the conduct of the experimental study, all reference materials and instructions, as well as screenshots of the DQF tool interface, were collected on a Google Sites webpage. The link to the page was projected to the whiteboard from the very beginning of the first testing session so that all participants could copy and open it on their desktop computers. In conformity with regulations on personal data protection, a personalized informed consent was obtained from each participant as for the use of their data for research project purposes only.

5.1. Participants

The language-independent nature of the training proposal suggested the involvement of students with different working language pairs, and measuring their results not only within each group but also across the groups. Therefore, the full-scale experimental study featured two different groups of subjects with EN-RU and EN-ES as their working language pairs. Members of both groups complied with the prerequisite of being in the final year of the Bachelor's degree in Translation, and their academic programs corresponded to the requirements of Qualifications Framework of the European Higher Education Area. The choice of the participants was based on the premises that translation competency of undergraduate students in their fourth year of university training is characterized by sufficient level of acquired knowledge, skills, and attitudes that can be expected of novice translators. The process of volunteers' recruitment was similar to the one explained in Section 4.4.1. All trainees were volunteers and did not receive any compensation for their participation.

The training of the EN-RU group was scheduled for autumn semester 2016 and involved 22 subjects who volunteered to participate and met the requirements. All of them were fourth-year students of Applied Linguistics Department (Kharkiv National Aerospace University). Their curriculum[12] featured Theory and Practice of Translation (English-Russian/Ukrainian and Russian/Ukrainian-English), Translation Technologies, Editing and Revision (English-Russian/Ukrainian), along with Theory of Algorithms, Computational Linguistics, Basics of Informatics and Programming and other specialized fields.

In the autumn semester 2017 fourth-year students of Translation and Interpreting Department (Universitat Autònoma de Barcelona) participated in the experimental study. This time the total number of students who agreed to undertake the training and met the requirements was 24 people. The academic curriculum[13] of this group featured such compulsory and/or optional subjects as Theory and Practice of Translation (English-Spanish/Catalan and Spanish/Catalan-English), Specialized Translation, Information Science Applied to Translation and Interpreting, Audiovisual Translation and Localization and others.

The summarized data of the study participants are presented in Table 29:

University / Department / Year	**Nr. of subjects**	**Working language pair**
Kharkiv National Aerospace University / Applied Linguistics Department / 2016	22	EN-RU
Autonomous University of Barcelona / Translation and Interpreting Department / 2017	24	EN-ES

Table 29. Total nr. of the full-scale study participants

[12] https://faculty7.khai.edu/ru/site/perechen-distsiplin.html (Last consulted on 20.06.2018)
[13] http://www.uab.cat/web/estudiar/ehea-degrees/study-plan/study-plan-structure-1345467897115.html?param1=1228291018508 (Last consulted on 20.06.2018)

5.2. Study corpus

The language pairs selected for the full-scale study were EN-ES and EN-RU. The first combination was stipulated by the full-time hosting institution of the researcher – Universitat Autònoma de Barcelona (UAB, Spain) and, consequently, higher probability of involving the local students to participate in the experiment. As mentioned in Section 4.4.1, the second combination had to do with the researcher's country of origin, and the fact that Kharkiv National Aerospace University (KhAI, Ukraine) was the institution that agreed to offer internship facilities for the researcher's external 3-month stay in conformity with the requirements of the UAB International Doctoral Research Component.

The Autodesk corpus featured the original segments in English for which raw MT output was available in both target languages (RU and ES). Quite logically, such raw MT segments were heterogeneous in terms of output quality, and contained different number and categories of errors. As the pilot study did not suggest crucial changes to the training agenda and instruments, the segments from the pilot study could be reused for the group with EN-RU as their working languages (Appendix III, Table III.1.1, III.1.2 and Link III.1.3). As for the testing and training assignments for the EN-ES group, a new set of segments was picked from the Autodesk corpus (Appendix III, Table III.2.1, III.2.2 and Link III.2.3), and it was made sure that the selected EN-ES corpus set contained the similar number and categories of MT errors as the EN-RU corpus set.

As can be seen in Table 30, the EN-RU set contains the same segments as were used in the pilot study. Similarly, the segments for EN-ES language pair embraced the total of 168 segments: 60 segments split between two testing sessions (10 segments for warming-up in each TS and 20 segments for post-editing in each TS), 8 segments for the training purposes used during the presentation and one set of 100 segments for remote training in PE:

	Types of task	**TS 1**	**In-class training**	**Remote training**	**TS 2**
		Nr. of segments/words			
EN-RU	Warming-up	10 s. / 142 w.			10 s. / 132 w.
	Post-editing	20 s. / 224 w.	8 s. / 89 w.	100 s. /1070 w.	20 s. / 232 w.
EN-ES	Warming-up	10 s. / 169 w.			10 s. / 163 w.
	Post-editing	20 s. / 241 w.	8 s. / 83 w.	100 s. /1103 w.	20 s. / 245 w.

Table 30. Study corpus

During the testing session and the remote training session, the students used the TAUS DQF tool, which proved its efficiency and applicability in the piloting. The order in which PE segments were presented to the trainees from both groups was randomized, revisiting of earlier segments was not possible, which is typical of the MTPE industry.

To decide on the proportion of different categories of MT errors in the segments that were further used for PE assignments, one hundred random EN-ES and EN-RU strings from the Autodesk multilingual corpus were analyzed. Each string consisted of the original segment in the source language, its translation by the MT engine and the "fit-for-purpose" segment approved by professional linguists. In this way, the general tendencies were tracked and later employed when selecting the segments for testing and training purposes.

The analysis revealed that about 35% of the selection contained more than two MT issues, that required intervention on the part of post-editors. These segments were classified as 'disfluent' or 'incomprehensible' regarding fluency and as the ones that render 'little' or 'none' of the meaning regarding adequacy. The other 65% were either not edited at all or up to two edits were introduced. That meant that they were 'good' or 'flawless' regarding fluency and rendered 'everything' or 'the most' of the meaning regarding adequacy. Such MT output quality better corresponded to our objective to introduce MTPE to students and to positively influence their attitude to the field. The PE assignments for testing and training only included the segments from the second category, for which reason the raw segments selected for the study either contained no issues at all or up to two edits could be introduced. A closer analysis with the help of MQM revealed that 30% of the segments were left without changes, the other 30% had issues with accuracy, while the fluency issues were edited in 40% of segments.

The reason for selecting one hundred segments for testing and training purposes was stipulated by time constraints, as the subjects were full-time students in the final year of their Bachelor's program who were busy with their academic and professional commitments. That fact implied that participation in the experiment was only possible on condition that the professor who was supposed to be giving a lecture / practical class to that group of students agreed to present the course material more compactly at a certain point of the syllabus. In this way, the researcher could get an opportunity to conduct the testing sessions and the in-class training session during the time slot previewed for the course material.

- *MT evaluation assignment*

Human evaluation of MT output most commonly consists in application of "adequacy and fluency paradigm" where adequacy (also known as 'accuracy') is understood as the extent to which the machine translation renders the meaning of the input in the source language, and fluency (also known as 'intelligibility') is the extent to which the MT output is a 'good' exemplar of the target language (Doherty, 2017). In such scenarios, human evaluators are expected to rate MT output segment by segment, i.e., without context at the sentence level, with the source text segment presented alongside, frequently with the help of an ordinal scale (Koehn, 2009). At the same time there is a rapidly growing literature on limitations such evaluation entails, especially in light of dichotomies of good versus bad translation (Doherty et al. 2010; Blatz et al., 2003), the use of interval scales (Koehn and Monz, 2006; Specia and Farzindar, 2010; Bojar et al., 2013; Graham et al., 2013) or subjectivity of human evaluators has also been highlighted (Koponen, 2012; Turchi et al., 2014). Even so, it was decided to include this type of task into both TSs since in our case the issue under scrutiny was not the evaluation of MT output *per se*, but rather familiarization of the subjects with MT issues by exposing them to raw MT output of different quality. Another important argument in favor of including an MT evaluation assignment into the testing session was that nearly half of the *Sharing Post-Editing Practices* questionnaire respondents admitted that it is a common practice to start a PE project with evaluation of the raw output and determination whether it should be post-edited or translated from scratch (Chapter 3). For this reason, the MT output evaluation of ten segments was offered as the first assignment of the pre-training and post-training testing sessions.

The study corpus made it possible for the researcher to evaluate the required amount of post-editing by comparing the raw MT category and its PE counterpart. As such, when drafting the warming-up assignments (ten segments for each TS), five of such segments them were 'excellent/good enough' to be delivered to the client after some editing or directly without any changes made. The other five warming-up segments would require more effort and would probably be good candidates to be translated 'from scratch' since post-editing would result counterproductive.

- *PE assignment*

The original segments and the corresponding MT output came from the online Autodesk database, and each testing assignment contained twenty segments and the equal number of MT errors. In terms of quality the PE assignments included a mix of segments that did not require any editing and segments that contained one/two MT errors. In particular, each testing session assignment contained six segments that did not require editing, six segments with adequacy issues and eight segments with fluency issues. In this way an effort was made to imitate the frequency with which different categories of MT errors appeared in the Autodesk corpus.

- *Remote training*

Each training set was comprised of one hundred segments and the equal number of MT errors. Namely, thirty segments were not to be edited, thirty contained the cases of adequacy, and the remaining forty were to be post-edited for better fluency. The purpose of such distribution was to imitate the frequency with which different categories of MT segments appeared in the selected pool of segments.

5.3. Instruments

This section provides a description of the range of instruments applied in the experimental study, such as instructions, questionnaires, and in-class training materials (Appendix III, Table III.3, and Links III.4, III.5.1 and III.5.2).

- *Instructions*

Apart from drafting the tasks for testing and training sessions, it was essential to provide participants with clear and concise instructions on how to perform the testing assignments. It is well known that thorough preparation of reference materials results in improved validity, reliability, and efficiency of performance, and also increases the value of the obtained data (Doherty, 2017). The instructions contained explicit information to minimize cases of assumptions, misunderstanding and arbitrary rankings.

As demonstrated by the pilot training outcomes, the subjects did not experience any difficulties when interpreting the instructions, for which reason the document that was used for the pilot study was re-used in the course of the full-scale study. The instructions were drafted with reference to the industry standards and current practices adopted in the MTPE sector. We also considered the data from the survey *Sharing Post-Editing Practices* (Chapter 3), where among the most popular reference materials the respondents indicated at the general project specifications regarding the expected output quality level, delivery dates, required tools etc. In contrast, very few respondents mentioned the use of PE guidelines with instructions on and example of editing raw MT output errors. This detail was taken into consideration, and the guidelines were kept to the minimum.

The reference information for the pre-/post-training TSs was presented in three blocks: the project brief, project objectives, and PE guidelines (Appendix III, Table III.3). The project brief described the technical details of the assignments, such as the origins and the total number of segments to be evaluated and post-edited, and the way to access the DQF tool. The participants were also informed that it was possible to refer to any available resources in case of issues with meaning, form, and function of source and/or target segment(s).

The project objectives comprised two types of assignments – the evaluation assignment for the warming-up and the PE assignments. The expected quality level was indicated as ‘full post-editing’. The first task focused on the evaluation of adequacy and fluency. The former was interpreted as “the scope of meaning expressed in the target translation as compared to the source,” the latter referred to “the extent to which the translation is error-free and is perceived as natural/intuitive by a native speaker.” In line with TAUS recommendations, the evaluation scale choices for the category of adequacy parameter were described as “everything – most – little – none”, while the fluency category was to be measured in terms of “flawless – good – disfluent – incomprehensible” values. The second task of each TS was a PE assignment which required “publishable/human-like” output quality level. Such requirement suggested that the participants were expected to pay attention and make sure that the MTPE output was understandable, grammatically correct and conveyed the original meaning.

Finally, the PE guidelines provided concise information on adequacy and fluency issues. It was explained that the former embraced cases of mistranslation, addition and/or omission, untranslated segments/words which led to problems with meaning transfer; the latter focused on possible problems with the target language output, e.g. morphology, verb forms, syntax, orthography, punctuation and “noise” (e.g., incorrect/missing/extra function words/symbols, e.g. prepositions or punctuation marks), etc. While moderating the TSs, the instructor also mentioned those issues with the raw MT that should not be edited (the so-called "stylistic changes") such as cases of replacing a correct lexical unit with a synonym or changing the word order for the sake of fluency or stylistic purpose, etc.

- *Questionnaires*

To elicit information on the participants' academic background and attitudes regarding MTPE-related issues, an online questionnaire was drafted (Appendix III, Links III.5.1 and III.5.2). The questionnaire was seen as an independent research instrument that gave access to those aspects of PE performance that could not be observed directly (Wagner, 2010: 23) and collected information that could not be reached through quantitative methods.

Unlike most qualitative research approaches that involve direct observation of behavior, questionnaires rely on individuals' self-reports of their knowledge, attitude or behavior; consequently, the validity of the provided data depends on the honesty of respondents (Mertens, 2014: 105). To meet the needs of our study, the questionnaire followed simple descriptive approach to gauge the characteristics of the subjects at one point in time. Given the pre-/post-test nature of the research, its longitudinal application was considered so that values from the pre-training session could be compared to the post-training ones.

After analysis of the pilot study results (Section 4.4.5), the updated questionnaire for TS 1 included the following blocks: introduction, glossary, respondents' profile, MTPE-related attitudes, and evaluation of PE performance as perceived by the trainees. At the end of TS 1 questionnaire form, the students were invited to give written permission to use their data for further analysis.

In the introductory block, the participants were informed that by filling in the questionnaire they were contributing to doctoral research on post-editing competency acquisition that is being conducted within the framework of the ProjecTA research project (Universitat Autònoma de Barcelona, Spain). Particular attention was paid at the fact that the experimental results were to be used to evaluate the efficiency of the training proposal on PE performance enhancement so that such proposal could be incorporated into academic syllabi of translation/interpreting departments or used for in-house training. The anonymity of all research participants was guaranteed, identifiable information about participants' details was not to be reported or published, and all data were to be processed confidentially. Also, it was stressed that the benefit of participation in the training consisted in getting a more profound understanding of Machine Translation and Post-Editing industry, hands-on PE experience, and practical background for further training in expert PE skills. The Glossary section comprised a brief description of the key research concepts – machine translation and post-editing.

To collect information on participants' profiles, the TS 1 questionnaire inquired about the subjects' academic background in MTPE-related modules and translation-related experience. Next, the students were invited to write down their name, department/program/academic year and to indicate experience in any MTPE-related modules and/or translation/PE projects, specifying the details in case the answer was positive.

The block on MTPE-related attitudes and evaluation of PE performance as perceived by the trainees consisted of the questions that were identical for both TSs (Table 31):

Question	Answer options	Objective
1. What is your attitude towards the usage of MTPE in translation/localization industry?	1-4 scale (1=very negative, … 4 = very positive)	To identify possible bias towards MT
2. Do you agree with this statement: "Machine translated and post-edited output of less-than-maximum quality is good enough to be delivered to the client as a complete job"?	1-4 scale (1=strongly disagree, … 4 = fully agree)	To investigate how the subjects see the quality issue in MTPE
3. As a novice translator, would you be interested in performing PE jobs on a regular basis?	1-4 scale (1=no, … 4 =yes)	To get an insight into the subjects' attitudes towards pursuing PE professionally
4. I am ... with my performance during this testing session	1-4 scale (1 = very dissatisfied, … 4 = very satisfied)	To gauge the participants' self-satisfaction level
5. If I am asked to perform similar evaluation/post-editing jobs, I consider my PE competency as ...	1-4 scale (1 = deficient, … 4 = excellent)...	To investigate the perceived training effect of the proposal

Table 31. Questionnaire (identical for both TSs)

Along similar lines, the TS 2 questionnaire was drafted. This time there was no need for background information on the participants (since the researcher had already collected these data before), for which reason the questionnaire started with a glossary. Then, one more time the students were invited to express their attitude towards MTPE, less-than-maximum quality of PE output, eagerness to take up post-editing professionally, self-satisfaction with PE performance and PE skills. To complement the collected data and get a deeper insight into the possible impact produced by the training, the students were encouraged to share their ideas in the free-text slot at the end of the questionnaire form. The questionnaire ended with a thank-you note and a comment about the anonymity of the collected data.

- *In-class presentation*

The PPT presentation combined theoretical and practical topics related to the MTPE field and translation industry, on the one hand, and shared the results of the survey *Sharing Post-Editing Practices* (Chapter 3), on the other. As was already mentioned, the survey involved acting translators and post-editors and yielded first-hand data on MTPE-related processes and tasks. The survey results were included s training materials so as to meet the researcher's aspiration to provide students with an overview of PE expertise as reported by post-editors. Our sincere belief is that the real-life examples facilitate the introduction of the training participants into the field and help them improve their understanding of the MTPE industry as well as get an overall idea about the emerging profile of a post-editor.

The presentations consisted of seven thematic sections in correspondence with the aims of the in-class training. Table 32 provides an overview of such objectives, the topics covered and the relevant slides (Appendix III, Link III.4):

Objectives	Content	Slide nr.
Raise awareness regarding the profile of a post-editor	o respondents' countries of residence, age, working language pairs, academic background, professional background o the frequency of translation/PE-related tasks in the regular workflow, perceived average productivity of PE projects, regularity of PE task in different subject fields o PE project preparation, the starting point of a PE job,	1-12

	PE tools and systems	
Introduce the basic concepts of MTPE	○ origins of the MT industry ○ the MTPE market share ○ shortcomings of MT	13-18
Discuss PE quality standards	○ broad/narrow definition of translation quality ○ light PE vs. full PE	19-20
Decide on the key PE skills	○ pre-conditions for successful PE ○ general rules of PE ○ 4 levels of MT output quality ○ top skills of a post-editor (based on the survey results)	21-24
Focus attention on decision-making triggers	○ PE triggers (based on the survey)	25
PE practice	○ segments with MT issues (EN-RU)	26-27
Expose students to PE expertise	○ comparison of translation vs. PE as professional activities (based on the survey) ○ comparison of the competencys levels: translator vs. post-editor (based on the survey)	28-29
End of the presentation		30

Table 32. In-class training presentation

5.4. Protocol

- *Pre-training testing session*

The suggested training proposal aimed at enhancing PE performance of undergraduate students. At the beginning of the pre-training testing session (TS 1), the participants were informed that by taking part in the experimental study they contribute to doctoral research on PE competency acquisition. It was stressed that anonymity of the participants would be protected, no reports or publications containing identifiable information regarding their names and contact data would be published.

The testing session started when the participants went to the indicated web-page in Google Sites and opened the link with instructions on how to perform the testing session assignments. As explained earlier, this document dealt with the tasks the students were supposed to perform, described the required tool and how to access it, and contained the instructions on the performance of the assignments with detailed information on how the evaluation and post-editing tasks were supposed to be completed. Our objective at this point was twofold: first, to give students a comprehensive idea of criteria applied to quality evaluation in PE; and second, to screen subjects' initial level of PE competency and to check how/if it changes as a result of the training.

During the warming-up task, the students were asked to evaluate 10 raw MT segments in the DQF tool. To facilitate evaluation of raw MT output, the instructions contained the explanation of the adequacy criteria (ranging from everything to none) and fluency criteria (ranging from flawless to incomprehensible). On top of that, the DQF tool also featured a built-in option of demonstration of the evaluation criteria on demand. In the case of the post-editing task, the subjects were informed that "publishable quality" of the assignments was required. Such a criterion implied full accuracy and compliance with the target language grammar and spelling rules so that the output was understandable, grammatically correct and conveyed the original meaning. As well as in the previous case, all raw MT segments were selected from the Autodesk online multilingual corpus. The instructions ended with customized PE guidelines, devised to familiarize the subjects with the types of raw MT issues to be edited (accuracy and/or fluency errors) and not to be edited (stylistic changes). Having read through the instructions, the participants moved to the next section of the web-page to check the layout of the warming-up and the post-editing tasks in the DQF tool. At this point, links to TS 1 assignments were sent to all participants so that they could start working.

After completion of the evaluation/post-editing part of TS 1, the students proceeded to the next link, which led them to the questionnaire form. The questionnaire started with a brief description of the project and benefits of participation, and contained a glossary. First, the students answered to open- and closed-end questions about their academic background, professional experience in translation and/or postediting. In the next block of questions, they shared ideas concerning attitudes towards the usage of MT in translation/localization industry, their perception of quality standards adopted in MTPE and attitudes towards PE as a professional occupation. Also, the study participants were asked to evaluate their PE performance and express the degree of their disposition to perform PE in the future. The last paragraph read that by writing down their first and last name the students granted their consent and voluntarily agreed to participate in a series of research assignments as well as to provide their data for further processing. Such processing included but was not limited to data evaluation, classification, and publishing of the study results in the present doctoral research and future publications. All students provided their informed consent to participate in the study.

The key objective of this phase of the study was to collect data on the subjects' PE performance, attitudes towards MTPE-related issues and PE performance convictions before the training. This information was further used to measure the influence of the proposal on novice translators and to contribute to the ongoing research in the field of training in PE.

- *Training sessions*

The core component of programmed learning is the program itself – an ordered sequence of chunks with the rising level of difficulty, presenting some information and ending in a question so that the student provides final answers. The program is expected to have a logical layout, to engage students in participation, to provide them with feedback and contain a clear statement of measurable objectives. Another important requirement is adaptability of the program to individual learning rhythm of the students. For this reason, the training activities of our proposal consist of a combination of theoretical and practical elements involving an in-class seminar and remote self-study.

In-class training

The lead-in part of the presentation was focused on the scope of post-editing expertise, as revealed by the results of the survey (Chapter 3). At first, the students got an overview of the survey participants' age, countries of residence and working language pairs. Then, the information on respondents' membership in professional translators' associations, their academic background(s) and experience in translation and/or post-editing was provided. The next block of slides focused on what PE is about and how it is performed. Special attention was paid to the frequency of translation/PE-related tasks in respondents' workflow, average productivity rates and metrics for their calculation. The training session participants were informed about the frequency of applying (semi-) automatic PE operations, correlation of full/light PE and high-/low-visibility content and the most common subject fields for PE projects. When talking about how the PE workflow of translators engaged in PE is arranged, MTPE project management and the starting point of PE assignments were analyzed. Next, the frequency of using relevant tools, systems, and reference materials in MTPE-related projects was discussed.

The training session continued with a description of the origins of the MT industry in the middle of the 20th century and a brief overview of MT models developed since then. Before introducing shortcomings of MT, the participants were invited to come up with their ideas on what such shortcomings might be like. Having covered this issue, the data regarding the MTPE market share were discussed, as were the pros and cons of using MT in the workflow. The latter issue predetermined the theme of the following group of slides, which dealt on the broad vs. narrow definition of translation quality, followed by the comparing and contrasting similarities and differences of light vs. full post-editing.

Next, the students were invited to work in groups and decide on the pre-conditions for a successful MTPE project. The answers were written down and compared to the training materials. To facilitate acquisition of PE competency, the MT output evaluation levels were analyzed as interpreted by the flagship of the MTPE industry – TAUS. It was made clear that no post-editing was required if the MT output could be classified as "excellent" and understanding of a particular segment was not improved by reading the source; minor post-editing was recommended for the cases of "good" segments, i.e., when the MT output contains minor errors affecting grammar, syntax, punctuation, word formation or unacceptable style. On the other hand, the training participants were advised to consider serious post-editing for the MT output samples of "medium" quality, when understanding was improved by the reading of the ST, and manual retranslation from scratch in the case of segments of "poor" quality when one's understanding only derived from the reading of the source segment.

In continuation, the students learned about the basic principles of PE, such as maximum use of raw MT output, making sure the target text corresponds to the source text and contains no additional information, ignoring stylistic errors with the exception of culturally offensive, inappropriate and unacceptable terms, applying the basic rules of spelling, grammar, punctuation, and formatting. To approach the topic of PE strategies from a different angle, the instructor recurred to the survey results in the part of PE-related skills ranking. It was demonstrated that the total of responses could be boiled down to top

3 PE skills: the ability to make decisions quickly on whether MT output is editable, ability to produce “fit-for-purpose” output and ability to abstain from over-/under-editing. Then, the students were invited to think of 3 key reasons that would cause post-editing of a particular MT issue. The next slide featured another screenshot from the survey – this time the trainees zoomed into decision-making triggers that cause post-editing or translation from scratch.

As mentioned in Chapter 1, for training and testing purposes the MT error typology elaborated in the framework of the QTLaunch-Pad project based on MQM annotation guidelines and the MQM annotation decision tree (version 1.4, 2014) was used. The versatile nature of the so-called “one-size-fits-all” metrics provided a solid baseline to analyze the PE output produced by participants with different target languages and minimal/no experience in PE. Since the MQM model is characterized as language-neutral, it could be demonstrated and applied during the training sessions with both groups of the participants.

On the whole, the MQM model was considered flexible and applicable to the output available in Spanish and Russian languages, being sufficiently broad to include the main categories of edits in both languages. Given the time constraints of the project, the brevity and conciseness of the selected typology were among its other advantages, as were ease of use and clear boundaries, which facilitated its prompt memorizing by the trainees. To put to practice the acquired knowledge and skills, the participants were invited to post-edit 8 segments of the corresponding language pair and discuss their outcomes in groups. After that the instructor demonstrated the “golden standard” to provide feedback on the recently emitted PE performance.

Since all participants were translation students, at the end of the presentation we thought it particularly useful to pay attention to the comparison of post-editors’ vs. translators’ profiles as described by the survey respondents themselves. For this reason, both activities were compared through the prism of the perceived scope of required competencies and levels of satisfaction with the roles of a translator and/or post-editor.

<u>*Remote training*</u>

At the beginning of each of the two following weeks, the students received a 50-segment long PE assignment to be performed using the DQF tool (the same tool that was used during the testing session). However, the compilation of segments for this part of the training was different from the one used in TS 1: the tool was customized in such a way that first the students received a raw MT segment to be post-edited, and then the system demonstrated the post-edited equivalent of the aforementioned segment. As a result, the students could see how close/far from the "golden standard" their output was. In this manner, the trainees were provided with immediate feedback right after emitting their response, which reinforced their experiential learning.

Remote training was based on self-learning principles: as soon as the students submitted their opinion on evaluation, they could see how/if the segment was post-edited by Autodesk experts (or was left without changes). The raw MT segments were explicitly marked with the abbreviation MT to demonstrate that intervention might be required, while the segments that started with the abbreviation PE were the "golden standard" considered as segments of publishable quality. In this way, the training participants could see for themselves those cases when post-editing of MT errors was necessary, and the ones where such edits could be classified as preferential and/or stylistic. To avoid any possible misunderstandings, before the end of the in-class training session the instructor demonstrated the sequence of raw and "fit-for-purpose" segments on the whiteboard.

In this way, the students got prompt feedback on how close their evaluation of MT output quality was to the evaluation performed by professional post-editors. Immediate error correction made the remote training session a self-consistent model, as the content was split into small didactic units, which in our case equaled segments. Enhancement of PE performance happened through exercise and control, which led to PE strategy assimilation.

- *Post-training testing session*

At the closing stage of the experimental study, the post-training testing session (TS 2) was conducted. The participants were provided with instructions on how to accomplish assignments. This time, TS 2 aimed to obtain the information that would facilitate evaluation of the subjects' PE performance before and after the suggested training, as well as measure the subjects' tendencies in their attitudes.

Using the same data collection instruments, TS 2 started with a warming-up evaluation assignment. Next, the students performed post-editing of raw MT output. After the accomplishment of both assignments, they proceeded to filling in the questionnaire. As explained earlier, the questionnaire was aimed at gauging post-training MTPE-related attitudes and PE performance convictions. In line with the pilot study, the TS 2 questionnaire was complemented with an open-ended question to collect the students' impressions about the impact of the training (if any).

In this way, an extensive dataset of quantitative and qualitative values was collected for further analysis and interpretation (Part III).

Concluding remarks

To enhance PE competency among undergraduate translation students a training proposal was elaborated in accordance with the EHEA recommendations and competency-based training principles. The efficiency of such proposal was measured by comparing the PE performance of the subjects before and after the training. Bearing in mind that the fewer the number of the participants, the more important it is to include multiple data sources to achieve a balance in the study (Hatch, 2002: 50), PE competency acquisition was measured with the help of qualitative and quantitative data collected via questionnaires and simulations of PE jobs.

Among the major weaknesses of experimental studies are threats to validity, for which reason a thorough planning was involved to minimize their effect. In order that no events that happen during the course of the study may influence the result (so-called "history threat"), it was made sure that the participants did not attend any training aimed at enhancement of PE competency either before or during the experiment. Both testing sessions were held at the same time on one and the same day of the week with a two-week break in between, which helped us exclude maturation threat, since no significant physical and/or psychological changes that would account for discerned study effect could have occurred with the participants. The threat of testing (improvement of the post-training test results only because it is the second time the students take the test) and instrumentation (difference of measuring instruments used in pre-test and post-test) were minimized by drafting the test assignments in a way so that they contained an equal number of segments selected in accordance with the MT error typology applied in the study, and using the same tools and evaluation scales. Since all participants were volunteers, the only type of threat that could not be fully controlled by the researcher was mortality. As a consequence, during the piloting there were students who participated in TS 1, although dropped out later. Fortunately, no similar cases were reported during the full-scale study.

The conducted study is an example of applied research since it is focused on the solution of practical problems that exist in the MTPE industry and academic sector. Its primary objective was to develop a sharable approach to PE competency enhancement, to describe the implications brought by the study design, and to share suggestions regarding the procedures and techniques aimed at PE competency acquisition. Efficiency and effectiveness of the proposed training were first tested in the course of the pilot study, which was followed by a full-scale experimental study. Collection of qualitative and quantitative values from the study participants minimized the possible bias and provided a solid ground for triangulation of the study results.

The aim of the present research was to draft and put into practice a baseline training proposal that would result in PE competency acquisition by undergraduate translation students who were not previously exposed to post-editing workflow. The training objectives included an introduction of the subjects to the concept of MTPE and the changes it brings to the translation industry; enhancement of the subjects' PE performance; improvement/keeping positive the subjects' attitudes towards MTPE-related issues and their role in the MTPE process.

Current research into the psychology of learning seems to validate the view that endorsing responsibility to students makes them responsible for their success and gives more chances to become professionals after graduation. For this reason, a significant part of the training was performed by the participants autonomously. The pool of the participants was made of 46 volunteers in the final year of their undergraduate (Bachelor's) program at the Autonomous University of Barcelona (Spain) with EN-ES as their working language pair and Kharkiv National Aerospace University (Ukraine) with EN-RU as their working language pair.

To prove the research hypothesis about the beneficial influence of the training on the subjects' PE competency, sufficient evidence was to be collected. The pre-/post-test methodology adopted for the experimental study provided two sets of data: the first one was collected after TS 1 , and the second one – after TS 2. The use of the TAUS DQF tool as data collection instrument assured for two types of quantitative values: throughput rates (measured by the time required to complete a PE assignment, otherwise called the word-per-hour rate), and output quality (measured by the number of under-edited, over-edited and fit-for-purpose PE segments produced by the participants). Qualitative values were obtained in the form of answers to the 6-item questionnaire that gauged students' attitudes towards MT phenomenon and quality criteria adopted in the MTPE sector, students' eagerness to take up PE jobs on a regular basis, and self-assessment of their participation in the proposed training (in terms of acquired PE competency and satisfaction with PE performance). Also, at the end of the second testing session, the participants shared their opinions on the perceived impact of the training.

The case study was aimed at enhancing PE competency in conformity with the constructivist framework and the principles of programmed learning. The suggested training program might have involved teaching methods used in teaching translation and/or revision due to the author's belief that some of the tasks aimed at PE skills development are very much like those used to train translators/editors, though not identical. The proposal may be alternated and adapted to the specific needs of each particular project and is expected to be of use for teaching staff and those in charge of in-house training.

Part III. Study outcomes: analysis and reflections

After focusing on the design and methodology applied to the experimental study, conducted at two universities: Universitat Autònoma de Barcelona (Spain), and Kharkiv National Aerospace University (Ukraine) during 2016-2017 (Part II), in Part III we provide descriptive, inferential and interpretative analysis of the study outcomes and share our reflections on the potential of the suggested training proposal in light of the changes brought to the MTPE landscape by the rise of neural MT paradigm. Therefore, Chapter 6 examines the collected qualitative and quantitative data and focuses on the interrelation of PE performance values and students' attitude towards MT. Next, Chapter 7 offers a brief description of the Neural Machine Translation (NMT) model and speculates over how and to what extent application of (N/S)MT systems could potentially influence the training. Finally, a conclusion is drawn about the impact the recent changes in MT principles are likely to have on the suggested training proposal.

Chapter 6. Analysis of experimental study outcomes

This chapter consists of three sections and conclusive remarks, and offers analysis and interpretation of the obtained data. Section 6.1 starts with a description of quantitative datasets, coming from pre- and post-training testing sessions that reflect PE performance of the participants. For greater clarity, the results of each group are treated as data subsets inside the total pre-/post-training dataset made of the combined results of both groups. The analysis includes calculation of core measurements and visual representation of the obtained values, as well as the comparison of segmented and combined data for each testing session. To see if and to what extent the tendencies demonstrated by the experimental groups can be extrapolated more widely, inferential analysis is conducted for each subset of data. After that, the associative correlations between the quantitative values are examined.

In continuation, Section 6.2 describes the trends observed in participants' MTPE-related attitudes and self-evaluation, as well as students' opinions regarding the effect of the suggested training. Associative analysis is performed to measure the statistical significance between different categories of values within each data set.

Finally, Section 6.3 pretends to correlate quantitative and qualitative values by means of comparative analysis and in this way to explore the trends of PE performance data distribution when contrasted against MT-related attitude.

6.1. PE performance

Descriptive analysis of PE performance presupposes examination and contrasting of the values obtained before and after the training (i.e., testing sessions 1 and 2, further referred to as TS 1 and TS 2). For better informativeness, the results are presented in tables and in the form of boxplot diagrams (also known as box-and-whisker diagrams). The analyzed values are discrete and report on participants' throughput (i.e., word-per-hour rate, further referred to as WPH rate), and the quality of PE segments, such as under-edited segments vs. fit-for-purpose segments vs. over-edited segments. To keep the analysis succinct and to the point, calculations of the core values are presented in the form of tables, while the exhaustive numeric breakdown of all PE performance data is displayed in Appendix IV. To describe the core values of the available datasets, the minimum and maximum values are defined, the arithmetic mean and median are calculated; to complement central measures and describe the core values dispersion the standard deviation is introduced.

Personal information about each participant was coded and stored separately. To describe and examine inferences and correlations between the collected batches of quantitative values a separate Excel file was created for each subset of data. This measure provided us with a possibility to get a clearer picture of the tendencies demonstrated by each group separately before combining the data. After that, the relevant statistical methods were applied, and the obtained results were analyzed.

Apart from the core measurements, the distribution of values is visually represented by boxplot diagrams. To this end, the R Commander was used – a platform-independent basic-statistics user interface for R, based on the *tcltk* package. When drawing diagrams, the R Commander sorted the collected quantitative values into four equal-sized groups with 25% of the values placed in each group. The median that marks the midpoint of a dataset was represented by a black line and was consistent with the results, indicated in the relevant table. The upper whisker presented the values from the upper quartile to the maximum value and the lower whisker – the values from the lower quartile to the minimum value. As such, seventy-five percent of experimental data fell below the upper quartile, and twenty-five percent were placed below the lower quartile. The circles presented the outliers – i.e., the extreme values that deviate from the rest of the samples.

Descriptive analysis of the results is followed by inferential analysis. Its objective is to evaluate the possibility to extrapolate the trends demonstrated by the experimental sample (two groups of undergraduate students) on a larger scale, and as a consequence to come up with a reasonable prediction of the effect of the suggested training proposal. To this end, our aim was to infer key tendencies from the sample data so as to make a judgement on whether the results observed in this study were dependable ones, which corroborates the beneficial effect of the training on the participants' PE competency, or whether such results had happened by chance.

Two methods applied are parameter estimation and hypothesis contrast. Parameter estimation analyzes the distribution of data, provided by the participants before and after the training. Data distribution complements the average mean, median, and standard deviation values, since this time the results are ordered and presented in ascending or descending way, which opens more possibilities for data interpretation. The method used to contrast hypothesis depends on data distribution and consists in comparing the formulated statement against the empirical data to decide whether or not the hypothesis is compatible with these data.

In concordance with the research hypothesis about the beneficial influence of the proposed training, we assume that the data should be contrasted unilaterally with the direction of the contrast toward an increase of throughput and fit-for-purpose PE segments, on the one hand, and a decrease of over-edited and under-edited segments, on the other. To provide confirmatory evidence for these hypotheses to be discarded or accepted, bar diagrams were drawn to define the type of distribution of values, and the normality test (otherwise called “goodness-of-fit” test) is applied. In conformity with the nature of the data analyzed in this section, which are discrete quantitative values, a chi-square test is deployed for these purposes. The level of statistical significance applied in the normality test was 0,05 which defines data distribution as probabilistic ($p>0,05$) or non-probabilistic ($p<0,05$), thus indicating whether parametric or non-parametric statistical analysis should be used when contrasting the study hypotheses. Hence, in conformity with the results of the normality test and bar diagrams, discrete values with probabilistic distribution are analyzed using Student’s paired-samples t-test, while for values with non-probabilistic distribution Wilcoxon signed-rank test was applied. Both tests aim at contrasting the hypotheses and help decide whether the hypothetical judgement should be maintained or rejected. It is important to mention that for this kind of tests statistical significance level is 0,05. For this reason, when the difference between the groups was checked, the null hypothesis was accepted in case if p-value>0,05 and was rejected if p-value<0,05. The calculations are conducted with the help of R Commander.

Finally, associative correlations are analyzed with the aim to measure the relation of variables within a sample. The available quantitative values are examined using the relevant associative statistics methods. Given the significant number of the analyzed values, these datasets are treated like correlations of continuous data. In this case, Pearson product-moment correlation or Spearman rank-order correlation is applied for parametric and non-parametric distribution correspondingly. These tests compare the proportion of cases of each combination of categorized values with the aim to verify whether the variables are independent (Hypothesis 0) or dependent (Hypothesis 1).

6.1.1. Descriptive and inferential analysis of PE throughput

In this sub-section PE throughput values of Group 1 (EN-RU) and Group 2 (EN-ES) are studied separately; then the same operations are applied to the combined results. First, the data are arranged in tables where columns TS 1 and TS 2 show the relevant WPH rate for each of the TSs, the column Difference demonstrates the increase/decrease of the throughput values in TS 2 as opposed to TS 1, followed by percentage correlation of the analyzed results (column "%"). A detailed numeric breakdown of the participants' throughput is presented in Appendix IV, Table IV.1. Next, to get an even better overview of data distribution and examine the traceable patterns, the sample results for each group separately and both groups combined are illustrated by box-and-whisker diagrams.

Group 1. As demonstrated in Table 33.1.1, in Group 1 the core values of TS 2 exceed those of TS 1 in all categories, the fact that is proved by positive increase reported in the Difference column. The increase in the part of minimum values is reported as 279 WPH (364 WPH in TS 1 vs. 643 WPH in TS 2), while the maximum values demonstrate improvement of throughput by 775 WPH (2210 WPH in TS 1 and 2985 WPH in TS 2). On a more fine-grained scale, the increase of the minimum value is nearly twice more significant than the increase of the maximum value (76 % vs. 35%):

	TS 1	**TS 2**	**Diff.**	**%**
Min.	364	643	279	76%
Max.	2210	2985	775	35%
Arithmetic Mean	1032,3	1636	603,7	58%
Median	1002,5	1494	491,5	49%
Standard deviation	415,33	582,2	166,87	40%

Table 33.1.1. Core values and SD (WPH rate, Group 1)

The collected data suggest that participation of Group 1 students in the training was beneficial and contributed to the rise in PE throughput since the arithmetic mean and median have increased in TS 2 almost twice.

When visualizing Group 1 performance in both TSs, the G 1_TS 1 boxplot turned out to be comparatively shorter than the G 1_TS 2, suggesting that TS 1 was characterized by a higher level of internal agreement of values obtained from the subjects. In contrast to TS 1, students demonstrated quite a different throughput rate in TS 2, which is reflected in a taller boxplot in general and its third quartile in particular. While in TS 1 the 2nd and 3rd quartile groups showed a similar distribution regarding the median, in TS 2 the observed WPH rate for the 3rd quartile group suggests quite varied results (Figure 9.1.1):

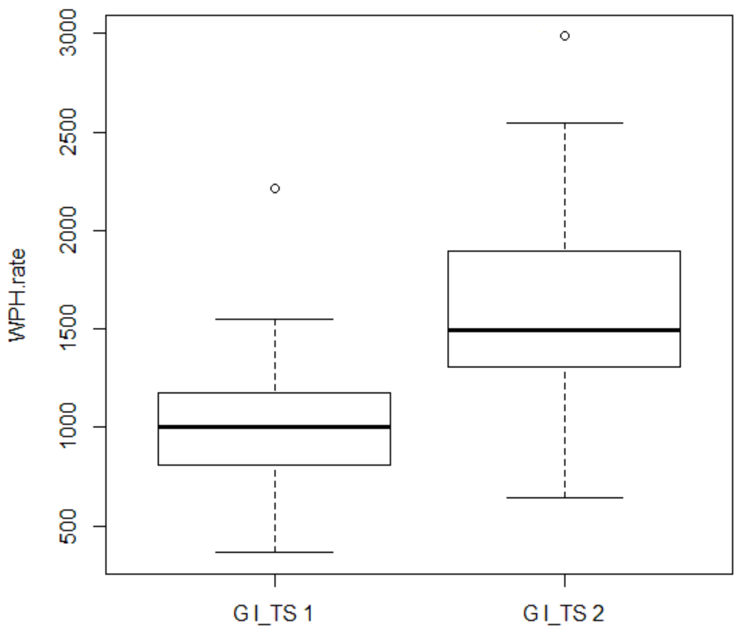


Figure 9.1.1. Throughput boxplot diagram (Group 1)

As can be seen from the Figure, the throughput demonstrated by the participants in TS 2 increased on all levels, be it the extreme values or the median, and showed more heterogeneity if contrasted against the results of TS 1.

Our hypothesis for this subsection was defined as follows: *the WPH rate demonstrated by Group 1 in TS 1 is lower than the WPH rate in TS 2*, which entails application of unilateral contrast and selecting the option "Difference < 0" in the relevant statistical test. To reject or accept the aforementioned hypothesis, we proceed to inferential analysis of Group 1 results. Figure 9.1.2 summarizes the distribution of values in both TSs.

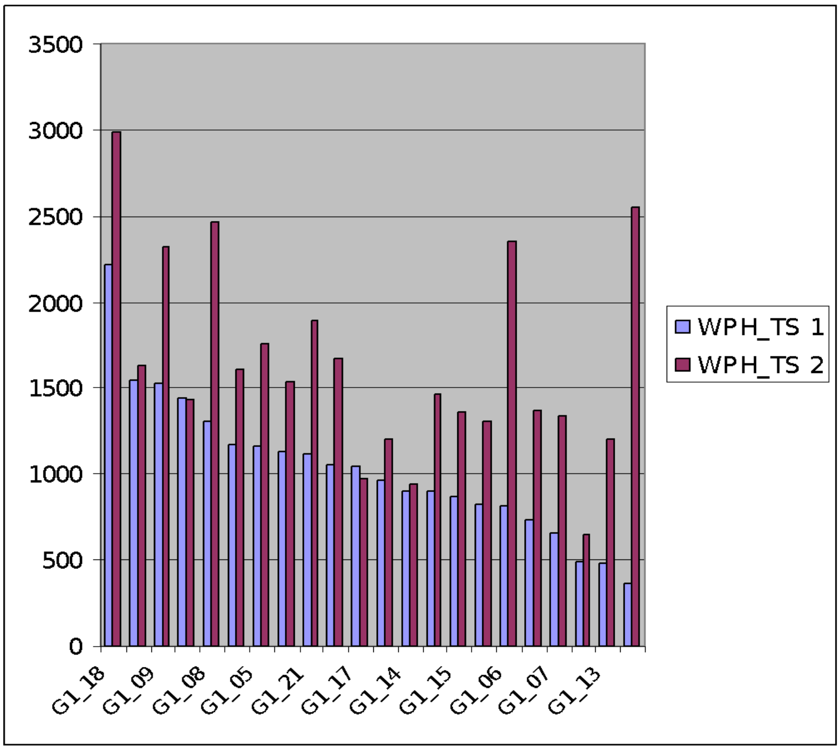


Figure 9.1.2. Distribution of Group 1 values in TS 1 and TS 2 (the horizontal axis represents the participants, the vertical axis contains the WPH rate)

To get a more in-depth perspective of the data provided by the diagram, and to decide what type of statistical method to apply, the normality test was conducted. Its results are shown in Table 33.1.2, while the screenshot of R Commander is demonstrated in Appendix V, Image V.1.

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,7024	probabilistic
TS 2	p = 0,1222	probabilistic

Table 33.1.2. Test of normality (WPH rate, Group 1)

As we can see, the distribution of results in both TSs demonstrated probabilistic tendencies, which gives us grounds to apply the *t*-Student paired-sample test to confirm or reject the hypothesis. The results of these operations are shown in Table 33.1.3 (the screenshot of R Commander calculations are presented in Appendix V, Image V.2).

	t-Student test (statistical significance level p<0,05)	Result
Hypothesis 0: TS 1 ? TS 2	p = 0,0000098	H0 is rejected
Hypothesis 1: TS 1 < TS 2		H1 is accepted

Table 33.1.3. Contrast of hypotheses (WPH rate, Group 1)

As we can see, the reported *p*-value is 0,000009843 (round off p=0,0000098). It is smaller than 0,05, which confirms out hypothesis for Group 1 throughput results (TS 1 < TS 2).

Group 2. As well as in the previous case, the core values of Group 2 in TS 2 exceed the values of TS 1, as demonstrated by a positive increase in the Difference column (Table 33.2.1). However, in this case, the increase of WPH rate for the minimum and the maximum value is more similar in terms of absolute values (455 WPH for the minimum values vs. 530 WPH for the maximum value). On the other hand, when comparing the increase percentage-wise, the difference between the minimum values is nearly twice bigger than between the maximum values (66% vs. 21%), which corroborates the tendency observed in Group 1.

	TS 1	TS 2	Diff.	%
Min.	689	1144	455	66%
Max.	2432	2962	530	21%
Arithmetic Mean	1244,8	1842	597,2	48%
Median	1154,0	1642	488	42%
Standard deviation	443,85	488,9	45,05	10%

Table 33.2.1. Throughput core values and SD (WPH rate, Group 2)

The collected data suggest that participation of Group 2 students in the training was beneficial and contributed to the rise in PE throughput since after the training the arithmetic mean and median have increased.

Distribution of Group 2 throughput results (Figure 9.2.1) indicates similarities in TS 1 and TS 2 inter-quartile range, although with a significant increase of the median value in TS 2. TS 1 results included an outlier that fell outside the upper whisker. Another noteworthy observation deals with the data produced by the 2nd quartile group: while in TS 1 the 1st and 2nd quartile groups show a similar range of variability, TS 2 is characterized by a very uneven distribution of data, especially the 2nd quartile group. This fact suggests that twenty-five percent of the sample demonstrated very similar PE throughput after the training:

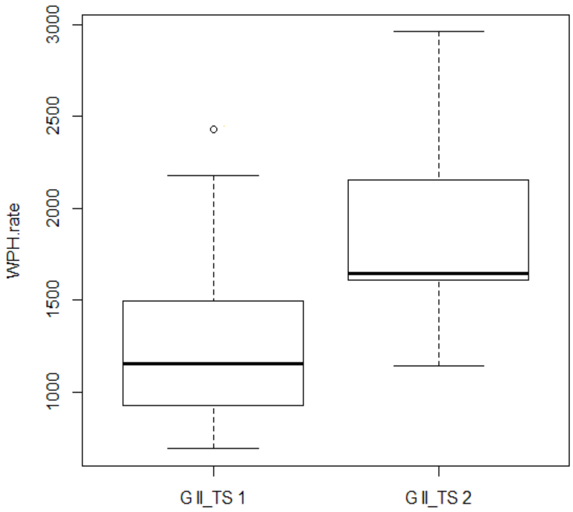


Figure 9.2.1. Throughput boxplot diagram (Group 2)

The WPH rate reported by Group 2 students in TS 1 and TS 2 respectively was analyzed for inferences. To estimate the preliminary distribution of values the bar diagram was drawn based on the data provided in each of the TSs (Figure 9.2.2).

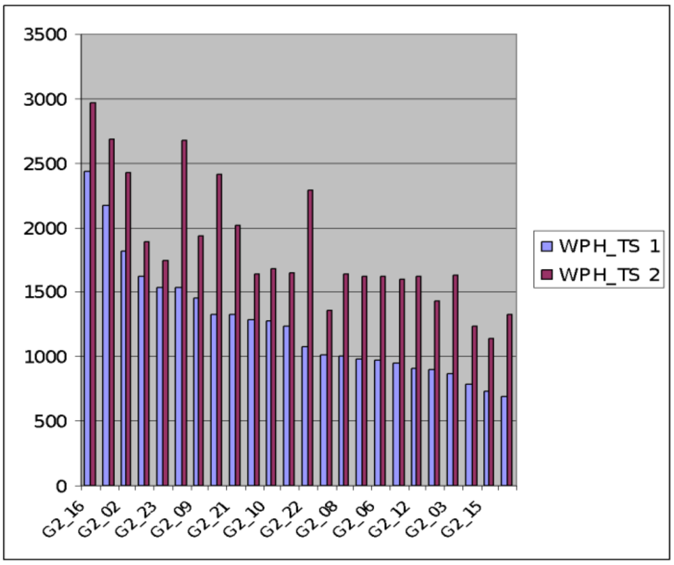


Figure 9.2.2. Distribution of Group 2 values in TS 1 and TS 2 (the horizontal axis represents the participants, the vertical axis contains the WPH rate)

To zoom into the tendencies of Group 2 data distribution, the normality test was conducted. Its results are indicated in Table 33.2.2, while the screenshot of R Commander calculations is shown in Appendix V, Image V.3.

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,2466	probabilistic
TS 2	p = 0,0029	non-probabilistic

Table 33.2.2. Test of normality (WPH rate, Group 2)

In this case, the TS 1 data set demonstrated probabilistic distribution, while TS 2 data set was distributed non-probabilistically. For this reason, we apply the non-parametric Wilcoxon test to corroborate our hypothesis. The results are presented in Table 33.2.3; the screenshot of R Commander calculations is provided in Appendix V, Image V.4.

	Wilcoxon test (statistical significance level p<0,05)	**Result**
Hypothesis 0: TS 1 ? TS 2	p = 0,0000097	H0 is rejected
Hypothesis 1: TS 1 < TS 2		H1 is accepted

Table 33.2.3. Contrast of hypotheses (WPH rate, Group 2)

The Wilcoxon test revealed the *p*-value that equals 0,000009702 (round off p = 0,0000097). This result is smaller than 0,05, which proves statistical inference between TS 1 and TS 2 values and confirms our hypothesis on the increase of the WPH rate after the training.

Groups 1 and 2. Finally, in Table 33.3.1 the core values of both groups are collected to see the average rates for core values in each of the TSs. As it turned out, the average minimum WPH rate corresponded to the data provided by Group 1, while the average maximum WPH rate was closer to the data provided by Group 2, exceeding the latter only by 1%. The average values of other core measurements and SD were in between the values reported by each of the groups.

	TS 1	**TS 2**	**Diff.**	**%**
Min.	364	643	279	76%
Max.	2432	2985	553	22%
Arithmetic Mean	1143,2	1743	599,8	52%

Median	1052,5	1630	577,5	55%
Standard deviation	439	539,53	100,53	23%

Table 33.3.1. Core values and SD (WPH rate, Groups 1 and 2)

On the whole, the boxplot diagram (Figure 9.3) corroborates the findings that characterize both groups and indicates the increase of throughput after the training:

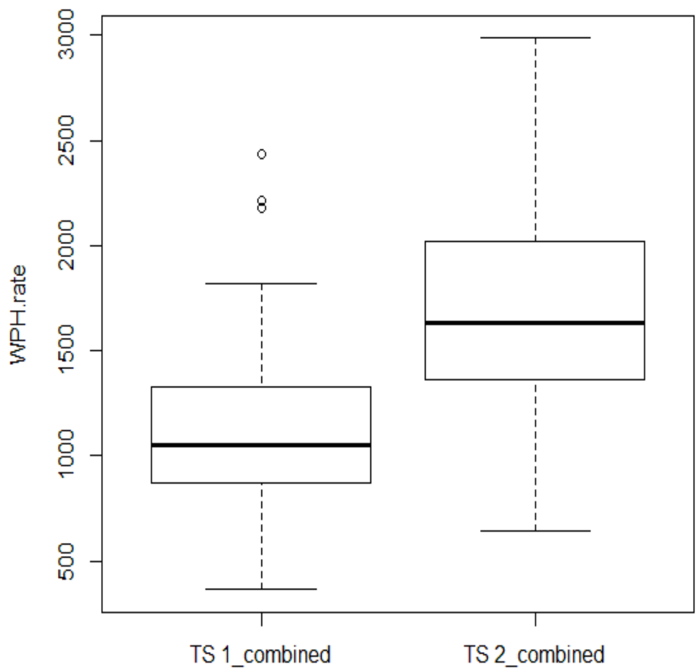


Figure 9.3. Throughput boxplot diagram (Groups 1 and 2)

In particular, when analyzing the combined results of both groups, the 2nd quartile in both TSs demonstrated less varied results than the other quartiles. TS 1 boxplot was slightly shorter than TS 2 one, indicating an increase of the interquartile range after the training. Also, in TS 1 some values were recorded outside the upper whisker zone, while TS 2 did not demonstrate any outliers. The analysis of throughput values reported an increase of the minimum and maximum values as well as the mean, and rather even dispersion of data. However, in TS 2 a more significant difference between the extreme values was observed. In addition, the upper quartile in both TSs was nearly one and a half times more distant from the median value than the lower quartile, suggesting broader dispersion of values in the 3rd quartile groups as opposed to the 2nd quartile groups.

Statistical correlations observed in Groups 1 and Group 2 results demonstrated consistency since in both cases the increase of WPH was reported in TS 2. However, to corroborate the available evidence the combined results of both groups were required. Previously Figures 2.1 and 2.2 demonstrated the distribution of values in each of the groups, while Table 33.3.2 summarizes the results of normality test conducted on the combined set of values (the screenshot of R Commander results is shown in Appendix V, Image V.5).

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,3808	probabilistic
TS 2	p = 0,0005	non-probabilistic

Table 33.3.2. Test of normality (WPH rate, Groups 1 and 2)

As Table 33.3.2 shows, distribution of TS 1 data is probabilistic, while the contrary is true for TS 2. In this case, the non-parametric test (namely, Wilcoxon signed-rank test) is applied to examine possible statistical correlations. Its results are provided in Table 33.3.3 (the screenshot of R Commander calculations is presented in Appendix V, Image V.6).

	Wilcoxon test (statistical significance level p<0,05)	**Result**
Hypothesis 0: TS 1 ? TS 2	p = 0,0000000024	H0 is rejected
Hypothesis 1: TS 1 < TS 2		H1 is accepted

Table 33.3.3. Contrast of hypothesis (WPH rate, Groups 1 and 2)

The statistical significance level for this type of test was defined as $p<0{,}05$, and the test produced the outcome of $p=0{,}000000002369$ (rounded off $p=0{,}0000000023$). The test results confirmed the hypothesis about the increase of the WPH rate increased after the training.

To summarize, the results of Group 1, Group 2 and the combined results corroborate our hypothesis about the beneficial influence of the training on the trainees' throughput rate. However, if boxplot diagrams that illustrate Group 1 and combined results distribution do not demonstrate any particular trends, the Group 2 boxplot is skewed towards the bottom which indicates a tendency to provide more homogenous output by "slower" performers.

6.1.2. Descriptive and inferential analysis of PE output: under-edited segments

This section describes the distribution of under-edited segments in both TSs. The columns TS 1 and TS 2 show the core values in each of the TSs, the column Difference demonstrates the increase/decrease of the number of PE segments in TS 2 as opposed to TS 1, followed by percentage correlation of the results (column %). To be more succinct, the Tables 34.1.1, 34.2.1 and 34.3.1 contain only the maximum and minimum values, arithmetic mean, median and standard deviation. A detailed numeric breakdown of the participants' PE output is presented in Appendix IV, Tab. IV.2 (Group 1) and IV.3 (Group 2). Distribution of values is visualized through a box-and-whisker diagram for each group separately and the combined results.

Group 1. The analysis starts with the examination of under-edited segments, which were produced by Group 1 in both TSs. Table 34.1.1 contains the core values and standard deviation. As suggested by the Difference column, the observed values increase in the part of minimum and maximum values, and decrease in the part of the arithmetic mean and median, indicating a reduction of data variation after the training. The SD is insignificant as it is close to 0:

	TS1_un	**TS2_un**	**Diff.**	**%**
Min.	1	2	1	100%
Max.	9	10	1	11%
Arithmetic Mean	6	5	-1	-17%
Median	6	4,82	-1,18	-20%
Standard deviation	1,95	1,87	-0,08	-4%

Table 34.1.1 Output quality (Under-edited segments, Group 1)

On the whole, the results indicate a slight decrease in the total number of under-edited segments after the training.

Visualization of Group 1 under-edited segments (Figure 10.1.1) demonstrates even distribution of values that belong to the interquartile range as the upper and lower quartile appear at an equal distance from the median in TS 1. In TS 2 the tendency changes and the lower quartile is more distant from the median than the upper quartile, which means a wider variety of results in the 2nd quartile group. Figure 10.1.1 corroborates the aforementioned finding about a slight decrease in the number of under-edited segments towards TS 2. At the same time, it is important to mention that TS 2 shows more heterogeneity of the 2nd quartile group, which may also be interpreted as the effect of the training.

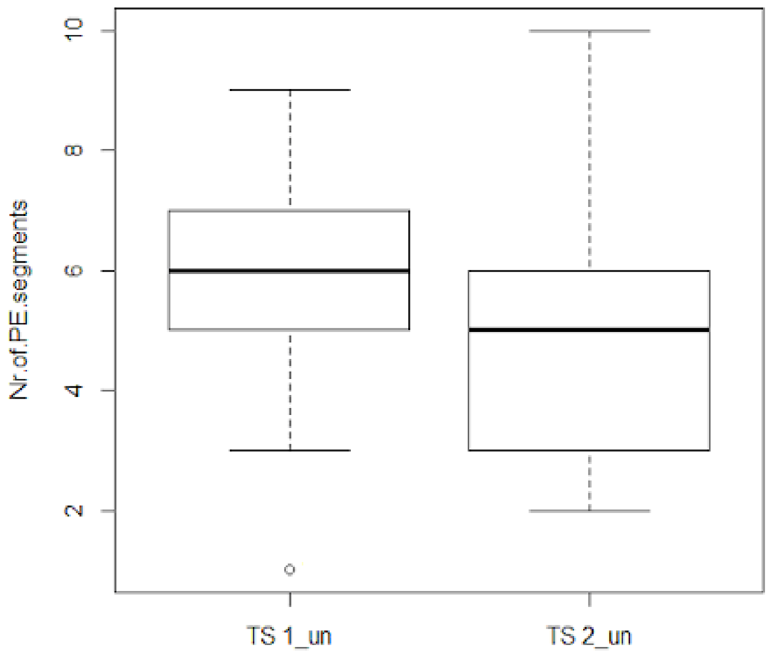


Figure 10.1.1. Output quality boxplot diagram (under-edited segments, Group 1)

The hypothesis for this subsection is defined as follows: *the number of under-edited segments produced by Group 1 in TS 1 is higher than in TS 2*, which entails application of unilateral contrast and selecting the option “Difference > 0” in the relevant statistical test.

According to the pre-defined order, the descriptive analysis of Group 1 under-edited segments is followed by the inferential analysis. The bar diagram is drawn to inspect the distribution of values for this data set in each of the TSs (Figure 10.1.2).

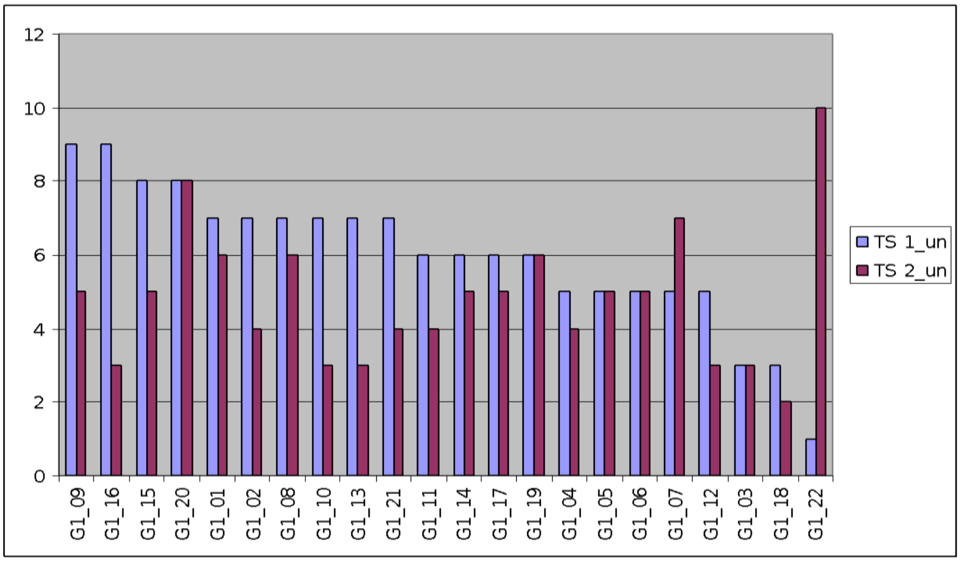


Figure 10.1.2. Distribution of Group 1 values in TS 1 and TS 2 (the horizontal axis represents the participants, the vertical axis contains the number of under-edited segments)

While the distribution of TS 1 values is seemingly exponential, the diagram does not yield a clear indication of the values order. To decide on whether parametric or non-parametric statistics should be applied, it is necessary to conduct the normality test. The test results are indicated in Table 34.1.2, while the screenshot of R Commander results is shown in Appendix VI, Image VI.1.

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,09497	probabilistic
TS 2	p = 0,07352	probabilistic

Table 34.1.2. Test of normality (under-edited segments, Group 1)

Next, given that the under-edited segments were reported to be distributed probabilistically, the *t*-Student paired-sample test was applied to evaluate the inference of the data before and after the training. The results of the test are demonstrated in Table 34.1.3, while the screenshot of R Commander results is shown in Appendix VI, Image VI.2.

	***t*-Student test (statistical significance level p<0,05)**	**Result**
Hypothesis 0: TS 1 ? TS 2	p = 0,03582	H0 is rejected
Hypothesis 1: TS 1 > TS 2		H1 is accepted

Table 34.1.3. Contrast of hypothesis (under-edited segments, Group 1)

The test results yielded *p*-value that is smaller than 0,05, which supports our hypothesis about the statistically significant decrease of the number of under-edited segments in PE assignments done by Group 1 students in the post-training test.

Group 2. The core values and standard deviation of under-edited segments of Group 2 are presented in Table 34.2.1. Unlike Group 1 results, the observed differences demonstrate an increase of the maximum value, and a decrease of the minimum value. The arithmetic mean, median and SD do not show significant changes and are close to 0.

	TS 1_un	**TS 2_un**	**Diff.**	**%**
Min.	1	0	-1	-100%
Max.	11	12	1	9%
Arithmetic Mean	6,1	5,96	-0,14	-3%
Median	5,5	6	0,5	9%
Standard deviation	2,32	2,99	0,67	28%

Table 34.2.1. Output quality (under-edited segments, Group 2)

Analysis of boxplot diagrams representing Group 2 results (Figure 10.2.1) demonstrates a higher diversity of tendencies than Group 1. The range of values in TS 1 2nd quartile group is rather insignificant and implies their homogeneity in comparison to other quartiles. In TS 2 both the upper and lower quartile are placed at a nearly equal distance from the median, suggesting more even distribution of values in the 2nd and 3rd quartile groups. Another observation concerns the minimum/maximum values, which demonstrate the tendency to decrease/increase in TS 2.

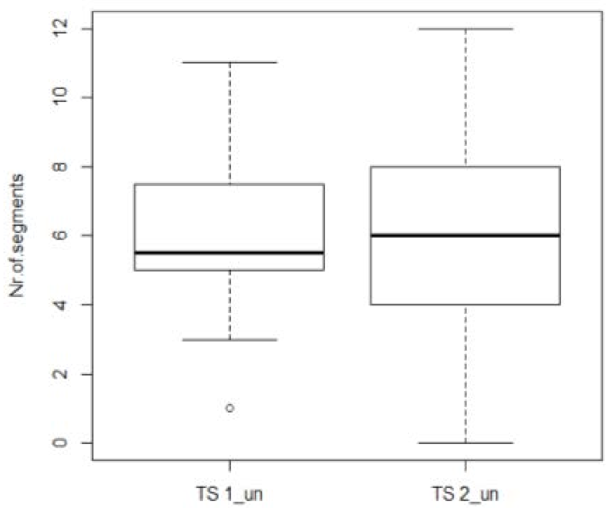


Figure 10.2.1 Output quality boxplot diagram (under-edited segments, Group 2)

In other words, Groups 2 reported a slight increase of the number of under-editings after the training, although the minimum value reported a decrease, which means that some group members managed to commit fewer under-editing in TS 2.

Next, we conducted inferential analysis on the number of under-edited segments produced by Group 2 students in TS 1 and TS 2 respectively. To estimate the preliminary distribution of values the bar diagram was drawn using the data collected in each of the TSs (Figure 10.2.2):

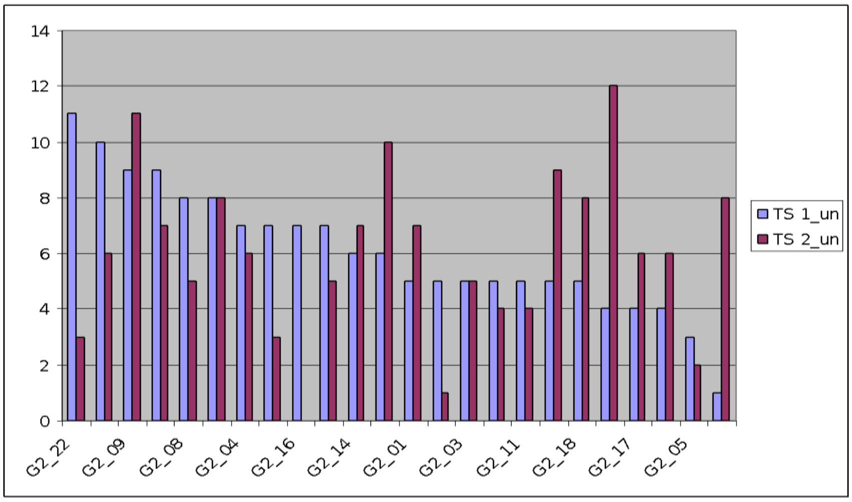


Figure 10.2.2. Distribution of Group 2 values in TS 1 and TS 2 (the horizontal axis represents the participants, the vertical axis contains the number of under-edited segments)

While the distribution of TS 1 results is seemingly exponential, the diagram contains no direct indication of how the values are grouped. The normality test was conducted to decide on the further statistical methods to be employed. Its results are indicated in Table 34.2.2, while the screenshot of R Commander output is shown in Appendix VI, Image VI.3.

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,07524	probabilistic
TS 2	p = 0,3766	probabilistic

Table 34.2.2. Test of normality (under-edited segments, Group 2)

The results yielded by the R Commander report show that the data were distributed probabilistically, so the *t*-Student paired-sample test was applied to evaluate inference of the data before and after the training. Table 34.2.3 shows the results of the test; the screenshot of R Commander calculations is presented in Appendix VI, Image VI.4.

	t-Student test (statistical significance level p<0,05)	Result
Hypothesis 0: TS 1 ? TS 2	p = 0,4385	H0 is accepted
Hypothesis 1: TS 1 > TS 2		H1 is rejected

Table 34.2.3. Contrast of hypothesis (under-edited segments, Group 2)

The test yielded *p*-value that is larger than 0,05 (p = 0,4385), which rejects our hypothesis about the decrease of the under-edited segments in PE assignments done by Group 2 students in the post-training test. Consequently, no statistical correlation was found between the under-edited results in TS 1 as compared to TS 2.

Groups 1 and 2. Analysis of the combined number of under-edited segments produced by both groups demonstrates that on the whole, the maximum value grew by 1 segment, while the minimum value decreased by 1 segment:

	TS 1_un	TS 2_un	Diff.	%
Min.	1	0	1	-100%
Max.	11	12	-1	9%
Arithmetic Mean	6	5,41	0,59	-10%
Median	6	5	1	-17%
Standard deviation	2,12	2,56	-0,44	-21%

Table 34.3.1. Output quality (under-edited segments, Groups 1 and 2)

As can be seen, the minimum and maximum throughput values in TS 1 and TS 2 show opposite tendencies of decrease vs. increase, although by 1 segment in each case. The arithmetic mean shows a tendency to decrease (-10%), its value lies in between the results observed in G 1 (-17%) and G 2 (-3%). The median value also demonstrates a tendency to decrease by 1 segment; the SD value is close to 0, which corroborates the trend shown by each of the experimental groups.

According to the predefined order, the data are arranged into boxplot diagrams (Figure 10.3):

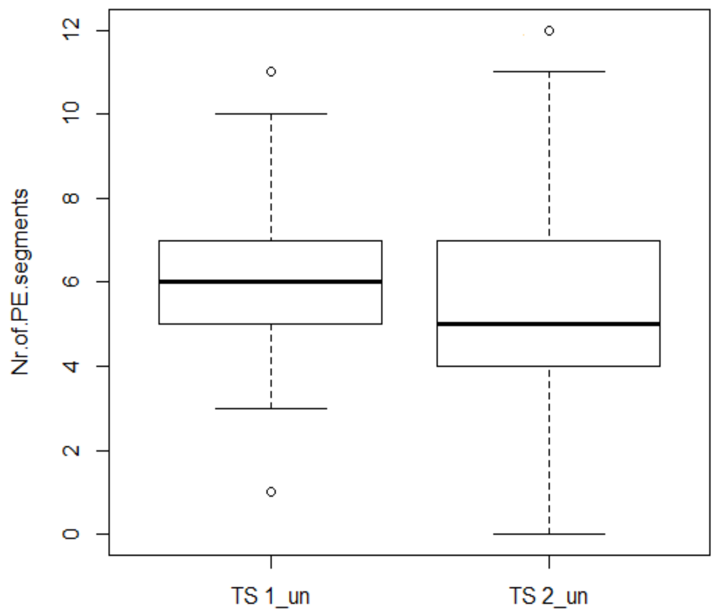


Figure 10.3. Output quality boxplot diagram (under-edited segments, Groups 1 and 2)

The tendencies demonstrated by the combined results of TS 1 and TS 2 go in line with the ones shown by each group separately in terms of the increase of inter-quartile range in TS 2. On the other hand, the decrease of the median is reported, which may be interpreted as a beneficial effect of the training. As such, we may conclude that the combined results of both groups show that after the training the students are likely to correct more under-editings than before it, the finding that is supported by the reduced median value and the lower extreme value.

Having analyzed all sets of data, we may now focus on the principal tendencies. Although Table 34.3.1 (the combined results) showed weak negative dynamics of minimum values, scrutinizing Group 1 results reported weak positive dynamics. As for the maximum values, the combined results showed an increase of values; such tendency goes in line with the results of each group when analyzed separately. The arithmetic mean reported a slight decrease in TS 2 for each of the analyzed subsets of data. The median value decreased in Group 1 and the combined dataset, although the countertendency could be traced in Group 2. The SD values showed a slight increase for Group 2 and the combined dataset, while Group 1 reported their decrease. In other words, the results of each group partially coincide with general observations of the combined results. On a fine-grained scale, Group 1 shares tendencies on three core measures (maximum value, arithmetic mean and median); while Group 2 does the same for four core measures (minimum value, maximum value, arithmetic mean and standard deviation). The standard deviation of the results of both TSs was rather insignificant for Group 1 and moderately significant for Group 2.

Comparison of statistical correlations demonstrated by Group 1 and Group 2 produced contradictory results. While the observed decrease of under-edited segments after undertaking the training was reported as statistically significant in Group 1, quite contrary data were obtained in Group 2. To find out the prevailing tendency, the combined results of both groups were analyzed. No preliminary estimation of values distribution using a bar diagram was made since both sets of data were described in Figure 4.1 and Figure 4.2. Instead, a chi-square test was applied directly. Its results are indicated in Table 34.3.2 (the screenshot of R Commander results is shown in Appendix VI, Image VI.5):

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,000002	non-probabilistic
TS 2	p = 0,0201	non-probabilistic

Table 34.3.2. Test of normality (under-edited segments, Groups 1 and 2)

The test demonstrates the non-probabilistic distribution of values in both TSs of the combined sample, which requires non-parametric statistical study, such as Wilcoxon signed-rank test, to evaluate inference of the data before and after the training. Table 34.3.3 shows the results of the test (the screenshot of R Commander calculations are presented in Appendix VI, Image VI.6):

	Wilcoxon test (statistical significance level p<0,05)	**Result**
Hypothesis 0: TS 1 ? TS 2		H0 is accepted
Hypothesis 1: TS 1 > TS 2	p = 0,06222	H1 is rejected

Table 34.3.3. Contrast of hypothesis (under-edited segments, Groups 1 and 2)

Although the combined results of the test reject our hypothesis on the decrease of the total number of under-edited segments after the training, yet the obtained *p*-value (0,06222) only slightly exceeds the suggested significance level of p<0,05. It is possible to speculate that to validate the proposed hypothesis further studies with a higher number of the participants would be necessary.

Therefore, the hypothesis about the decrease of under-edited segments after the training proved to be statistically significant for Group 1 only, while Group 2 results demonstrated the opposite tendency, and the combined results occupied the middle-ground position with a slight tendency towards the null hypothesis.

6.1.3. Descriptive and inferential analysis of PE output: fit-for-purpose segments

This section starts with the description of core values for fit-for-purpose segments. Then, the inferences between TS 1 and TS 2 are examined. To this end the hypothesis of this subsection was defined as follows: *the number of fit-for-purpose segments in TS 1 is lower than in TS 2*, which entails application of unilateral contrast of hypotheses and selecting the option "Difference < 0" in the relevant statistical test.

Group 1. As shown in Table 35.1.1, the core values representing fit-for-purpose segments of Group 1 increased positively in TS 2. However, the maximum value remained the same (15 segments in either of the TSs), and the negative difference between SD values in TS 1 and TS 2 indicates a decrease in results deviation after the training:

	TS 1_ffp	**TS 2_ffp**	**Diff.**	**%**
Min.	8	10	2	25%
Max.	15	15	0	0%
Arithmetic Mean	11,55	13	1,45	12%
Median	11,5	13,5	2	17%
Standard deviation	1,99	1,85	-0,14	-7%

Table 35.1.1. Output quality (fit-for-purpose segments, Group 1)

Next, Figure 11.1.1 helps visualize the distribution of values for this data set in each of the TSs. Examination of the values representing the number of fit-for-purpose segments demonstrates that while the lower quartile of each boxplot is alike with respect to the median, the upper quartile is higher in TS 1. The minimum value in TS 1 is 2 segments lower than in TS 2 (8 segments vs. 10 segments), while the maximum value is equal in both TSs and makes 15 segments. On the whole, a conclusion may be drawn about the positive effect of the training as corroborated by the increase of the minimum value.

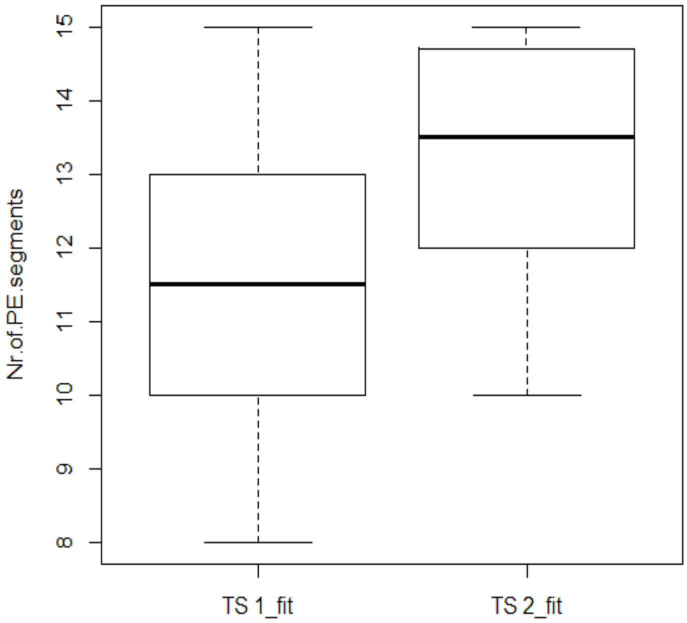


Figure 11.1.1. Output quality boxplot diagram (fit-for-purpose segments, Group 1)

The increase of the share of fit-for-purpose segments is supported by the rise of the median and the lower extreme. At the same time, the shortening of the 4th quartile group indicates to the homogeneity of the values which surpass the median. But while the distribution of TS 1 results is seemingly exponential, the diagram contains no direct indication of how the values are distributed (Figure 11.1.2):

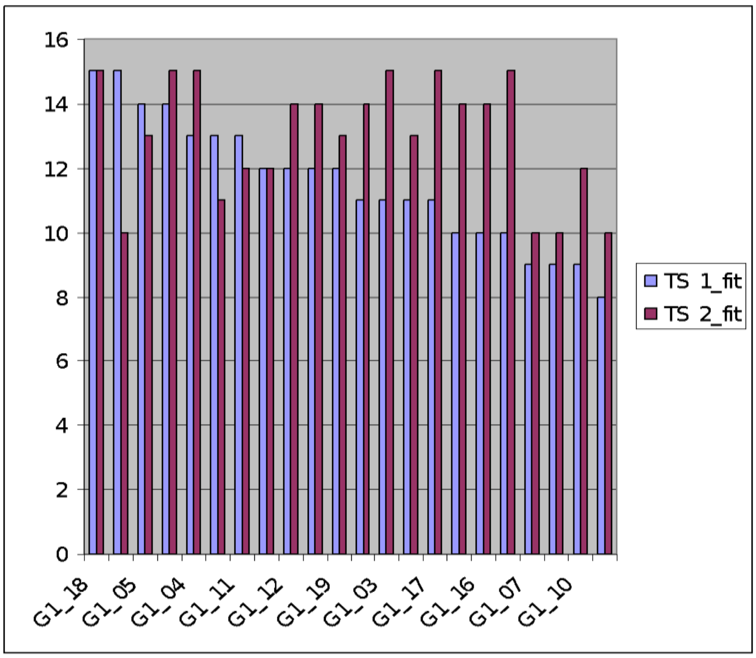


Figure 11.1.2. Distribution of Group 1values in TS 1 and TS 2 (the horizontal axis represents the participants, the vertical axis contains the number of fit-for-purpose segments)

To get a deeper insight in the data and to decide what type of statistical method to apply, the normality test was conducted. Its results are shown in Table 35.1.2 (the screenshot of R Commander results is shown in Appendix VII, Image VII.1):

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,3938	probabilistic
TS 2	p = 0,0255	non-probabilistic

Table 35.1.2. Test of normality (fit-for-purpose segments, Group 1)

Since the TS 1 data set is distributed probabilistically, and TS 2 data set is distributed non-probabilistically, the Wilcoxon test is used to corroborate our hypothesis that "the number of fit-for-purpose segments in TS 2 is bigger than the number of such segments in TS 1". The results are presented in Table 35.1.3 (the screenshot of R Commander calculations are displayed in Appendix VII, Image VII.2):

	Wilcoxon test (statistical significance level p<0,05)	**Result**
Hypothesis 0: TS 1 ? TS 2		H0 is rejected
Hypothesis 1: TS 1 < TS 2	p = 0,005	H1 is accepted

Table 35.1.3. Contrast of hypotheses (fit-for-purpose segments, Group 1)

As we can see, the *p*-value is smaller than 0,05 (p=0,005), which proves there is a statistical correlation between the number of fit-for-purpose segments produced by Group 1 before and after the training. These findings corroborate our hypothesis about the positive influence of the training on the increase of fit-for-purse segments in the students' output.

Group 2. The tendencies demonstrated by Group 2 are very similar to the ones reported by Group 1. As shown in Table 35.2.1, all core values representing fit-for-purpose segments increased positively, excluding the SD rate, which was close to 0.

	TS 1_ffp	**TS 2_ffp**	**Diff.**	**%**
Min.	4	6	2	50%
Max.	14	18	4	28%
Arithmetic Mean	9	11,54	2,54	28%

Median	9	11,5	2,5	28%
Standard deviation	3,15	3,13	-0,02	-0,6%

Table 35.2.1. Output quality (fit-for-purpose segments, Group 2)

When comparing TS 1 and TS 2 results, the rise of the median value is evident, although the interquartile range of both subsets of values is similar in size. The results also suggest the increase of extreme values in TS 2 as opposed to TS 1. In terms of values distribution, Group 2 shows even distribution in both TSs, while all core values rose (Figure 11.2.1):

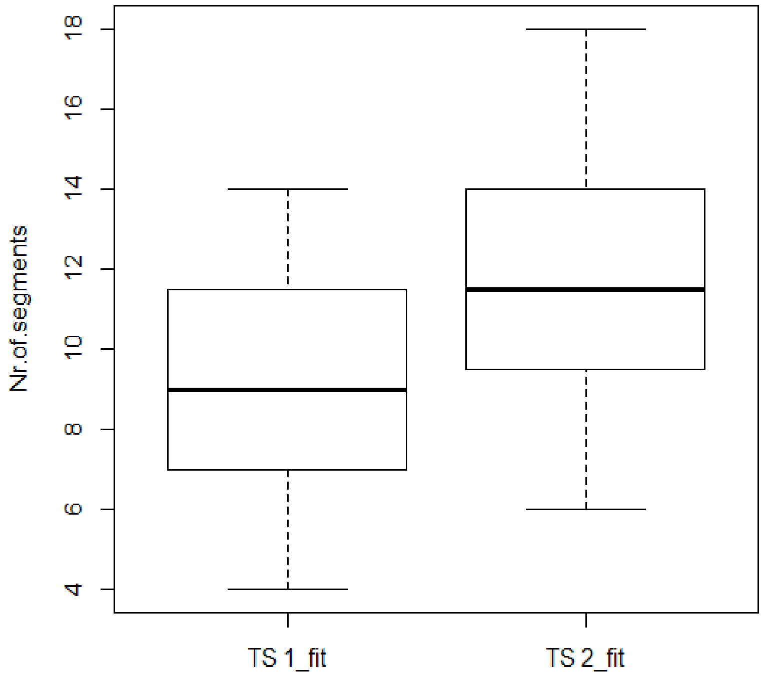


Figure 11.2.1. Output quality boxplot diagram (fit-for-purpose segments, Group 2)

To conduct the preliminary evaluation of values distribution the bar diagram was drawn, representing the data provided in each of the TSs (Figure 11.2.2):

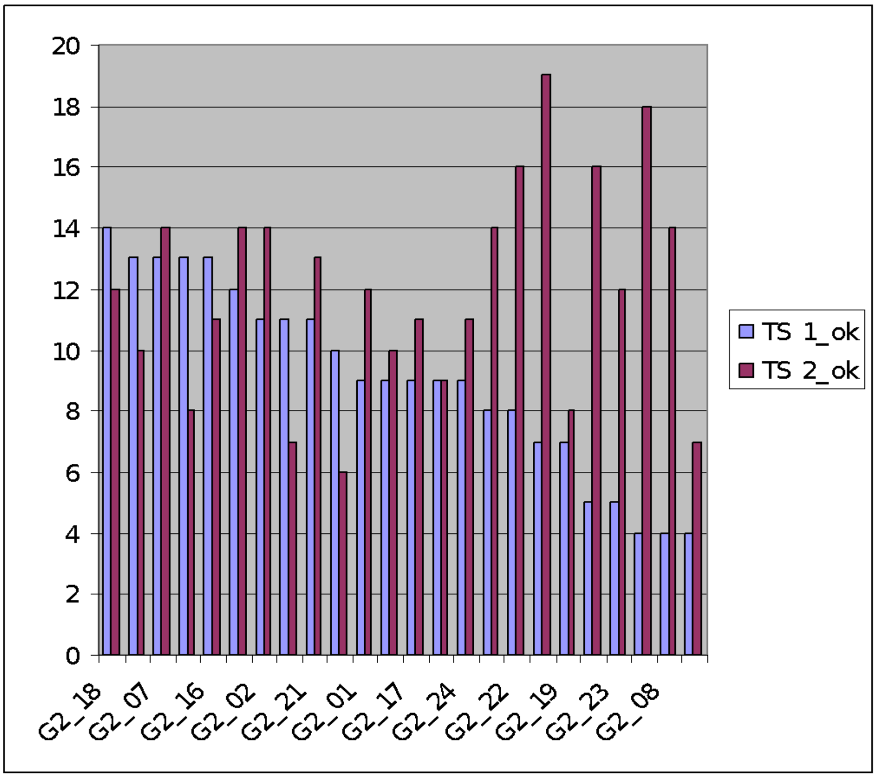


Figure 11.2.2. Distribution of Group 2 values in TS 1 and TS 2 (the horizontal axis represents the participants, the vertical axis contains the number of fit-for-purpose segments)

Next, to reveal the tendencies of data distribution, the normality test was conducted. Its results are indicated in Table 35.2.2 (the screenshot of R Commander results is shown in Appendix VII, Image VII.3):

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,07524	probabilistic
TS 2	p = 0,7512	probabilistic

Table 35.2.2. Test of normality (fit-for-purpose segments, Group 2)

In this case, in both TSs the dataset was distributed probabilistically. For this reason, we apply the *t*-Student paired-sample test to corroborate our hypothesis. The obtained results are presented in Table 35.2.3; the screenshot of R Commander calculations are indicated in Appendix VII, Image VII.4.

	***t*-Student test** (statistical significance level p<0,05)	**Result**
Hypothesis 0: TS 1 ? TS 2	p = 0,01	H0 is rejected
Hypothesis 1: TS 1 < TS 2		H1 is accepted

Table 35.2.3. Contrast of hypotheses (fit-for-purpose segments, Group 2)

The test results reveal that the *p*-value that is smaller than 0,05, which proves a statistically significant correlation between TS 1 and TS 2 results and confirms our hypothesis on the increase of the number of fit-for-purpose segments after the training.

Groups 1 and 2. As shown in Table 35.3.1, the minimum values of the combined results in TS1 and TS 2 were 4 and 6 segments, while the maximum values in the corresponding TSs were 15 and 18. The arithmetic mean demonstrated a tendency to increase by 19 %, supported by similar patterns observed in G 1 and G 2 separately. The same is true for the median, with the total increase of 13%. Although the SD results did not show unanimity when comparing G 1 and G 2, the average tendency was reported as slightly negative (-7%).

	TS 1_fit	**TS 2_fit**	**Diff.**	**%**
Min.	4	6	2	50%
Max.	15	18	3	20%
Arithmetic Mean	10,26	12,24	1,98	19%
Median	11	12,5	1,5	13%
Standard deviation	2,9	2,7	-0,2	-7%

Table 35.3.1 Output quality (fit-for-purpose segments, Groups 1 and 2)

The boxplot diagram (Figure 11.3) indicates to a rise in the average number of fit-for-purpose segments after the training, although in both TSs the lower 50% of the participants demonstrate more heterogeneous performance than the top 50% of the participants:

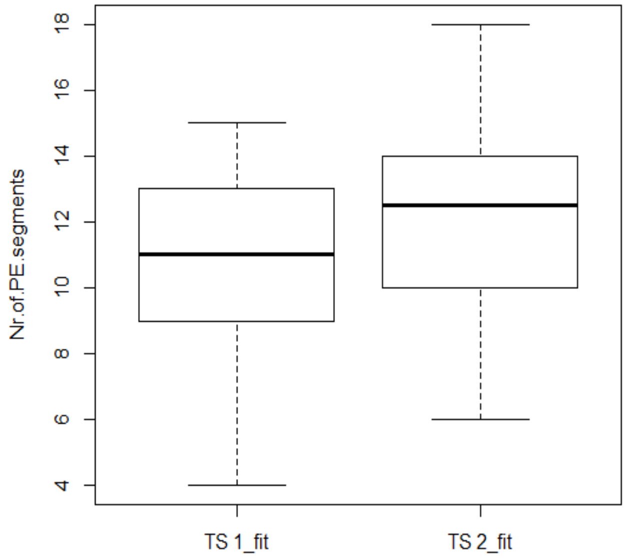


Figure 11.3. Output quality boxplot diagram (fit-for-purpose segments, Groups 1 and 2)

The tendencies tracked in fit-for-purpose results demonstrate unanimity with the results provided by analysis of each group separately. As such, the key trends are the increase of the median value, on the one hand, and the increase of minimum and maximum values, on the other. Yet, the diagram also suggests that in TS 2 the 3rd quartile group shows less diversity of data as compared to the relevant boxplots of each group.

In total, both groups have reported a positive increase of the number of fit-for-purpose segments in TS 2. While the minimum values for either session in both groups showed an increase, the maximum values demonstrated no changes in Group 1 and an increase in Group 2, which resulted in the average increase by 3 segments when comparing both groups. On a closer look, the minimum and maximum values differed more dramatically in Group 2 (TS 1: 4 and 14; TS 2: 6 and 18) than in Group 1 (TS 1: 8 and 15; TS 2: 10 and 15). The arithmetic mean demonstrated a tendency to increase both in G 1 (12%) and G 2 (28%). The median value for TS 1, as opposed to TS 2, was slightly higher in Group 1; yet, the combined data reported the average increase of TS 2 results by 1,5 segments. The calculation of the average SD value yielded very close results (2,9 in TS 1 vs. 2,83 in TS 2).

Statistical correlations observed in Groups 1 and 2 demonstrate consistency since in both cases the number of fit-for-purpose segments increased in TS 2. Even so, in order to be able to prove that such a tendency could be observed in a sample with a higher number of the participants, we analyze the combined results of both groups. Figures 11.1.1 and

11.2.1 visualized distribution of values in each of the groups, while Table 35.3.2 shows the results of normality test conducted on the combined set of values (the screenshot of R Commander results is shown in Appendix VII, Image VII.5):

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,1064	probabilistic
TS 2	p = 0,0032	non-probabilistic

Table 35.3.2. Test of normality (fit-for-purpose segments, Groups 1 and 2)

As demonstrated in Table 35.3.2, while the distribution of TS 1 data is probabilistic, the contrary is true for TS 2. In this case, the non-parametric test (namely, Wilcoxon signed-rank test) is applied to examine possible statistical correlations. The results of the test are provided in Table 35.3.3 (the screenshot of R Commander calculations are presented in Appendix VII, Image VII.6):

	Wilcoxon test (statistical significance level p<0,05)	**Result**
Hypothesis 0: TS 1 ? TS 2	p = 0,0008	H0 is rejected
Hypothesis 1: TS 1 < TS 2		H1 is accepted

Table 35.3.3. Contrast of hypothesis (fit-for-purpose segments, Groups 1 and 2)

The statistical significance level for this type of test was defined as p<0,05, and the test result produced the outcome of p=0,0007905 (rounded off p=0,0008). As demonstrated by the test results, the hypothesis that the number of fit-for-purpose segments will increase after the training is confirmed.

The analysis of Group 1, Group 2 and the combined data sets all corroborate the hypothesis about the positive influence of the training on the students' PE performance in the part of fit-for-purpose segments.

6.1.4. Descriptive and inferential analysis of PE output: over-edited segments

Finally, the values corresponding to the numbers of over-edited segments in both TSs are examined. The hypothesis for this subsection was defined as follows: *the number of over-edited segments in TS 1 is higher than in TS 2*, which entails application of unilateral contrast of hypotheses and selecting the option "Difference > 0" in the relevant statistical test.

Group 1. In Table 36.1.1 Group 1 core values and standard deviation of over-edited segments number are collected. As can be seen, the minimum value equaled 0, while the maximum value demonstrated negative decrease comparing TS 1 and TS 2. Although the difference of arithmetic mean results negative, SD values were somewhat positive, and their absolute value was close to 0, which similar tendency demonstrated by the median:

	TS 1_ov	**TS 2_ov**	**Diff.**	**%**
Min.	0	0	0	0
Max.	6	5	-1	-17%
Arithmetic Mean	2,45	2	-0,45	-18%
Median	2	2	0	0
Standard deviation	1,60	1,64	0,04	2%

Table 36.1.1 Output quality (over-edited segments, Group 1)

In each of the TSs the values representing the number of over-edited segments rendered very similar results regarding the inter-quartile range and the median value (Figure 12.1.1). The only moderately significant difference was detected in the part of the maximum value, which made 6 in TS 1 and 5 in TS 2 respectively, while the minimum value in both TSs was equal to 0.

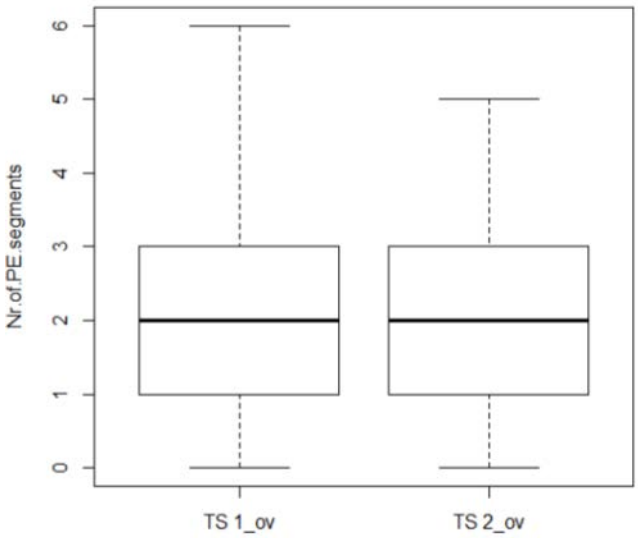


Figure 12.1.1.Output quality boxplot diagram (over-edited segments, Group 1)

In other words, the median representing the number of over-edited segments was reported as equal, and 75% of the results remained the same, while the 4th quartile group of values got smaller.

Inferences for over-edited segments were calculated starting with the analysis of Group 1 results in TS 1 and TS 2. Initial evaluation of the distribution of values was done using the bar diagram, which contained the Group 1 data provided in each of the TSs (Figure 12.1.2).

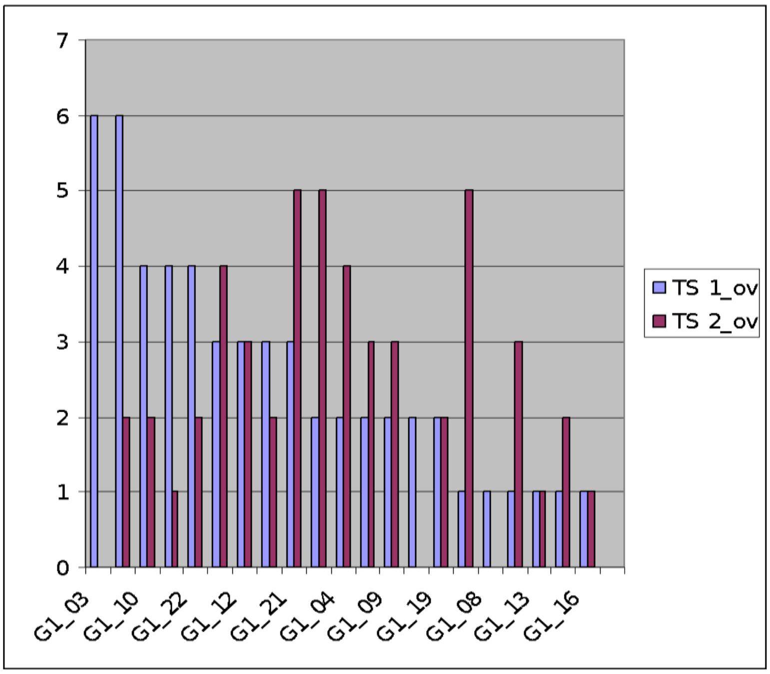


Figure 12.1.2. Distribution of Group 1 values in TS 1 and TS 2 (the horizontal axis represents the participants, the vertical axis contains the number of over-edited segments)

To further explore the tendencies indicated in Figure 12.1.2, the normality test was conducted. Its results are indicated in Table 36.1.2 (the screenshot of R Commander results is shown in Appendix VIII, Image VIII.1):

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,0334	non-probabilistic
TS 2	p = 0,1564	probabilistic

Table 36.1.2. Test of normality (over-edited segments, Group 1)

As demonstrated in the table above, TS 1 data set is distributed non-probabilistically, while the opposite is true for TS 2. To further process these results and corroborate our hypothesis that "the number of over-edited segments in TS 1 is bigger than the number of such segments in TS 2", the non-parametric Wilcoxon test was applied. Its results are presented in Table 36.1.3 (the screenshot of R Commander calculations is displayed in Appendix VIII, Image VIII.2):

	Wilcoxon test (statistical significance level p<0,05)	**Result**
Hypothesis 0: TS 1 ? TS 2	p = 0,4148	H0 is accepted
Hypothesis 1: TS 1 > TS 2		H1 is rejected

Table 36.1.3. Contrast of hypotheses (over-edited segments, Group 1)

The Wilcoxon test results reveal the *p*-value which is larger than the established significance level (p<0,05), which makes us reject the hypothesis about the decrease of over-editing after the training.

Group 2. Next, analysis of Group 2 over-edited number of segments is done (Table 36.2.1). As well as in G 1, the minimum value in both TSs equals 0. All other measurements demonstrated a decrease in TS 2, the trend that is confirmed by negative values of "difference" and "%" columns.

	TS 1_ov	**TS 2_ov**	**Diff.**	**%**
Min.	0	0	0	0
Max.	13	9	-4	-31%
Arithmetic Mean	4,83	2,5	-2,33	-48%
Median	4,5	2	-2,5	-55%
Standard deviation	3,63	2,25	-1,38	-38%

Table 36.2.1. Output quality (over-edited segments, Group 2)

A different tendency is observed in the boxplots representing the values that correspond to the number of over-edited segments, as in both TSs the maximum values decreased, and the minimum values were equal to 0. The upper and lower quartiles are located symmetrically in respect of the median value; the latter demonstrated significant decrease, and the TS 1 inter-quartile range is almost two times larger than the TS 2 one, suggesting less variation of data after the training:

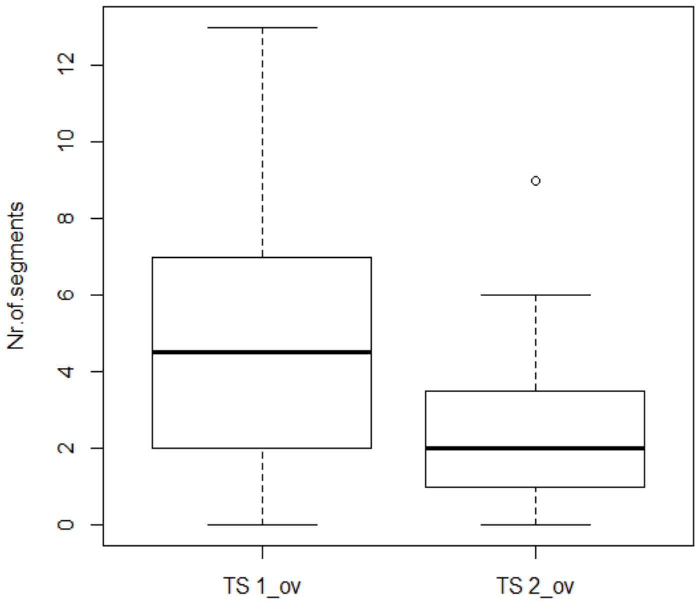


Figure 12.2.1. Output quality boxplot diagram (over-edited segments, Group 2)

Unlike in the previous case, Group 2 demonstrated a substantial decrease of all core values and more homogeneity in what concerns over-editings after the training. Next, the inferences of the number of over-edited segments before and after the training are calculated for Group 2. Once again the bar diagram was used to get an overview of values distribution in each of the TSs (Figure 12.2.2):

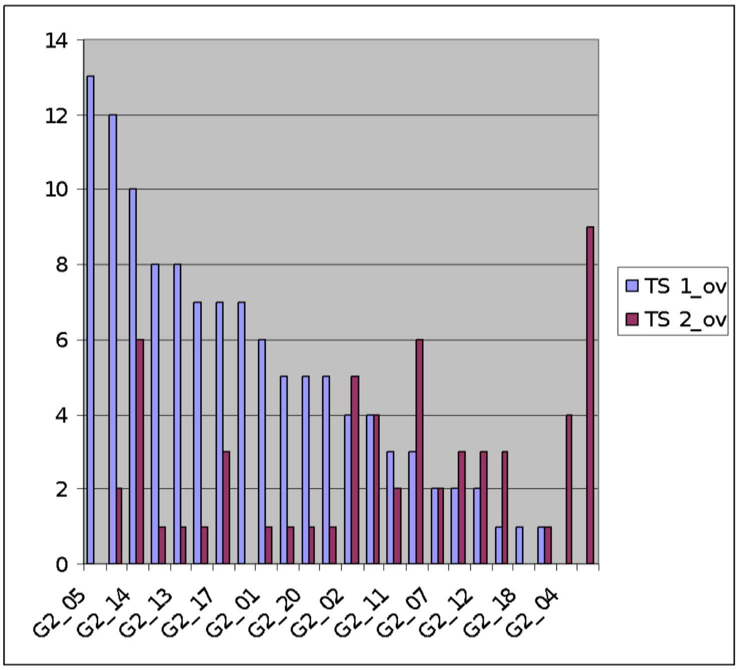


Figure 12.2.2. Distribution of Group 2 values in TS 1 and TS 2 (the horizontal axis represents the participants, the vertical axis contains the number of over-edited segments)

To further explore the tendencies, the normality test was conducted. Its results are indicated in Table 36.2.2 (the screenshot of R Commander results is shown in Appendix VIII, Image VIII.3):

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,4579	probabilistic
TS 2	p = 0,0204	non-probabilistic

Table 36.2.2. Test of normality (over-edited segments, Group 2)

As we can see, the data from TS 1 demonstrated a probabilistic distribution, while the opposite tendency was true for TS 2. To further process these results and corroborate our hypothesis, the non-parametric Wilcoxon test with the “Difference > 0” option was used. The results are shown in Table 36.2.3; (the screenshot of R Commander calculations are presented in Appendix VIII, Image VIII.4):

	Wilcoxon test (statistical significance level p<0,05)	**Result**
Hypothesis 0: TS 1 ? TS 2		H0 is rejected
Hypothesis 1: TS 1 > TS 2	p = 0,0133	H1 is accepted

Table 36.2.3. Contrast of hypotheses (over-edited segments, Group 2)

The *p*-value, obtained using the Wilcoxon test is smaller than the established significance level (p<0,05), which gives us grounds to accept the hypothesis about the positive effect of the training that results in the decrease of over-edited segments in TS 2.

On the whole, when analyzing G 1 and G 2 results, a number of similarities and differences could be detected. The minimum values in both subgroups equaled 0, while the maximum values were lower in Group 1 (TS 1: 6 vs. TS 2: 5) as compared to Group 2 (TS 1: 13 vs. TS 2: 9). All other core values demonstrated moderately negative tendencies towards TS 2.

Groups 1 and 2. The trends observed in the combined data set reveal that the minimum values in both TSs are equal to 0, while all other average values and SD were prone to decrease (Table 36.3.1):

	TS 1_ov	**TS 2_ov**	**Diff.**	**%**
Min.	0	0	0	0
Max.	13	9	-4	-30%

Arithmetic Mean	3,69	2,39	-1,3	-35%
Median	3	2	-1	-33%
Standard deviation	3,06	1,96	-1,1	-35%

Table 36.3.1. Output quality (over-edited segments, Groups 1 and 2)

As can be seen from the Table, the combined TS 1 results reported 13 segments while TS 2 reported 9. These calculations are consistent with the negative dynamics of values observed for each group separately, although when zooming in the difference between TS 1 and TS 2, the obtained results were - 1 segment (Group 1) and - 4 (Group 2). The arithmetic mean of the combined data made 3,69 for TS 1 and 2,39 for TS 2, which resulted in the total difference of 1,3 segments. The difference of the median value in Group 1 showed very insignificant positive dynamics, while in Group 2 the dynamic between both sessions was moderately negative (-2,5). The standard deviation of the results of both TSs was rather insignificant for Group 1 (TS 1:1,60 vs TS 2: 1,64) and moderately significant for Group 2 (TS 1: 3,63 and TS 2: 2,25). The data distribution contributed to the average SD of 3,06 (TS 1) and 1,96 (TS 2).

Another particular feature of the combined data, as can be seen in the boxplot (Figure 12.3), is a decrease of the median value. Although in each of the TSs there were outliers, we see it possible to make a conclusion that TS 2 is characterized by a reduced number of over-editings and their higher homogeneity:

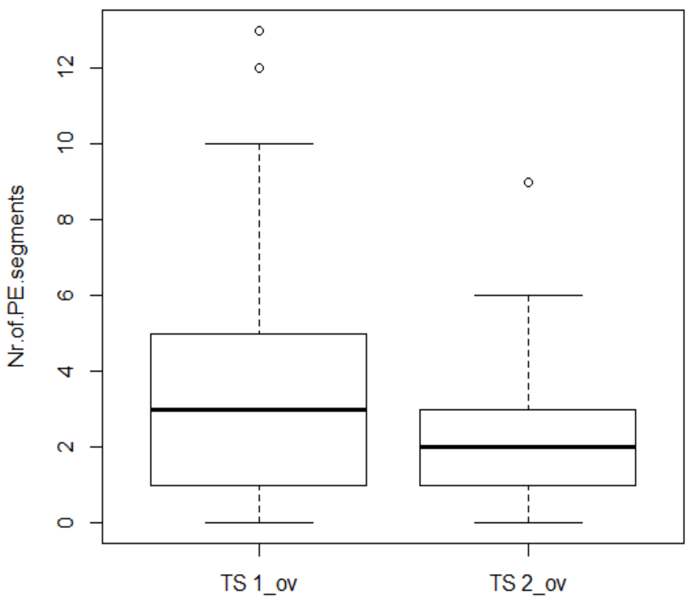


Figure 12.3. Output quality boxplot diagram (nr. of over-edited segments, Groups 1 and 2)

Statistical correlations reported by Groups 1 and 2 demonstrate little consistency, since Group 1 results show some propensity to reject the hypothesis, while Group 2 results tend to accept it. To generalize the data, the combined results of both groups are analyzed. Distribution of values in each of the groups was presented in Figures 12.1.2 and 12.2.2, while Table 36.3.2 shows the results of normality test conducted on the combined set of values (the screenshot of R Commander results is shown in Appendix VIII, Image VIII.5):

	Test of normality (statistical significance level p>0,05)	**Data distribution**
TS 1	p = 0,000273	non-probabilistic
TS 2	p = 0,000005	non-probabilistic

Table 36.3.2. Test of normality (over-edited segments, Groups 1 and 2)

As demonstrated in the Table, distribution of the combined values in both TSs is non-probabilistic. Consequently, the nonparametric Wilcoxon signed-rank test is applied to examine possible statistical correlations between the results corresponding to the number of over-edited segments in TS 1 and TS 2. Table 36.3.3 contains the results of the test, (the screenshot of R Commander calculations are displayed in Appendix VIII, Image VIII.6):

	Wilcoxon test (statistical significance level p<0,05)	**Result**
Hypothesis 0: TS 1 ? TS 2	p = 0,0176	H0 is rejected
Hypothesis 1: TS 1 > TS 2		H1 is accepted

Table 36.3.3. Contrast of hypothesis (over-edited segments, Groups 1 and 2)

The statistical significance level for this type of test was defined as $p<0,05$, and the test result produced the outcome of p=0, 01765 (rounded off p=0,0176). As demonstrated by the test results, the hypothesis that the number of over-edited segments decreased after the training is confirmed.

To sum up, both Group 2 and the combined dataset indicate to the statistically significant drop in the number of over-edited segments after the training; however, in the case of Group 1 the hypothesis is resected, as the share of over-edited segments was nearly the same in both testing sessions, which call for further examination of the issue with a larger number of the participants.

6.1.5. Associative correlation of PE throughput vs. PE output values

In this section, two instruments are used for data analysis: Pearson's product-moment correlations (for those cases when the variables were distributed probabilistically) and Spearman's rank-order correlations (a non-parametric version of Pearson's correlations). To decide which tool to choose, the information on the distribution of variables in each particular data set is required. To this end, we use the data of sections 6.1.1-6.1.4, where the distribution of variables representing the WPH rate and the number of under-edited/fit-for-purpose/over-edited segments in TS 1 and TS 2 was examined. Having analyzed the available data, a decision was made regarding the relevant operations for each pair of compared data.

TS 1 reported the non-probabilistic distribution of under-edited and over-edited segments, while the WPH rates and the number of fit-for-purpose segments were distributed probabilistically. Table 37.1 summarizes the results of correlation tests for the aforementioned combinations (screenshots of calculations made with R Commander are presented in Appendix IX, Images IX.1-IX.3):

TS 1	**Type of correlation**	**Strength / direction of correlation**
WPH rate vs. nr. of under-edited segments	(Spearman) TS1_un 1.0000 0.2264 WPH1 0.2264 1.0000	Weak/positive
WPH rate vs. nr. of fit-for-purpose segments	(Pearson) TS1_ffp 1.0000 0.1045 WPH1 0.1045 1.0000	Weak/positive
WPH rate vs. nr. of over-edited segments	(Spearman) TS1_ov 1.0000 -0.1654 WPH1 -0.1654 1.0000	Weak/negative

Table 37.1. Associations of quantitative values (WPH vs. segments) in TS 1

As the table demonstrates, the weak positive correlation is observed in the first and second clusters (WPH rate vs. under-edited segments and WPH rate vs. fit-for-purpose segments). However, there is a weak negative correlation detected between the WPH rate and the number of over-edited segments. On the whole, the examined correlations are not strong enough to be considered statistically significant.

To corroborate the data gleaned from Table 37.1, a more detailed analysis of correlations between the available categories of segments was conducted. Since all combinations contained at least one data subset that was distributed non-probabilistically, only Spearman correlations test was applied. Its results are presented in Table 37.2 (screenshots of calculations made with R Commander are presented in Appendix IX, Images IX.4-IX.6):

TS 1	**Spearman correlation**	**Strength / direction of correlation**
Fit-for-purpose vs. under-edited segments	TS1_ffp 1.0000 -0.3473 TS1_un -0. 3473 1.0000	Weak/negative
Over-edited vs. under-edited segments	TS1_ov 1.0000 -0.3674 TS1_un -0. 3674 1.0000	Weak/ negative
Fit-for-purpose vs. nr. of over-edited segments	TS1_ffp 1.0000 -0.6774 TS1_ov -0.6774 1.0000	Strong/negative

Table 37.2. Associations of quantitative values (segments) in TS 1

As can be seen, the analysis of associations of all PE segments in TS 1 demonstrates negative correlations in all combinations of data. On a fine-grained scale, the clusters of "fit-for-purpose vs. under-edited segments" and "over-edited vs. under-edited segments" demonstrate weak negative correlations and the *p*-values of -0,3473 (<-0,5) and -0,3674 (<-0,5) respectively. On the other hand, the cluster "fit-for-purpose vs. over-edited segments" reports strong negative correlation, supported by the calculated *p*-value of -0,6774 (>-0,5). The last result implies that in TS 1 the "more accurate" post-editors did not show a tendency to over-edit.

In TS 2 the distribution of all analyzed data (WPH rate, under-edited, fit-for-purpose, over-edited segments) was non-probabilistic, for which reason non-parametric Spearman correlation was applied. Table 37.3 summarizes the results of correlation tests for the aforementioned combinations (screenshots of the calculations made with R Commander are presented in Appendix X, Images X.1-X.3):

TS 2	**Spearman correlations**	**Strength / direction of correlation**
WPH rate vs. nr. of under-edited segments	TS2_un 1.0000 -0.0502 WPH2 -0.0502 1.0000	Weak/negative
WPH rate vs. nr. of fit-for-purpose segments	TS2_ffp 1.0000 -0.1853 WPH2 -0.1853 1.0000	Weak/negative
WPH rate vs. nr. of over-edited segments	TS2_ov 1.0000 0.3214 WPH2 0.3214 1.0000	Weak/positive

Table 37.3. Associations of quantitative values (WHP vs. segments) in TS 2

The results of the analysis confirm and complement previously detected trends. First, the correlation of WPH rate and the number of under-edited segments is described as "weak negative" since the number of under-edited segments demonstrated a propensity to increase in the output of students with lower throughput rates. However, the correlation is considered weak since the *p*-value (-0.0502) is smaller than -0,5 and does not correspond to the criteria of the statistically significant result. Next, opposing WPH rate and the number of fit-for-purpose demonstrates a negative correlation, indicating that the rate of such segments was slightly increased among students with lower throughput. The correlation is classified as weak, as the *p*-value (-0.1853) is smaller than -0,5 and does not correspond to the criteria of the statistically significant result. Finally, contrasting WPH rate and over-edited segments results in weak positive correlation, which gives us grounds to suggest that in the output of "faster" students the share of over-edited segments is likely to increase too.

To corroborate the data gleaned from Table 37.3, once again a more detailed analysis of correlations in between the available categories of segments was conducted. As well as in the previous case, all data subsets were reported to be distributed non-probabilistically, for which reason Spearman correlations test was conducted. The test results are presented in Table 37.4 (screenshots of calculations made with R Commander are presented in Appendix X, Images X.4-X.6):

TS 2	**Spearman correlations**	**Strength / direction of correlation**
Fit-for-purpose vs. under-edited segments	TS2_ffp 1.0000 -0.6521 TS2_un -0. 6521 1.0000	Strong/negative
Over-edited vs. under-edited segments	TS2_ov 1.0000 -0.2354 TS2_un -0.2354 1.0000	Weak/negative
Fit-for-purpose vs. nr. of over-edited segments	TS2_ffp 1.0000 -0.4105 TS2_ov -0.4105 1.0000	Moderate/negative

Table 37.4. Associations of quantitative values (segments) in TS 2

The analysis of associations of the total of categorized PE segments in TS 2 demonstrates negative correlations in all combinations of data. However, the strength of these correlations is different for each particular combination. The cluster of "fit-for-purpose vs. under-edited segments" shows strong negative correlation, validated by its *p*-value of -0.6521. The cluster "over-edited vs. under-edited segments" reports weak negative correlation, in this case, the *p*-value equals -0.2354 and does not meet the criteria for statistical significance. The cluster "fit-for-purpose vs. over-edited segments" reports moderately negative correlation with the *p*-value of -0.4105.

Thus, the conclusion may be drawn that in TS 2 more "accurate" post-editors showed a strong tendency towards producing fewer under-edited segments, and a moderate tendency towards producing fewer over-edited segments while post-editing.

6.2. Questionnaire responses

At the end of each testing session, a questionnaire was administered to the students so that they could share their opinions on a number of questions, including MTPE-related issues and auto-evaluate their participation. In particular, the questionnaire aimed at collecting information on students' attitude towards the expansion of MT into translation/localization industry, PE assignment quality threshold, predisposition to perform PE on a regular basis, self-satisfaction with PE performance, self-evaluation of acquired PE competency. To measure the participants' responses to these questions a 4-value scale was used, with 1 corresponding to the minimum value and 4 to the maximum one. The last question of TS 2 inquired about the overall effect of the training had no predefined answer scale so that the participants could freely express their opinions on the training outcomes. Hereafter we analyze the answers to each group of questions. Diagrams are used to visually represent the observed tendencies.

Subsections 6.2.1 and 6.2.2 start with a general overview of the participants' answers to a particular question. Then, each participant is assigned to one of the categories in conformity with the tendencies traced in his/her attitudes and convictions as expressed in TS 1 and TS 2. The categories are the following: "negative" (if the scores assigned by a particular participant in both TSs were "1" or "2" or changed between these two values), "improved" (if the assigned score changed from "1" or "2" to "3" or "4"), "worsened" (if the assigned score changed from"3" or "4" to "1" or "2") and "remained positive (if the scores assigned in both TSs were "3" or "4" or changed between these two values). In Subsection 6.2.3 interpretative analysis of the students' opinions about the influence of the suggested training on their PE competency is conducted.

As already mentioned in Section 6.1, associative statistics is aimed at measuring the relation of variables within a sample using, so chi-square test is applied in Subsection 6.2.4

to structure the collected qualitative values. Similarly to Pearson/Spearman correlations, a chi-square test compares the proportion of cases for each combination of categories containing the examined variables and helps to decide whether two sets of data are independent (Hypothesis 0) or dependent (Hypothesis 1).

6.2.1. Descriptive analysis of MTPE-related attitudes

In the first question of the questionnaire, the participants expressed their attitude towards the usage of MT in the translation industry by picking one of 4 possible answers (“1” – *very negative*, “2” – *negative*, “3” – *positive*, “4” – *very positive*). The students’ opinions are summarized in Table 38, (the detailed numeric breakdown on their attitudes towards MT is presented in Appendix XI, Table XI.1):

	Group 1		**Group 2**	
Attitude	**TS 1**	**TS 2**	**TS 1**	**TS 2**
very negative	0	0	0	0
negative	3	6	2	1
positive	18	15	22	15
very positive	1	1	0	8
Total nr. of answers	22	22	24	24

Table 38. What is your attitude towards the use of Machine Translation in the translation industry?

As Table 38 shows, the “positive” opinion regarding the use of MT in the translation industry turned out to be rather common in both TSs and both groups. However, a slight decrease of this value towards TS 2 is observed (G 1: 18 vs. 15; G 2: 22 vs. 15). On the other hand, the number of “negative” opinions also increased from 3 to 6 answers in Group 1, while Group 2 demonstrated a slight tendency of decrease (from 2 to 1).

Figures 13.1 and 13.2 reflect the dynamics of individual responses in each of the groups.

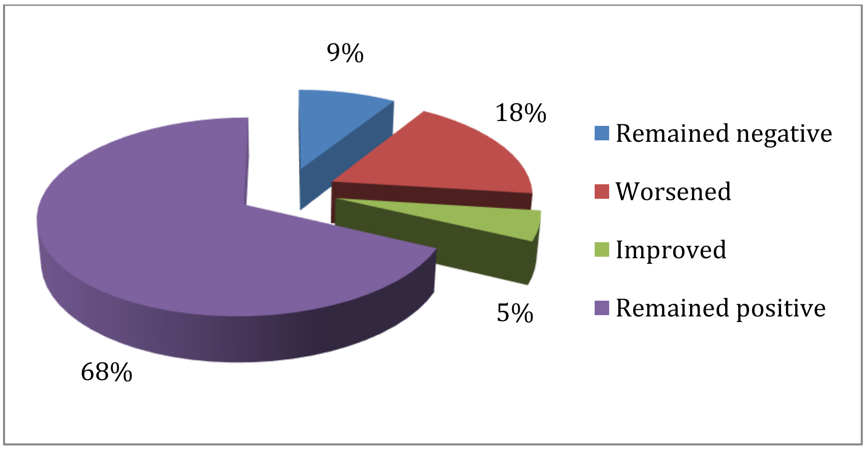


Figure 13.1. What is your attitude towards the use of Machine Translation in the translation industry? (dynamics of individual responses, Group 1)

In Figure 13.1 comparison of the participants' opinions expressed in TS 1 and TS 2 is conducted. As we can see, 68% of the participants (15 students) expressed a positive attitude towards the use of MT in the translation industry in both sessions. The attitude of 1 student (5%) has improved, the attitude of 18% (4 students) worsened, and 9% (2 students) kept being negative throughout both TSs.

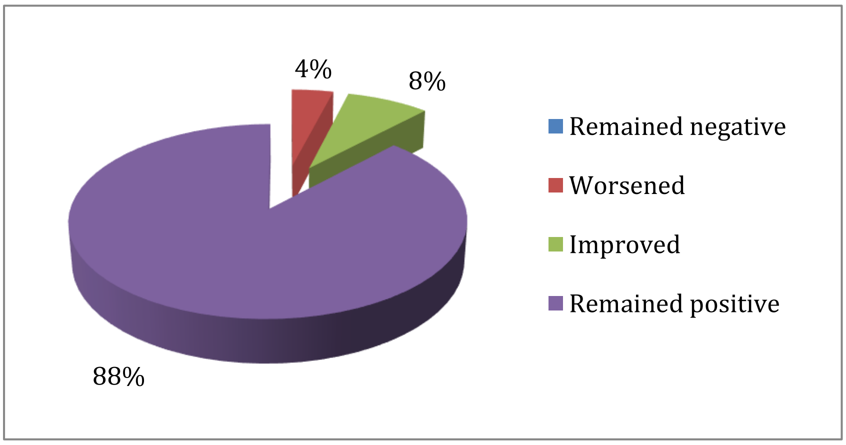


Figure 13.2. What is your attitude towards the use of Machine Translation in the translation industry? (dynamics of individual responses, Group 2)

As for Group 2 (Figure 13.2.), the major tendency may be described as stability of attitude, since 21 students (88%) reported (very) positive attitude in both TSs and 2 students (8%) demonstrated improvement of his/her attitude towards TS 2. A minority (1 student) demonstrated some worsening of their attitude, and there were no participants whose attitude would have remained negative.

Next was the question of whether the participants agreed with the statement that machine translated and post-edited output of less-than-maximum quality is good enough to be delivered to the client as a complete job. The answer scale contained 4 values: "1" – *I strongly disagree*, "2" – *I disagree*, "3" – *I agree*, "4" – *I fully agree*. Distribution of students' answers among the suggested categories of values is summarized in Table 39, while the detailed numeric breakdown on participants' attitudes towards MTPE is presented in Appendix XI, Table XI.2:

	Group 1		**Group 2**	
Opinion on quality standards	**TS 1**	**TS 2**	**TS 1**	**TS 2**
I strongly disagree	6	5	1	1
I disagree	11	6	11	10
I agree	4	10	11	13
I fully agree	1	1	1	0
Total nr. of answers	22	22	24	24

Table 39. Do you agree that MTPE output of "less-than-maximum quality" is good enough to be delivered to the client as a complete job?

Table 39 shows that in TS 1 the prevailing tendency for Group 1 members was a propensity to "disagree", marked by a half of the participants (11 students); a smaller number of the participants selected other options. However, after TS 2 the more commonly selected value for this group was "I agree" (10 students). As for Group 2, before undertaking the training nearly half of the participants "disagreed" (11 students), while the other relative half (11 students) "agreed". After the training, the major trend was to "agree" with the statement, as mentioned by 13 students, while a smaller number of the participants selected other options.

Figures 14.1 and 14.2 reflect the dynamics of individual responses of each group.

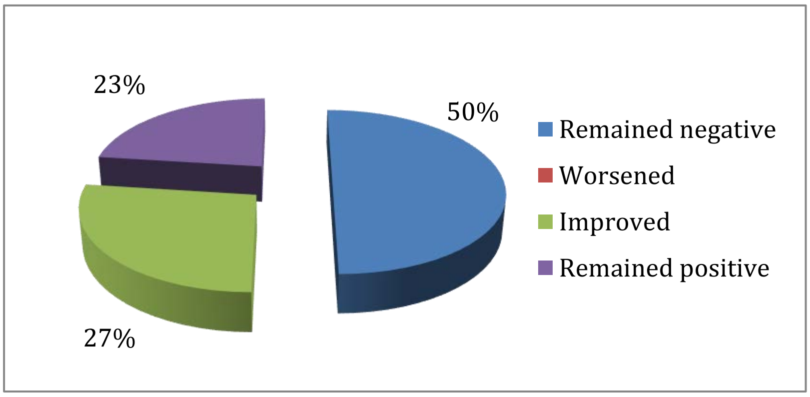


Figure 14.1. Do you agree that MTPE output of "less-than-maximum quality" is good enough to be delivered to the client as a complete job? (dynamics of individual responses, Group 1)

Figure 14.1 reveals the tendencies of Group 1, in which 16 participants did not demonstrate significant changes of their attitude: 11 of them (strongly) disagreed and 5 - (fully) agreed with the question in both TSs (50% and 23% correspondingly). On the other hand, 6 participants (27%) who disagreed with the statement in TS 1 demonstrated improvement of their attitude towards PE quality standards in TS 2.

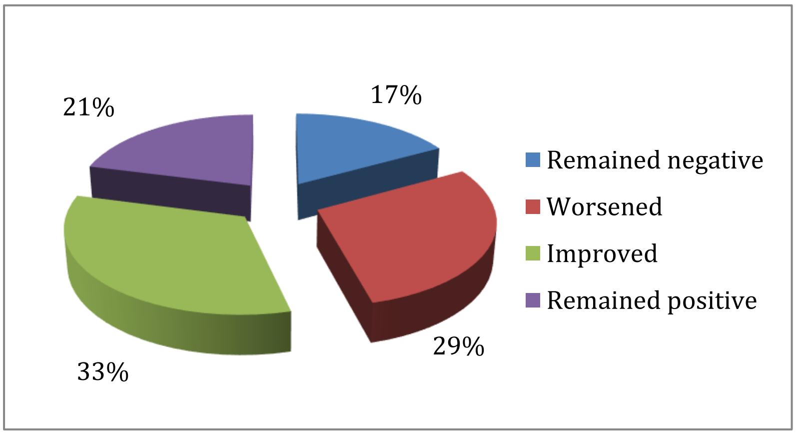


Figure 14.2. Do you agree that MTPE output of "less-than-maximum quality" is good enough to be delivered to the client as a complete job? (dynamics of individual responses, Group 2)

As for Group 2 (Figure 14.2), the training did not affect the attitude of 9 students, 4 of whom demonstrated disagreement in both TSs (17%), and 5 - agreement (21%). As for the others, 8 have students improved their attitude and agreed with the statement in TS 2 (33%), while 7 students who agreed with the statement in TS 1 opted to disagree with it in TS 2 (29%).

In the next question, the participants shared their opinions on whether they would be interested in performing PE jobs on a regular basis. The response scale contained 4 values: "1" – *no I won't*, "2" – *maybe, but I won't be looking forward to it*, "3" – *yes I will*, "4" – *yes, and I will be looking forward to it.* Students' attitudes towards taking post-editing as a professional career are summarized in Table 40 (the detailed numeric breakdown on participants' attitudes toward MTPE is presented in Appendix XI, Table XI.3):

	Group 1		**Group 2**	
Interest in PE as a profession	**TS 1**	**TS 2**	**TS 1**	**TS 2**
no	2	2	1	1
maybe, but rather not	14	14	14	10
yes	5	5	8	11
yes, absolutely	1	1	1	2
Total nr. of answers	22	22	24	24

Table 40. Would you be interested in taking up PE as a profession?

Group 1 reported quite balanced willingness to engage into PE with 14 students demonstrating a weak interest in PE as a profession after TS 1, and the same number of students ticking this category after TS 2. The results of Group 2 are more varied with a tendency to improvement of PE job perception. While in TS 1 the relevant majority (14 students) expressed their weak interest in PE as a profession with the answer "*maybe, but rather not*", in TS 2 as many as 11 participants believed they would be quite interested in taking up PE professionally.

Figures 15.1 and 15.2 show the dynamics of individual responses of each group.

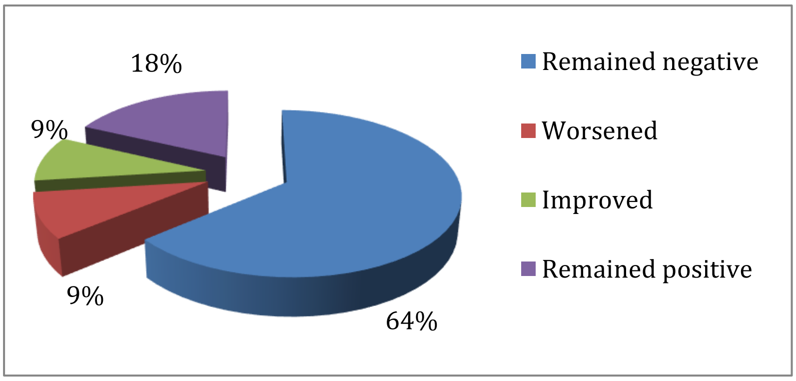


Figure 15.1. Would you be interested in taking up PE as a profession? (dynamics of individual responses, Group 1)

As demonstrated in Figure 15.1, the majority of the participants (64% which equals 14 students) expressed (relatively) negative attitude towards the perspective of taking up PE professionally in both TSs. What is more, the interest of 2 students (9%) became weaker, although 2 other students (9%) demonstrated more interest to PE job in TS 2. Only 4 students (18%) reported a positive attitude to this perspective in both sessions.

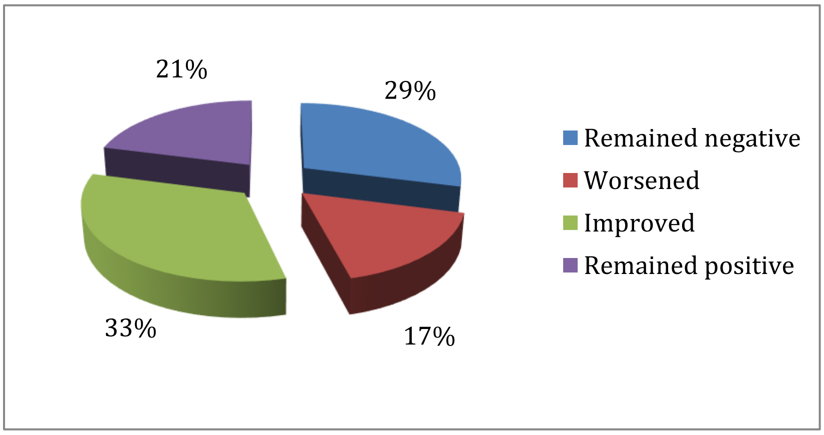


Figure 15.2. Would you be interested in taking up PE as a profession? (dynamics of individual responses, Group 2)

As we can observe in Figure 15.2, the relative majority (8 students, which equals 33%) improved their attitude toward PE as a job towards TS 2. Next goes the category of those who either did not want to do PE professionally or were not willing to engage in this activity at all (7 students – 29%). A group of 5 students (21%) reported a positive perception of PE profession in both sessions, and 4 participants (17%) decided that after the training their attitude regarding this issue got worse.

Descriptive analysis of the MTPE-related attitudes of the participants demonstrates a broad variety of obtained answers and few similarities between the groups. On the one hand, the attitude towards MT expansion was evaluated positively by relative majorities of both groups in each of the TSs. On the other hand, 50% of Group 1 demonstrated stability in their negative perception of "less-than-perfect" quality concept, although 27% said their opinions improved towards TS 2; and 64% were constantly negative about PE as a career. As for Group 2, no prevailing tendencies were detected when comparing different opinions on the second and third questions and their dynamics: 33% improved their attitude towards "less-than-perfect" quality concept, while nearly the same number of students (29%) demonstrated its worsening. However, in this case, the total of 58% expressed eagerness to take up PE professionally.

6.2.2. Descriptive analysis of MTPE performance convictions

To inquire about participants' satisfaction with their PE performance during each of the testing sessions, the following 4-value scale was proposed: "1" – *I am very dissatisfied*, "2" – *I am rather dissatisfied*, "3" – *I'm rather satisfied*, "4" – *I'm very satisfied*. Students' answers are collected in Table 41, while the detailed numeric breakdown on their attitudes towards MTPE is presented in Appendix XI, Table XI.4:

	Group 1		**Group 2**	
Satisfaction level	**TS 1**	**TS 2**	**TS 1**	**TS 2**
very dissatisfied	1	0	0	2
rather dissatisfied	9	10	11	12
rather satisfied	11	11	11	10
very satisfied	1	1	2	0
Total nr. of answers	22	22	24	24

Table 41. Are you satisfied with your performance in this TS?

As indicated, in Group 1 the most frequently ticked values for TS 1 and TS 2 were "*rather dissatisfied*" (9 vs. 10 participants) and "*rather satisfied*" (11 vs. 11 participants). As for Group 2, the frequency of most common values for TS 1 as opposed to TS 2 was nearly the same: 11 vs. 12 participants were "*rather dissatisfied*" with their performance, while 11 vs. 10 participants reported being "*rather satisfied*" in the corresponding testing sessions.

Figures 16.1 and 16.2 reflect the dynamics of individual responses for both groups in each of the TSs.

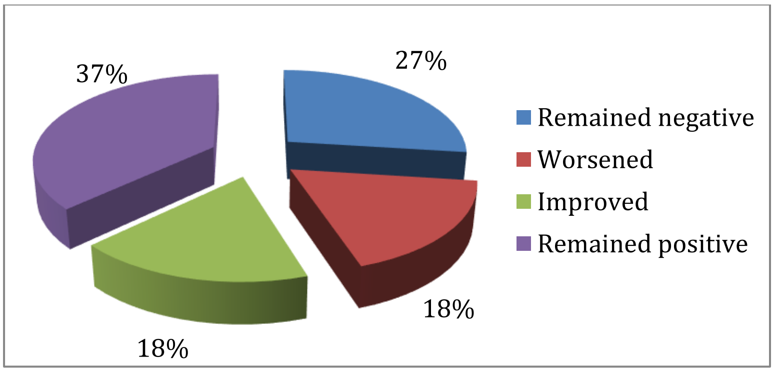


Figure 16.1. Are you satisfied with your performance in this TS?
(dynamics of individual responses, Group 1)

Group 1 results reported 4 cases of significant improvement in self-satisfaction (18%) and 4 cases in which self-satisfaction got worse (18%). In 14 cases the perception of one's PE performance did not significantly change between the TSs: 6 students were rather negative about it (27%), while 8 students kept being positive (37%).

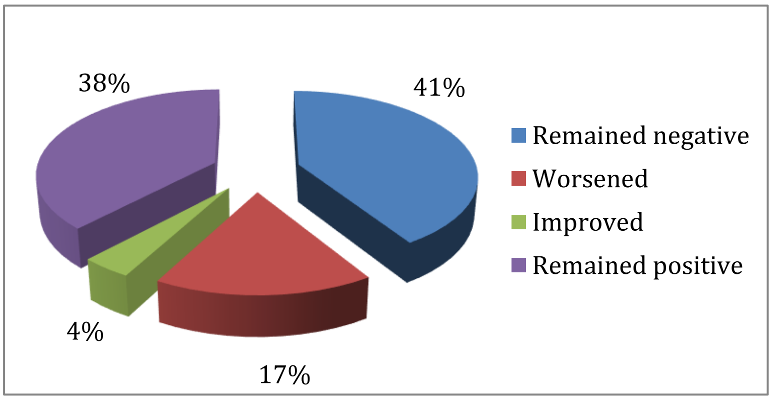


Figure 16.2. Are you satisfied with your performance in this TS?
(dynamics of individual responses, Group 2)

The majority of students from Group 2 (19 participants) did not demonstrate significant changes in satisfaction levels in TS 2: 10 of them (41%) were somewhat negative when evaluating their satisfaction with PE performance before and after the training, while the other 9 (38%) demonstrated the opposite tendency. However, 5 students displayed a propensity to change the attitude towards their PE performance significantly: 4 of them were much less satisfied with their performance in TS 2 (17%), while 1 believed it got notably better (4%).

One more question concerned students' satisfaction with their level of competency in PE if asked to perform similar assignments in the future. Students evaluated the perceived level of their PE competency on a 4-value scale ("1" – *deficient*, "2" – *average*, "3" – *sufficient*, "4" – *excellent*). The students' answers are summarized in Table 42, (the detailed numeric breakdown on responses is presented in Appendix XI, Table XI.5):

	Group 1		**Group 2**	
Satisfaction level	**TS 1**	**TS 2**	**TS 1**	**TS 2**
deficient	2	0	0	0
average	12	11	15	12
sufficient	8	11	9	12
excellent	0	0	0	0
Total nr. of answers	22	22	24	24

Table 42. If asked to perform similar tasks in future, how would you evaluate your level of PE competency?

As the results show, the prevailing trends for both Groups were to evaluate one's PE competency as "average" or "sufficient" before and after the suggested training.

Figures 17.1 and 17.2 reflect the dynamics of individual responses for TS 1 and TS 2 correspondingly.

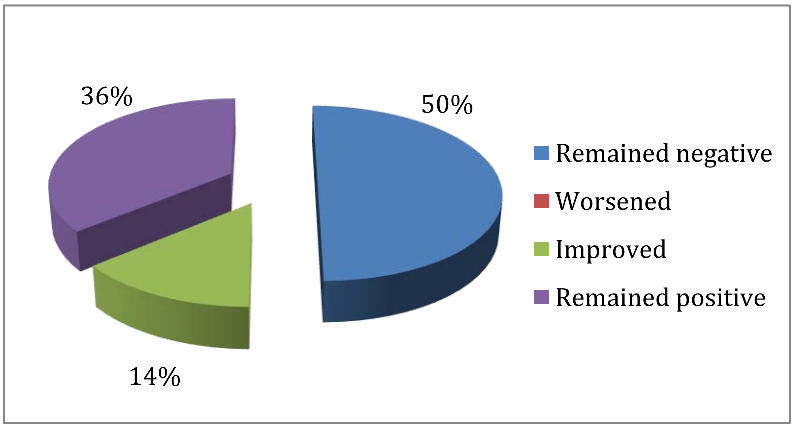


Figure 17.1. If asked to perform similar tasks in future, how would you evaluate your level of PE competency? (dynamics of individual responses, Group 1)

The total of 19 students from Group 1 did not change their perception of PE competency: 11 of them remained (somewhat) negative about it (50%), while 8 revealed the opposite tendency (36%). No one has reported PE competency deterioration while the remaining 3 students believed it got notably better in TS 2 (14%).

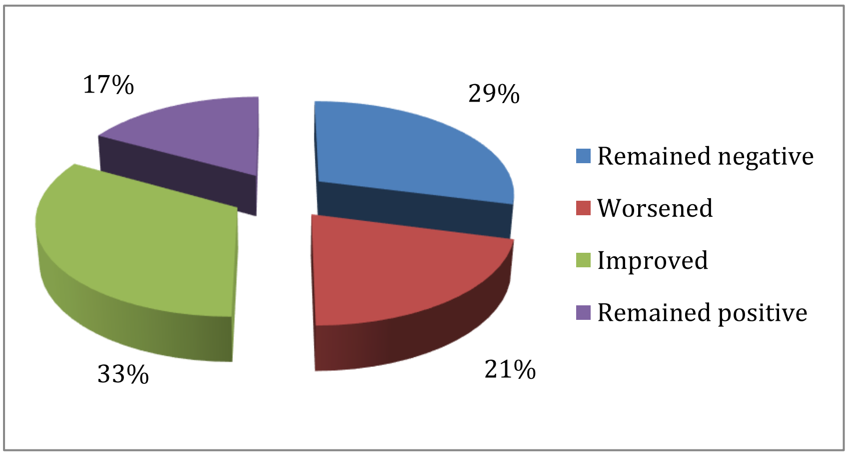


Figure 17.2. If asked to perform similar tasks in future, how would you evaluate your level of PE competency? (dynamics of individual responses, Group 2)

Similar tendencies were tracked in Group 2, where the total number of those whose opinions did not change much equals 11: 7 students remained negative about their PE competence (29%), and 4 students kept being positive in their beliefs (17%). What is more, 5 students reported deterioration of their PE competency (21%), while 8 participants believed in its improvement (33%).

Similarly to the description of MTPE-related attitudes, descriptive analysis of the participants' self-evaluation before and after the training demonstrates a broad variety of opinions and little resemblance between the groups. Yet, in terms of students' satisfaction with their performance in the TSs, relatively large constituencies in both groups showed a tendency towards the stability of their positive/negative opinion, while smaller constituencies demonstrated improvement/worsening of theirs. As for the self-evaluation of PE competency from the perspective of future PE assignments, Group 2 members differed more in their opinions, although on a larger scale in both groups 50% in total expressed positive/improved opinions regarding their PE skills, while the opinions of the other 50% remained negative/worsened.

6.2.3. Interpretative analysis of students' opinions

At the end of TS 2 the participants were asked to provide their ideas concerning the effect the training (if any). Out of the total of 46 participants, two abstained from comments, thus reducing the pool to 44 opinions. The thematic analysis was used to identify and interpret "key ideas or themes" (Matthews and Ross, 2010: 373). In this way, the highlighted themes were labeled as "PE skills" (27 responses), "MT performance" (20 responses) and "PE as a profession" (9 responses). Those comments and concerns which could not be assigned to any of the outlined sub-categories were analyzed separately. The total number of opinions exceeds 44, as some participants commented on more than one issue.

In Table 43.1 we summarized the comments concerning PE skills as perceived by participants. Here the student mentioned (no) enhancement of such skills as the major effect of participation in the training:

Participation in the training…	**Nr. of answers**
… did not influence my PE skills	3
… introduced me to a new set of skills	14
… enhanced my PE skills	10

Table 43.1. Perceived effect of the training on students' PE competency (PE skills perspective)

As we can see, the relative majority of respondents (14 students) mentioned getting to know PE as a professional field among the positive effects of their participation in the experimental study. These results correspond to the initial aim of the training since the latter was focused not only on the enhancement of PE performance as expressed in PE productivity and PE output quality but also familiarization of the participants with the new subject field and sharing the best PE practices as explained in Chapter 2. A smaller part of the sample (10 students) mentioned skills enhancement among the key benefits of participation in the training. While some students (G1_16, G1_18, G2_08, G2_09), did not give any details on what skills they considered enhanced, others (G1_04, G2_16) mentioned improvement of understanding of PE quality evaluation criteria and an increase in their PE throughput.

The analysis of the batch of comments focused on how participation in the training has influenced students' perception of MT performance revealed several sub-themes, as summarized in Table 43.2:

MT performance …	Nr. of answers
…improved my opinion about MT industry	7
...provides MT output of acceptable quality	6
…makes it possible to use MT as a professional tool	7

Table 43.2. Perceived effect of the training on students' PE competency (MT performance perspective)

Investigation of the reasons behind such opinions provides us with grounds for speculations that those students who noticed changes of their attitude towards MT performance (G1_01, G1_14, G1_18, G2_01, G2_06, G2_15, G2_18) did so because of the satisfactory quality of the observed MT output and its practicality for translation assignments. Six students (G1_15, G2_01, G2_03, G2_05, G2_12, G2_21) mentioned the improvement of MT quality and, as a consequence, future prospects for this resource. What concerns MT as a productivity tool, this point of view builds on several reasons: MT helps to cope with repetitive tasks faster (G2_20), it seems to have a positive influence on the profitability of translator's job (G2_02, G2_16, G2_19, G2_20), and to increase productivity when combined with PE (G1_15, G2_03, G2_07, G2_19, G2_20).

The third theme dealt with participants' attitude toward PE as a type of professional activity. The summarized opinions are presented in Table 43.3:

When thinking of PE as a job…	Nr. of answers
… the training helped me to make up my mind	5
… my attitude is negative	2
… my attitude is positive	2

Table 43.3. Perceived effect of the training on students' PE competency (PE as a career perspective)

As can be seen from this batch, five students (G1_07, G1_10, G1_17, G1_19, G2_24) said that participation in the experimental study helped them decide whether or not to take up PE professionally in future. However, they did not reveal more concrete ideas in this respect. Two students (G1_19, G2_07) expressed their negative attitude to PE as a professional activity by saying they "don't enjoy" or "are not interested". Other two students (G1_10, G2_02) believed PE looks interesting from the professional viewpoint.

Apart from positive opinions regarding participation in the training program, many students expressed a wish to proceed with training to be able to improve their PE performance. This concern goes in line with the concept of lifelong learning and opens an interesting avenue of exploration for further studies. Another important comment made by many students concerned MT and MTPE as an unfamiliar subject field. The students explained that they lack knowledge on the production of MT output and its further use, drafting and application of PE guidelines. Also, these comments may indicate possible areas of improvement translation training syllabi.

6.2.4. Associative correlation of questionnaire responses

Positive attitude towards MT and predisposition to get engaged in MTPE projects are considered to be among the key factors which positively influence PE performance. In this concern, we were interested in revealing correlations in the MTPE-related attitudes as well as self-evaluation of PE performance provided by participants of our experimental study.

To investigate associations between the available qualitative data, Chi-square test was applied to examine each of the following combinations of previously described categories: (1) attitude towards MTPE vs. attitude toward PE quality threshold; (2) attitude to PE quality threshold vs. attitude to PE as a job; (3) attitude towards MTPE vs. attitude to PE as a job; (4) self-satisfaction from PE performance vs. self-evaluation from proficiency in PE. If *p*-value > 0.05, the compared variables are considered independent and null hypothesis was confirmed.

The *p*-values for TS 1 are summarized in Table 44.1, while the relevant screenshots of R Commander are represented in Appendix XII, Images XII.1-XII.4 (Group 1), Images XII.5-XII.8 (Group 2) and Images XII.9-XII.12 (Groups 1 and 2 combined):

TS 1	**Group 1 (chi^2 *p*-value)**	**Group 2 (chi^2 *p*-value)**	**Groups 1 and 2 (chi^2 *p*-value)**
TS 1_Attitude towards MT vs. PE quality standards	0,4686	0,4613	0,2342
TS 1_PE quality standards vs. PE as a job	0,3092	0,2133	0,8121
TS 1_ PE as a job vs. attitude towards MT	0,0386	0,9088	0,7635
TS 1_Self-satisfaction vs. estimation of PE proficiency	0,0386	0,0026	0,000001

Table 44.1. Associative correlations of TS 1 qualitative values

On the whole, the obtained results do not show statistically significant correlations among attitudes towards MT, quality standards adopted in MTPE and eagerness to take up post-editing as a professional career (since the *p*-values reported by each group in particular and the combined data exceeded 0.05). However, the opposite is true for Group 1 results on the correlation of students' attitude to PE as a job vs. MT, yet the small size of the sample (22 responses) calls for further investigations. On the other hand, the association between self-satisfaction vs. auto-estimation of PE competency demonstrated significant results for each group separately and both groups together.

The *p*-values for TS 2 are summarized in Table 44.2. The relevant screenshots of R Commander are represented in Appendix XIII, Images XIII.1-XIII.4 (Group 1), Images XIII.5-XIII.8 (Group 2) and Images XIII.9-XIII.12 (Groups 1 and 2 combined):

TS 2	**Group 1 (chi^2 *p*-value)**	**Group 2 (chi^2 *p*-value)**	**Groups 1 and 2 (chi^2 *p*-value)**
TS 2_Attitude towards MT vs. PE quality standards	0,8637	0,3326	0,8574
TS 2_PE quality standards vs. PE as a job	0,8239	0,177	0,9077
TS 2_ PE as a job vs. attitude towards MT	0,0001	0,1159	0,0005
TS 2_Self-satisfaction vs. estimation of PE proficiency	0,0026	0,0009	0,000002

Table 44.2. Associative correlations of TS 2 qualitative values

The results reveal no associative correlation of the combinations "attitude towards MT vs. PE quality standards" and "PE quality standards vs. PE as a job" for either separated or combined data sets. On the contrary, statistically significant bonds were reported for the correlation of "PE as a job vs. attitude towards MT" (Group 1 and combined results) as well as students' auto-evaluation.

On the bases of the available evidence, it seems fair to suggest that MTPE-related attitudes of the participants in both TSs demonstrated no clear associative links except for the combination "PE as a job vs. attitude towards MT". Also, similar links were detected in the part of auto-evaluation, where students expressed their opinions on self-satisfaction with their PE performance and auto-estimation of PE proficiency. The tendencies are considered statistically significant as the calculated *p*-value is below the chi-square test threshold of 0,05, although a more in-depth study is required to confirm the discerned trends.

6.3. Correlation between PE performance and attitude towards MT

The previous sections were dedicated to descriptive, inferential and associative analysis of PE performance, as well as MTPE-related attitudes and convictions. However, qualitative and quantitative values were examined separately, and no inquiries concerning possible correlations between both types of data were investigated. To derive further insights from the available sets of data, Section 6.3 focuses on the interrelation of students' PE performance vs. their attitude towards MT.

There is a growing support to the claim that positive attitude towards MT improves PE performance. This viewpoint was also confirmed by the responses yielded by the survey participants (Chapter 1). To obtain further clues on the possible links between the available sets of qualitative and quantitative values, we were interested in looking at the following research question: *is there any correlation between positive/negative attitude towards MT and PE performance?*

Given the pre-test/post-test study design, we saw it possible to investigate this inquiry by splitting the subjects into sub-groups according to their attitude towards MT so as to compare PE performance of each group and keep track of (possible) changes. As suggested by the answers to the questionnaire, all participants belong to one of the following clusters: those with a positive attitude towards MT in both TSs, those with a negative attitude towards MT in both TSs, those whose attitude towards MT improved and those whose attitude worsened after undertaking the aforementioned training.

Before clustering, it was necessary to decide on the solid criteria for such fragmentation. As mentioned before, when filling in the questionnaire the students measured their attitude towards MT on the scale from 1 to 4, where 1 corresponded to "*very negative*", and 4 – "*very positive*". As such, the students who picked "3" and/or"4" in both TSs were assigned to Cluster A (36 students); those whose attitude towards MT worsened (i.e., changed from "3"/"4" to "2"/"1") in TS2 made Cluster B (5 students); cluster C was made of 3 students whose attitude towards MT improved after the training; and cluster D was made of those 2 students whose attitude towards MT remained negative throughout the study. The nature and volume of Cluster A make its results suitable for drafting baseline box plot diagrams, so as to contrast and compare the values of the other clusters in continuation.

As already mentioned, the majority of the participants had a positive attitude towards MT from the very beginning of the experimental research, which resulted in a rather limited number of those students who expressed negative attitude at any point of the study. Due to the circumstances, no division between Group 1 (EN-RU) and Group 2 (EN-ES) was made and all values were examined as one dataset. To be more succinct and keep to the point, the results are presented in Figures, whereas the detailed numeric data of all calculations are provided in Appendix XIV, Tables XIV.1-XIV.4.

6.3.1. Cluster A

Interrelation of qualitative and quantitative values started with arranging the data from cluster A into box plot diagrams. In Figure 18.1 distribution of values that correspond to the number of under-/over-edited segments is visualized:

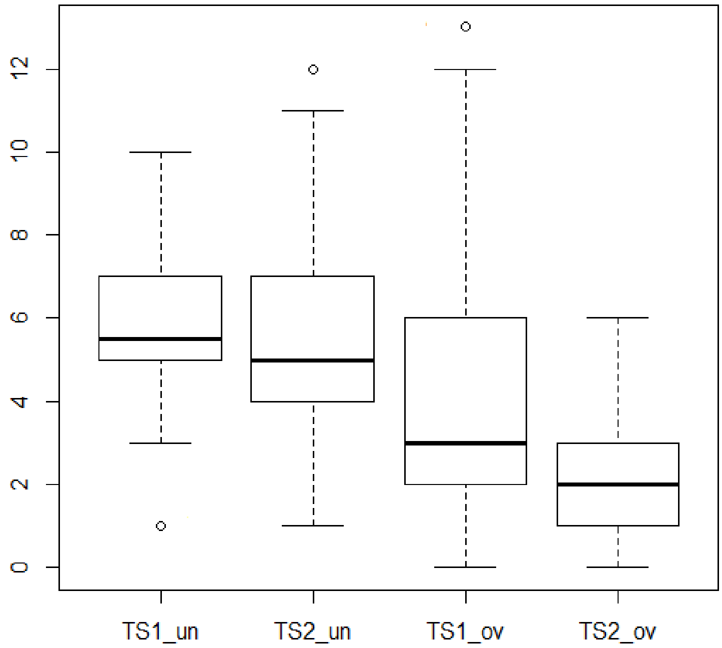


Figure 18.1. Cluster A: under-/over-edited segments in TS 1 and TS 2
(the vertical axis represents the number of segments)

In the part of under-edited segments, a slight decrease of the median and a more substantial decrease of the lower extreme are observed, although the upper extreme value increased, and an outlier was reported. In TS 2 the interquartile range got bigger which indicates at a broader variety of values. As for the boxplot representing the number of over-edited segments, in TS 1 it is skewed towards the lower extreme and demonstrates the asymmetrical distribution of values inside the interquartile range. In TS 2 the upper extreme value decreases significantly, and the same tendency is true to the median, while the lower extreme was constantly reported as 0.

In Figure 18.2 the distribution of values that represent the number of fit-for-purpose segments in both TSs is portrayed:

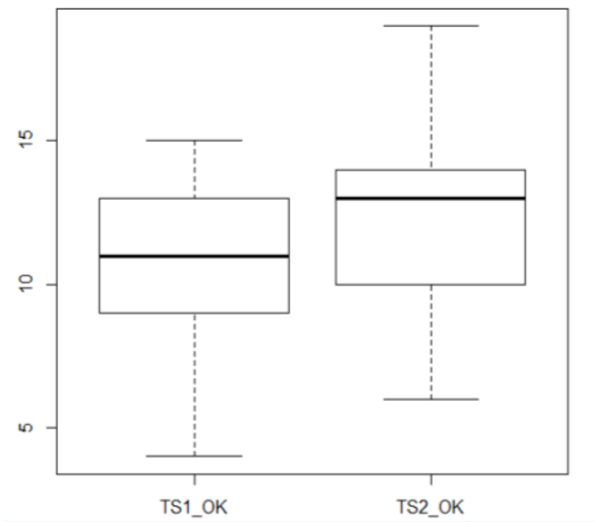


Figure 18.2. Cluster A: fit-for-purpose segments in TS 1 and TS 2
(the vertical axis represents the number of segments)

As can be seen, in line with the results previously discussed in Section 6.1, the median value increased, and so did both extremes.

Figure 18.3 visualizes throughput values distribution in TS 1 and TS 2:

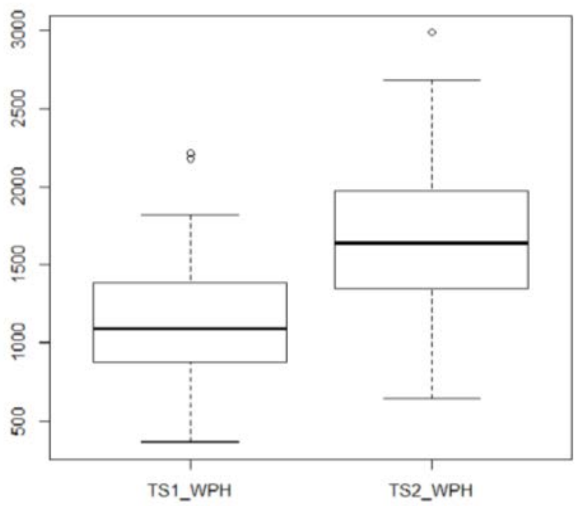


Figure 18.3. Cluster A: WPH rate in TS 1 and TS 2
(the vertical axis represents WPH values)

On logical grounds, Cluster A demonstrated the previously detected tendencies, namely the increase of all throughput parameters after the training.

6.3.2. Cluster A vs. Cluster B

Having arranged Cluster A values in box plot diagrams, we proceed to contrast them against the values of the other three clusters. The analysis of correlations between attitude towards MT and PE performance in the part of under-/over-edited segments starts with cluster B (Figure 19.1), where the output data of each student is marked by the same color:

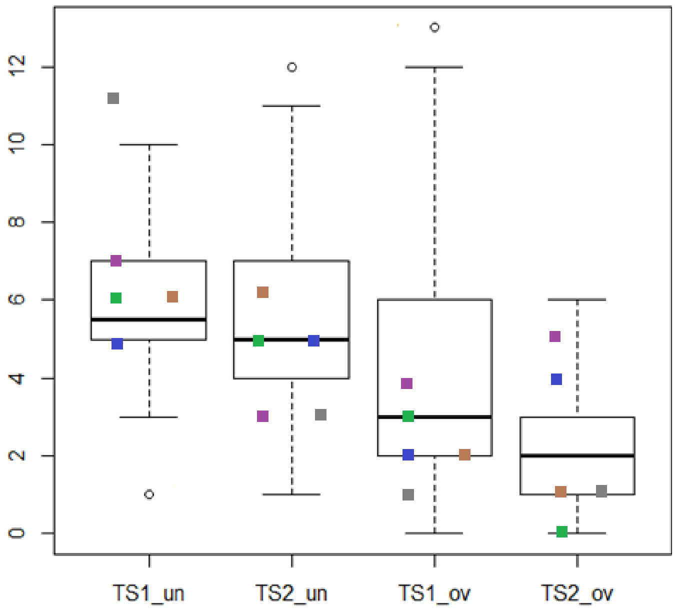


Figure 19.1. Distribution of Clusters A and B values: under-/over-edited segments (the vertical axis represents the number of segments)

In TS 1 the number of under-edited segments produced by 4 out of 5 students coincided with the interquartile range of the boxplot diagram, whilst one value was categorized as an outlier. In TS 2 the results of 3 out of 5 students coincided with the interquartile range of the boxplot diagram, while two values were below the first quartile.

In the part of over-edited segments, the distribution of values in TS 1 demonstrated slight asymmetry towards the lower extreme. In TS 2 the results of 2 students increased, while the rest demonstrated decrease or stability of PE performance.

Next, the focus of our attention moved to the correlation between students' attitude towards MT and PE performance in the part of fit-for-purpose segments (Figure 19.2):

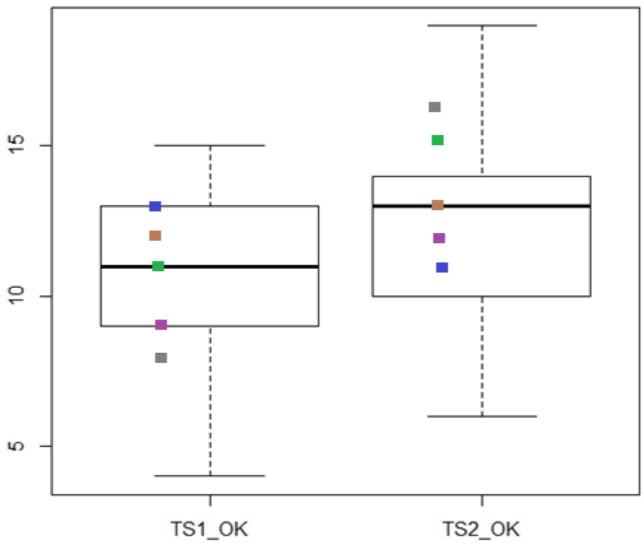


Figure 19.2. Distribution of Clusters A and B values: fit-for-purpose segments (the vertical axis represents the number of segments)

The distribution of values in both TSs may be described as balanced. In TS 1 the majority of values fell into the interquartile range. In TS 2 three of the values demonstrated the same tendency, while two more values were above the 3rd quartile. On a more fine-grained scale, one subject worsened their results, while the others demonstrated improvement.

Finally, the distribution of Cluster A vs. Cluster B throughout rates is visually represented in Figure 19.3:

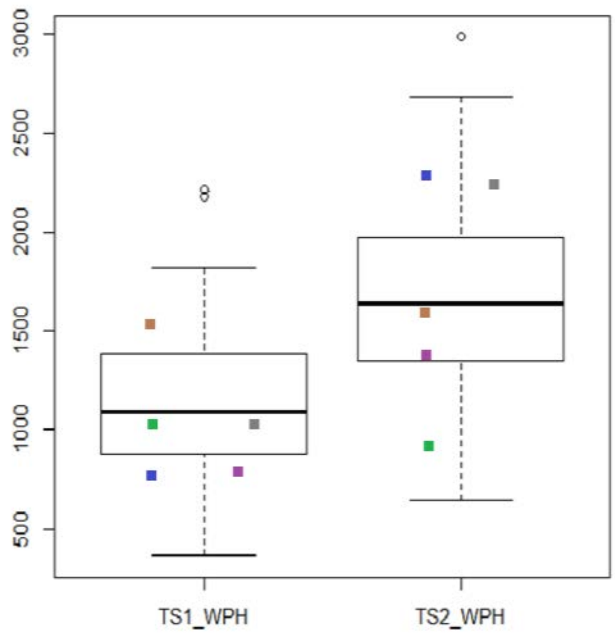


Figure 19.3. Distribution of Clusters A and B values: WPH rate (the vertical axis represents WPH values)

In TS 1 the majority of values were below the median or in its vicinity. TS 2 shows more balanced results, when nearly all students demonstrated an increase in WPH rate with the exception of one subject whose WPH rate decreased.

6.3.3. Cluster A vs. Cluster C

In this section PE performance of those with positive attitudes towards MT were compared with PE performance of those whose attitudes after the training changed from negative to positive. To begin, we examined the distribution of Cluster C values (under-/over-edited segments) across the baseline box plot diagram (Figure 20.1), and marked the output data of each student by the same color:

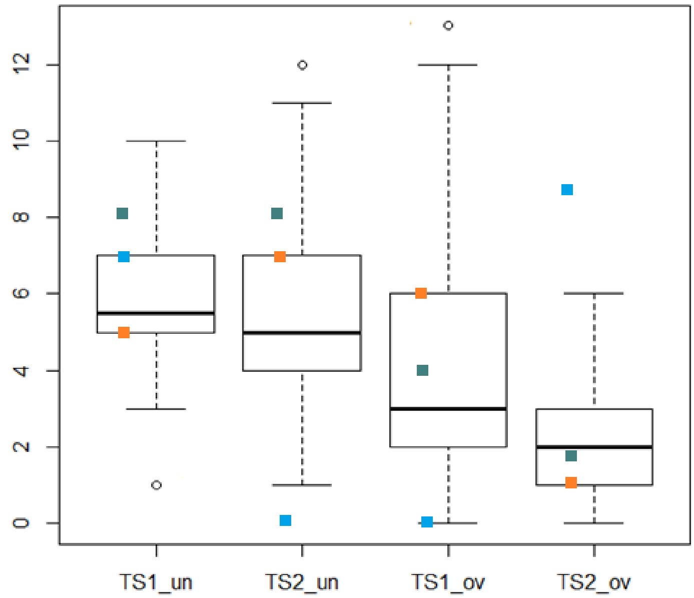


Figure 20.1. Distribution of Clusters A and C values: under-/over-edited segments (the vertical axis represents the number of segments)

In the part of under-editing segments, the Cluster C subjects revealed all types of tendencies: when comparing TS 1 and TS 2, the first subject demonstrated more cases of under-editings in TS 1 than in TS 2, the second subject, on the contrary, made more under-editings in TS 2 than in TS 1, and the results of the third student did not change. In the part of over-edited segments, two students improved their performance and over-edited a smaller number of segments after the training, while for the third student this value grew from 0 to 8.

To continue, the correlation between attitude towards MT and PE performance in the part of fit-for-purpose segments was scrutinized (Figure 20.2):

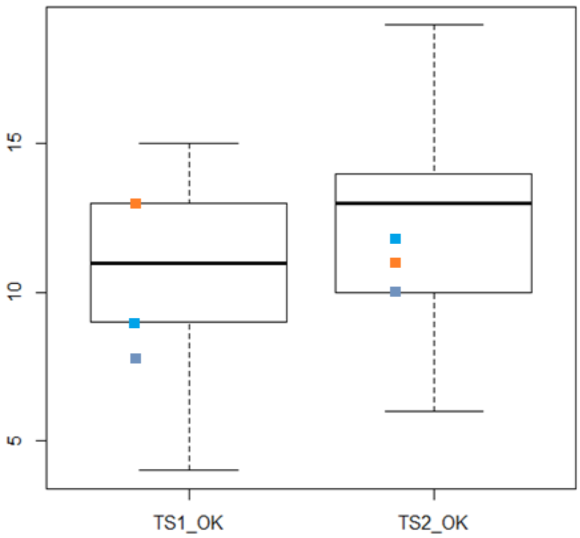


Figure 20.2. Distribution of Clusters A and C values: fit-for-purpose segments (the vertical axis represents the number of segments)

The distribution of values in TS 1 was rather dispersed across the boxplot, while in TS 2 all three values appeared to be located between the 1st quartile and the median. Two students demonstrated an increase in fit-for-purpose segments, while the results of the third student decreased.

Finally, in Figure 20.3 the distribution of Cluster A vs. Cluster C throughout rates is demonstrated:

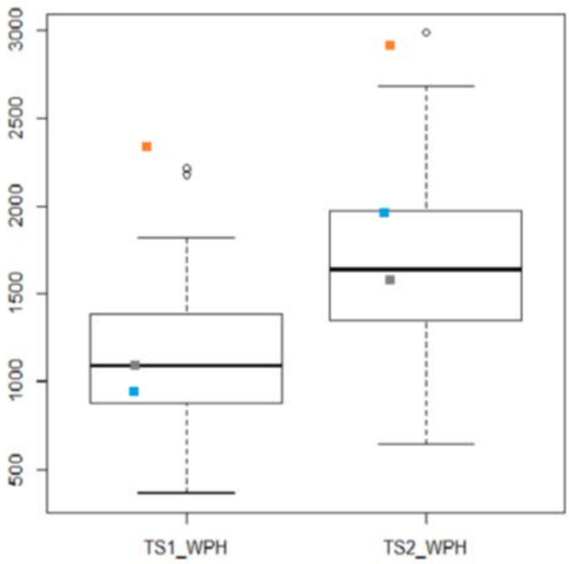


Figure 20.3. Distribution of Clusters A and C values: WPH rate (the vertical axis represents WPH values)

As can be seen from the Figure, all values of Cluster C demonstrated an increase towards TS 2. What it more, while two subjects produced the outcome that was within the interquartile range, the results of the third subject could be classified as an outlier in both TSs.

6.3.4. Cluster A vs. Cluster D

Cluster D was made of two subjects whose attitude towards MT remained negative in both testing sessions. One more time the correlation of both clusters started with analysis of the number of under-/over-edited segments produced in each TS (Figure 21.1), and the output data of each student was marked by the same color:

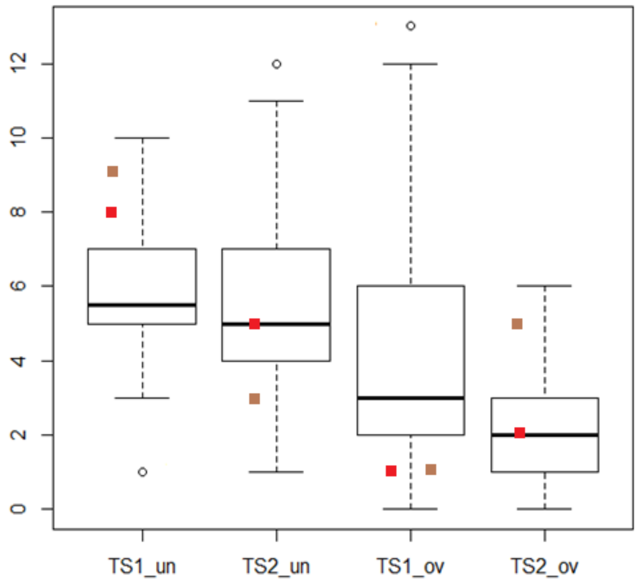


Figure 21.1. Distribution of Clusters A and D values: under-/over-edited segments (the vertical axis represents the number of segments)

As demonstrated by the Figure, in the part of under-editing segments Cluster D values were above the 3rd quartile in TS 1, but decreased significantly in TS 2. The opposite tendency could be traced in the part of over-edited segments, as in TS 1 both values were below the 1st quartile and increased in TS 2.

Next, we analyzed the correlation between attitude towards MT and PE performance in the part of fit-for-purpose segments (Figure 21.2):

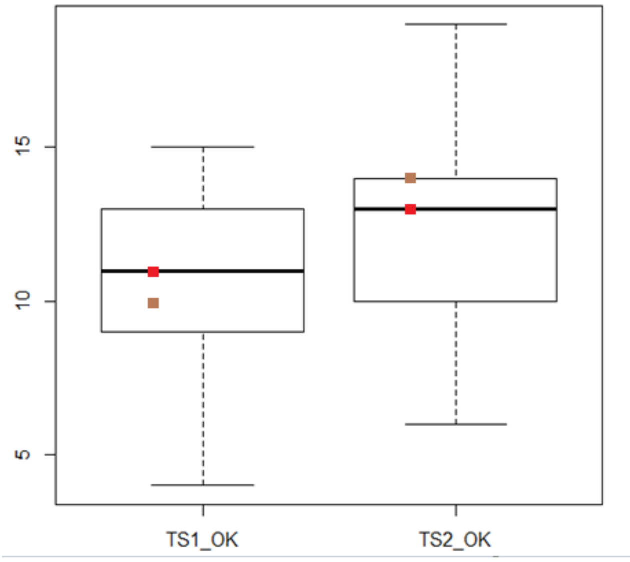


Figure 21.2. Distribution of Clusters A and D values: fit-for-purpose segments (the vertical axis represents the number of segments)

The distribution of values in TS 1 was within the interquartile range, although the second subject had it below the median. In TS 2 both subjects improved their PE performance and their results equaled the increased median value or the upper quartile value.

The last Figure to examine was the one with WPH rates of both clusters (Figure 21.3):

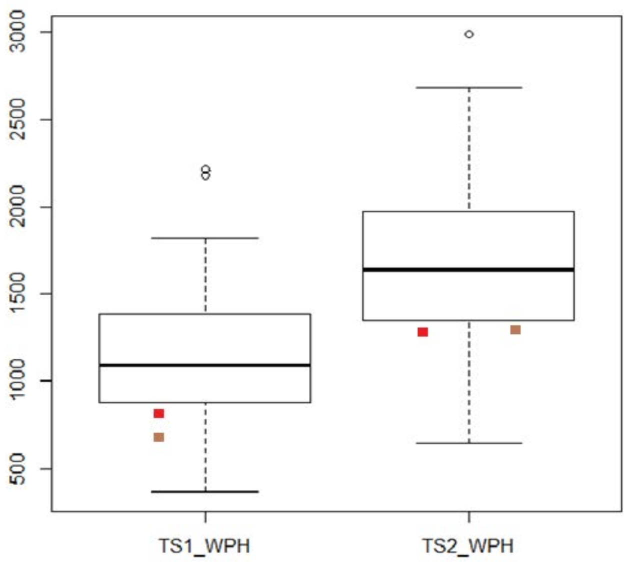


Figure 21.3. Distribution of Clusters A and D values: WPH rate (the vertical axis represents WPH values)

In line with the overall results of the experimental study, Cluster D values increased in TS 2. However, despite the increase of all values, it is important to pay attention that in both TSs the WPH rates were below the lower quartile.

Concluding remarks

To describe the trends that emerge from the analysis of PE performance, investigation of extreme and core values was complemented by the analysis of boxplot graphs (Section 6.1). The objective of such analysis was to draw inferences from the paired samples (i.e., results obtained before and after participation in the training) to confirm or discard the hypothesis that the obtained results were interdependent and did not happen by chance.

The proposed hypothesis (1) was as follows: *the WPH rate in TS 1 is lower than in TS 2*. The analyzed data proved that the inference of this kind was true for Group 1, Group 2 and the combined results. Regarding WPH rates, the minimum values of both TSs were nearly two times larger in Group 2, while the maximum values of both groups reported more similarity. Percentage-wise the maximum values in both groups increased less than minimum values, although both groups demonstrated the increase of WPH rate after the training.

Corroboration of the hypothesis (2): *the number of under-edited segments in TS 1 is higher than in TS 2* – demonstrated statistical significance for Group 1. This group also demonstrated reduction of core values variation after the training. However, for Group 2 the core values variations were close to 0. The observed range of values was broader in TS 2 for both groups of data. Analysis of the combined results reported a decrease in the arithmetic mean and the median indicating less under-editing in TS 2.

In the part of fit-for-purpose segments, the hypothesis (3): *the number of fit-for-purpose segments in TS 1 is lower than in TS 2* was examined. In this case, the *p*-value in each of the analyzed samples confirmed the statistical significance of the hypothesis. Both groups reported an increase of minimum values in TS 2; the same tendency was true for Group 2 maximum value, while Group 1 maximum value remained unchanged. The arithmetic mean and median of both groups increased positively, the SD was close to 0. The combined results reported an increase of all calculated measures except for the SD, which demonstrated a somewhat negative tendency and suggested a slight decrease of variety among values after the training.

To complete inferential analysis of PE segments correlations, we focused on the tendencies of over-edited segments distribution and the hypothesis (4): *the number of over-edited segments in TS 1 is higher than in TS 2*. In this case Group 2 demonstrated a reduction of core data variation after the training. However, for Group 1 the core values were mostly close to 0. The range of values was smaller in TS 2 for all groups of data. The analysis of the combined data sets shows a decrease in the arithmetic mean and the median, indicating to less over-editing in TS 2. The available values suggest no statistically significant correlation of Group 1 results. Conversely, both Group 2 and the combined data rendered statistically significant *p*-value, thus providing us with sufficient grounds to accept the suggested hypothesis.

On the whole, when comparing the total of TS 1 vs. TS 2 results, the collected values indicate an increase of word-per-hour rate and the number of fit-for-purpose segments as opposed to a decrease of the average number of segments categorized as over-edited and under-edited. Analysis of the obtained results prompts specific conclusions that can be drawn regarding statistical correlations between the analyzed paired samples. First, the WPH rate reported an increase in TS 2 for both groups separately and combined, in this way confirming our hypothesis on the positive influence of the training program. Second, it is possible to speculate that the number of under-editing is likely to decrease after the training, although the obtained *p*-value was slightly above the statistically significant level. Further studies with a higher number of the participants would be necessary to validate this hypothesis. Third, participation in the training reports positive influence on the number of fit-for-purpose segments which results in the increase of PE segments in this category. Finally, a statistically significant correlation was reported between the segments from the over-edited category in both TSs. Yet, when analyzed separately, only Group 2 confirmed this tendency, while Group 1 results were not statistically significant.

The data gleaned from the associative analysis of PE performance lead to two main conclusions. First, TS 1 and TS 2 trends were reported as opposite when comparing PE performance and WPH rate. While in TS 1 positive correlation was observed for "WPH rate vs. fit-for-purpose segments" and "WPH rate vs. under-edited segments", these two categories demonstrated negative correlations in TS 2. Conversely, the correlation between the categories “WPH rate vs. over-edited segments” was reported as negative in TS 1, and positive in TS 2. For the sake of discussion, it should be mentioned that the nature of all observed correlations in TS 1 is weak. The similar tendency is observed in TS 2, although the correlation of “WPH rate vs. over-edited segments” demonstrated moderately significant dependence. Second, the association among the observed categories of PE segments yielded negative correlations for nearly all possible combinations in each of the TSs. However, in two cases a strong negative dependence was reported, namely the combination “fit-for-purpose segments vs. over-edited segments” in TS 1 and “fit-for-purpose segments vs. under-edited segments” in TS 2.

As for the qualitative results (Section 6.2), the available evidence indicates that MTPE-related attitudes and convictions shared by the vast number of the participants did not undergo significant changes after the training. In both TSs the overall attitude to the expansion of MTPE in the translation industry landscape was evaluated quite positively. However, while Group 1 demonstrated improvement towards “less-than-perfect” quality standards in TS 2, Groups 2 members mostly disapproved of this criterion. On the other hand, Group 1 members were rather negative about taking up PE as a regular job, while Group 2 showed a slight improvement of the participants’ attitude towards such prospect. MTPE-related convictions of the participants demonstrated no drastic changes. The central values “*rather dissatisfied*” and “*rather satisfied*” were the most popular answer options for evaluation of one’s PE performance in both testing session. Similar tendencies were noticed when inquiring about students’ perceived PE proficiency, evaluated as “*average*” and “*sufficient*” by the majority of subjects, although this time there were traces of moderate improvement.

Section 6.2 also examined the students’ opinions about the impact of the training they participated in. The collected responses were split into two batches. The first batch concerned the training effects and the comments related to the training evaluation. The opinions dealt with three main themes: PE skills of the participants, application of MT in the translation industry and attitude towards PE as a type of professional activity. The second batch comprised the participants’ worries and concerns regarding the training, where two key topics could be detected: scarce familiarity with MT and PE, on the one hand, and the need of more training, on the other.

In the part of the qualitative values association, the majority of combinations within MTPE-related attitudes reported no statistically significant results. The only combination where the *p*-value could be considered as statistically significant was "PE as a job vs. attitude towards MT" in TS 2. Consequently, it is reasonable to speculate that one of the possible reasons for this is students' participation in the experimental study. As for the categories of self-evaluation, the voiced opinions reported statistical relationship of values before and after the training.

The objective of Section 6.3 was to detect and elaborate interrelations that might exist among the actual PE performance rates demonstrated by the students in terms of throughput and output quality, and their attitude towards MT. Having compared four clusters of the participants, who were arranged in conformity with the expressed positive/negative attitudes towards MT in TS 1 and TS 2, no major tendencies in PE performance were detected. The WPH rate increased irrespectively of improvement/stability/worsening of the participants' attitude between TS 1 and TS 2. However, it is important to stress that the throughput of Cluster D (students with a negative attitude towards MT in both TSs) was low before and after the training. As for the PE output quality parameters, a tendency towards a decrease of "under-edited" segments could be traced in Cluster B and Cluster D, an increase of over-edited segments was more common for Cluster D, while Clusters B and C demonstrated a weak opposite tendency. An increase of fit-for-purpose segments could be traced in all clusters, although to a different degree.

Chapter 7. Experimental study: NMT perspective

The chapter offers a brief overview of the NMT paradigm and pursues the objective to shed light on the extent to which this paradigm could impact the training content. To this end the source segments from the testing assignments are translated by a neural MT system (a different one for each language pair) and one statistical MT system, since involvement of a statistical MT engine provides us with an opportunity to contrast the NMT output against the SMT output that is different from the one used for the experimental study purposes. In particular, our attention focuses on the degree of similarity between the raw MT output used for the study needs and the (N/S)MT output of other systems; comparison of the "golden standard" used for the study needs and the (N/S)MT output of other system; assessment of the quality of the raw output produced by alternative (N/S)MT engines and extrapolating the collected pieces of data.

Based on the aforementioned analysis, suggestions are made about the changes in the design of the training proposal in case an NMT engine is selected to generate the strings further used for the training needs.

7.1. NMT paradigm and the training corpus

A cutting-edge panorama of MTPE scenario is rapidly changing in response to the rise of neural machine translation (NMT) models. Their parameters derive from parallel corpora and are supported by powerful machine learning algorithms and artificial neural networks (Casacuberta Nolla and Peris Abril, 2017). A lot of research has been done in this field: end-to-end encoder-decoder models were built (Kalchbrenner and Blunsom, 2013; Sutskever et al., 2014; Cho et al., 2014), attention mechanisms to the NMT encoder-decoder framework were introduced (Bahdanau et al., 2015), further improvements were made with respect to the relevant linguistics information and language pairs (Luong et al., 2015; Sennrich and Haddow, 2016). Under the circumstances, many translation industry flagships (e.g., Systran, Google, Wipo) are focusing their efforts on the creation of their own neural translation systems (Crego et al., 2016; Wu et al., 2016).

From the viewpoint of automatic evaluation, NMT engines are believed to outperform phrase-based statistical systems (Casacuberta Nolla and Peris Abril, 2017; Bahdanau et al., 2015; Sennrich et al., 2016; Bojar et al., 2016). The research conducted by a group of scholars from ADAPT Centre and Iconic Translation Machines (Castilho et al., 2017) made a step further and examined NMT output scores from the human evaluation perspective. It was stressed that when comparing neural vs. statistical MT using automatic metrics, the advantage of the former was reported. Things stopped being so clear-cut once human evaluation got involved. Despite gains in fluency, NMT demonstrated inconsistent results in adequacy evaluation and post-editing effort. The research group (ibid.) propounds the view that the apparent irregularity might be provoked by a relatively short time invested into NMT development, as opposed to the long-standing phase-based statistical MT engines. After investigation of three cases where NMT output was compared against SMT systems and human evaluation, the researchers came to a conclusion that despite a substantial improvement in the output quality for some language pairs and subject fields, the results are not yet so precise and there is a way to go before linguists could rank NMT systems higher than statistical ones.

At this point, it is important to stress that Autodesk post-editing data corpus used in our experimental study was released in 2015, while its content was translated during 2012-2014. As such, the MT system used at that time could not benefit from the advances in the field available nowadays. To see how and to what extent application of other (than Autodesk) engines would have influenced the output used in the course of the training (previously described in Part II), 80 original segments from the testing sessions of both groups (40 for each language pair) were fed to the total of two NMT systems and one statistical MT system. Combination of an NMT and an SMT engine for each language pair provided us with the data to roughly evaluate the performance of these types of engines and to predict possible tweaks to the training proposal.

In particular, the EN-ES training set was translated by DeepL NMT system, translations of the EN-RU training set were obtained from Google NMT system (as for June 2018 DeepL did not offer translations from/into Russian). Also, both language pairs were complemented by the raw output produced by Yandex (an SMT system). The key features of the engines are collected in Table 45:

DeepL	a neural network system capable of translating any type of text; the system builds on machine learning for natural language processing, and is trained on billions of high-quality translations
Google	a multilingual NMT service by Google, offering a set of robust functionalities that enable end-users to translate many different types of content

Yandex	a statistical machine translation system working with major east- and west-European languages

Table 45. Alternative (N/S)MT systems

To get an approximate estimate of the raw (N/S)MT output quality, the total of MT errors produced by the alternative (N/S)MT engines were analyzed with the MQM tool – the same tool that was used in the full-scale study. Next, the frequency of segments with/without MT errors was calculated and compared to the frequency of such segments in the referent output used for the study needs. Table 46 gives a snapshot of the types and ratio of MT errors produced by all engines, although a detailed analysis of MT errors was beyond the scope of our investigation. The raw MT segments for the EN-ES and EN-RU language pairs were split into fit-for-purpose segments (Ffp.) and segments with one or more errors (Not_ffp.); for the sake of accuracy the latter category was further subdivided into segments with one or more adequacy error(s) (Ade.), segments with one or more fluency error(s) (Flu.), or segments with both types of errors (Mix.):

System	**Ffp.**	**%**	**Not_ffp.**	**%**	**Ade.**	**Flu.**	**Mix.**
	EN-ES						
Autodesk	**12**	**30%**	**28**	**70%**	**11**	**17**	**0**
DeepL	33	82,2%	7	17,8%	2	4	1
Yandex	17	44,5%	23	54,5%	4	9	10
	EN-RU						
Autodesk	**11**	**27,5%**	**29**	**72,5%**	**12**	**17**	**0**
Google Translate	26	65%	14	35%	10	3	1
Yandex	29	72,5%	11	27,5%	5	2	4

Table 46. Autodesk MT output quality vs. other (N/S)MT systems output quality

The results of the EN-ES language pair show a significant (DeepL) and a moderate (Yandex) increase in the part of fit-for-purpose segments as compared to Autodesk and, correspondingly, a significant (DeepL) and a moderate (Yandex) decrease in the part of segments with MT issues. The share of segments with one or more adequacy/fluency error(s) and mixed errors is higher for Yandex, while DeepL demonstrated a substantial drop in the frequency of all types of errors.

Relatively similar tendencies were observed in the EN-RU set of segments. It is worth mentioning that for this language pair performance of NMT (Google Translate) and SMT (Yandex) systems yielded very similar results in terms of output quality. In particular, both alternative engines suggest an increased share of fit-for-purpose segments and, correspondingly, a decreased share of segments with one or more MT issue(s) in comparison with the output produced by Autodesk.

The performed analysis reveals that as of today both SMT and NMT systems show a propensity toward the production of good-enough raw output. Also, it is worth mentioning that the results of both alternative engines are more homogenous for the EN-RU set of segments, while the NMT model outperforms the SMT model when applied to the EN-ES set of segments.

7.2. (N/S)MT output: comparison and contrast

To get further insight into the raw MT content generated by the alternative (N/S)MT engines, the segments from Section 7.1 were involved into calculating the similarity index [14] between the referent and alternative raw MT outputs, and establishing the Levenshtein distance[15] between the alternative raw output and the "golden standard".

Given that the referent raw MT output used for the training and testing assignments is considered to be of good quality, the similarity between this type of the output and the output produced by alternative (N/S)MT systems could be interpreted as a sign of accurate performance of the latter. However, this would only be true for the cases when both outputs are considered as fit-for-purpose and do not require further post-editing. To neutralize decrease in the similarity index in those cases where the referent segment contains an error, while the segment produced by an alternative (N/S)MT engine is fit-for-purpose, the average Levenshtein distance (LD) between the alternative raw (N/S)MT output and the "golden standard" used in the course of this research was analyzed. Calculation of the LD also allowed for comparison of the number of edits required for

[14] Similarity was estimated as a fuzzy match between sentences. The original formula was published in Stack Overflow developer community on February 15, 2017. For more details please visit <https://stackoverflow.com/questions/42257760/define-acronyms-when-running-vb-code-calculating-similarity> (Last consulted on 24.06.2018)

[15] The original formula was borrowed from Wikipedia <https://en.wikipedia.org/wiki/Levenshtein_distance> and published in Stack Overflow developer community on November 22, 2010. For more details please visit <https://stackoverflow.com/questions/4243036/levenshtein-distance-in-vba> (Last consulted on 24.06.2018)

post-editing of the referent output and the alternative output in those cases when such segments contained (an) MT error(s).

The screenshots of the Visual Basic code used for calculating the similarity index and LD are presented in Appendix XV, Images XV.1 and XV.2. For the sake of brevity, the full strings produced by DeepL, Google and Yandex as well as calculations of similarity index and the LD are provided in Appendix XV, Tables XV.3-XV.6, while this section contains only concise information on the relevant calculations.

To take a closer look at what the EN-ES testing assignments might have been if produced by alternative (N/S)MT engines, Tables 47-50 offer a concise summary on the average performance of such engines as compared to the Autodesk. The results are split into three batches: Autodesk fit-for-purpose segments vs. the corresponding (N/S)MT segments (1), Autodesk segments with adequacy issue(s) vs. the corresponding (N/S)MT segments (2), and Autodesk segments with fluency issues vs. the corresponding (N/S)MT segments (3). After calculating the similarity index between two sets of raw MT segments, the LD_1 between Autodesk raw MT and "the golden standard" (i.e., the post-edited output produced by Autodesk linguists) was examined, as was the LD_2 between the raw MT output produced by an (N/S)MT engine and the "golden standard".

Quite logically, in Batch 1 (fit-for-purpose segments produced by Autodesk vs. the corresponding segments produced by (N/S)MT engines) the average LD_1 value is equal to 0, since the raw MT segments produced by Autodesk did not undergo any post-editing. When comparing fit-for-purpose (N/S)MT output with the corresponding Autodesk segments, it is plausible that the output of the former contains lexical forms and syntactic structures that differ from the ones produced by Autodesk, which results in longer average LD_2 as opposed to average LD_1.

Table 47 reports on the calculations performed for Autodesk raw/post-edited output vs. DeepL raw output:

Autodesk	**DeepL**	**Similarity**	**LD_1(av.)**	**LD_2 (av.)**	**Nr. of segm (Autodesk)**	**Nr. of segm (DeepL)**
Types of segments						
1. Ffp.	Ffp.	0,84	0	15,4	12	9
	Ade.	0,85	0	20		1
	Flu.	0,93	0	10		1
	Mix.	0,67	0	60		1

2. Ade	Ffp.	0,76	14,8	22,4	12	10
	Ade.	0,74	20	17		1
	Flu.	0,85	11	4		1
	Mix.	-	-	-		-
3. Flu.	Ffp.	0,84	9,2	16,0	16	14
	Ade.	-	-	-		-
	Flu.	0,92	6	10,5		2
	Mix.	-	-	-		-

Table 47. Autodesk vs. DeepL – comparison and contrast (EN-ES)

On the whole, Batch 1 demonstrates high index of similarity between the raw MT outputs produced by Autodesk and DeepL. However, the similarity index gets somewhat lower when the DeepL segment contains a mix of fluency and adequacy errors, which is also reflected in the increased the average LD_2 value. Focusing on the segments with one or more MT errors produced by Autodesk vs. the corresponding segments of DeepL (Batches 2 and 3), we can see that Batch 2 segments by DeepL are more similar to the "golden standard" (as proved by shorter average LD_2), while Batch 3 demonstrates the opposite tendency and as the average LD_2 is longer than the average LD_1.

To better visualize the amount of editing required in those cases when the original segment was (machine) translated by Autodesk/DeepL, and an error (or more) occurred in both cases (Batches 2 and 3), in Figure 22 we collected the LD values for all segments from Batches 2 and 3, excluding the cases where DeepL output was fit-for-purpose:

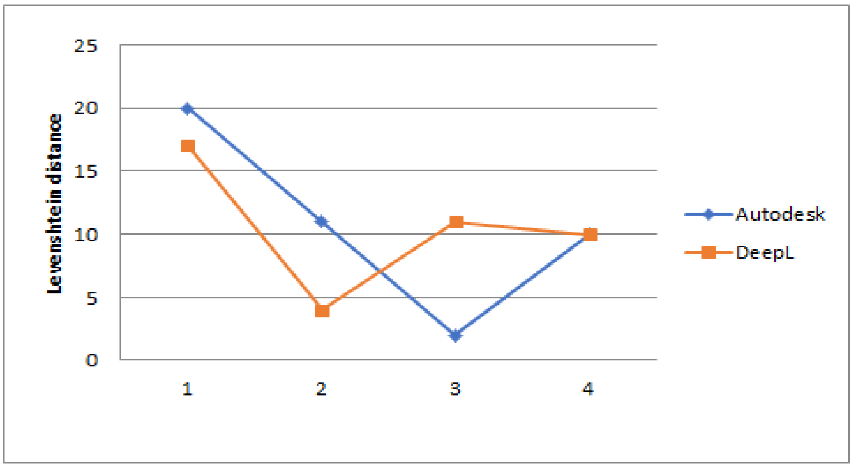


Figure 22. Levenshtein distance between Autodesk/DeepL segments with errors and the "golden standard" (the horizontal axis shows the number of segments)

Judging from the Figure 22 data, it is possible to assume that when the referent raw segment contains an adequacy error, and the corresponding DeepL segment also contains adequacy/fluency/mixed error(s) (segments 1 and 2), the output produced by DeepL would require less editing, as demonstrated by LD_2 values which are smaller than LD_1 values. However the same is not true for the case when both the raw referent segment and the DeepL segment contain fluency errors (segments 3 and 4), as despite a very high similarity between the raw output of both engines, more editing would be needed if the original were translated by DeepL (segment 3) and the amount of editing would be the same for both types of output (segment 4).

Along similar lines the segments used for the experimental study were compared and contrasted against the output produced by the SMT system Yandex (Table 48):

Autodesk	**Yandex**	**Similarity**	**LD_1 (av.)**	**LD_2 (av.)**	**Nr. of segm (Autodesk)**	**Nr. of segm (Yandex)**
Types of segments						
1. Ffp.	Ffp.	0,87	0	15,1	12	7
	Ade.	0,66	0	50		1
	Flu.	0,80	0	23,5		2
	Mix.	0,52	0	57,5		2
2. Ade	Ffp.	0,77	14,75	19,8	12	4
	Ade.	0,85	14,5	46		2
	Flu.	-	-	-		-
	Mix.	0,65	15,16	35,66		6
3. Flu	Ffp.	0,79	5,33	34,33	16	6
	Ade.	0,55	2	32		1
	Flu.	0,78	11,42	33,28		7
	Mix.	0,70	13,5	49,5		2

Table 48. Autodesk vs. Yandex – comparison and contrast (EN-ES)

For this type of engine, the similarity index of Batch 1 is characterized by higher heterogeneity than in the previous case (Table 47), this observation is supported by a rather long LD between the “golden standard” and the raw Yandex output. The similar tendency is preserved in Batches 2 and 3, where the alternative raw output bears less resemblance to the referent raw output and also is likely to require more effort on the part of post-editors, as implied by the longer LD between the Yandex output and the “golden standard” (LD_2). On the other hand, Yandex produced a slightly higher number of good-enough segments than Autodesk.

Along similar lines, to better visualize the amount of editing required in those cases when the original segment was (machine) translated by Autodesk/Yandex and an error (or more) occurred in both cases (Batches 2 and 3), in Figure 23 we collected the LD values for all segments from Batches 2 and 3, excluding the cases when Yandex output was fit-for-purpose:

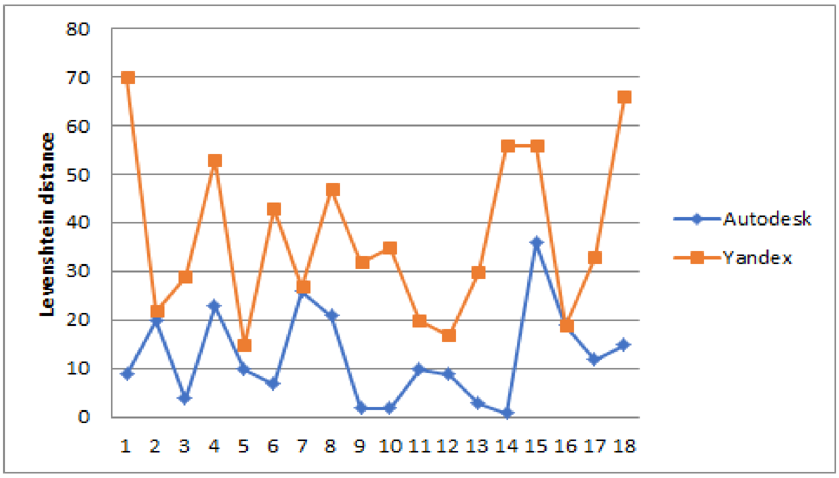


Figure 23. Levenshtein distance between Autodesk/Yandex segments with errors and the "golden standard" (the horizontal axis shows the cardinal number of segments)

On the bases of the above mentioned data it is possible to speculate that on the whole Yandex generated a bigger share of good-enough raw MT segment as opposed to the output produced by Autodesk. However, if the Yandex engine is applied in the course of the training, its MT errors would require the same/bigger amount of post-editing than Autodesk MT errors of the original training content, as proved by equal / slightly higher / significantly higher LD values.

Next, the focus of our attention moved to the EN-RU set of segments. First, the segments used for the experimental study were compared and contrasted against the output produced by the NMT system Google Translate (Table 49):

Autodesk	**Google Translate**	**Similarity**	**LD_1 (av.)**	**LD_2 (av.)**	**Nr. of segm (Autodesk)**	**Nr. of segm (Google Translate)**
Types of segments						
1. Ffp.	Ffp.	0,80	0	22,6	11	7
	Ade.	0,76	0	22,6		3
	Flu.	0,48	0	34		1
	Mix.	-	-	-		-

2. Ade.	Ffp.	0,73	11,12	27,9	12	8
	Ade.	0,78	11	23		2
	Flu.	0,85	7	2		1
	Mix.	0,60	9	48		1
3. Flu.	Ffp.	0,75	3,55	24,82	17	11
	Ade.	0,60	18,80	35,60		5
	Flu.	0,60	1	43		1
	Mix.	-	-	-		

Table 49. Autodesk vs. Google Translate – comparison and contrast (EN-RU)

The similarity index of Batch 1 may be described as somewhat heterogeneous, and the LD between the raw output and the “golden standard” is rather long (LD_2). Similar tendencies in terms of similarity index and the LD_2 are demonstrated in the Batches 2 and 3. The only exception is the case is when an adequacy issue in the raw Autodesk output was juxtaposed to a fluency issue in raw Google Translate, where the LD_2 value is smaller than LD_1 value, and similarity between two raw segments is somewhat high. Even so, Google Translate produced a larger number of fit-for-purpose segments than Autodesk.

In Figure 24 we collected the LD values for all segments from Batches 2 and 3, excluding the cases when Google Translate output was fit-for-purpose for better visualization of the amount of editing required in those cases when the original segment was (machine) translated by Autodesk/Google Translate and an error (or more) occurred in both cases:

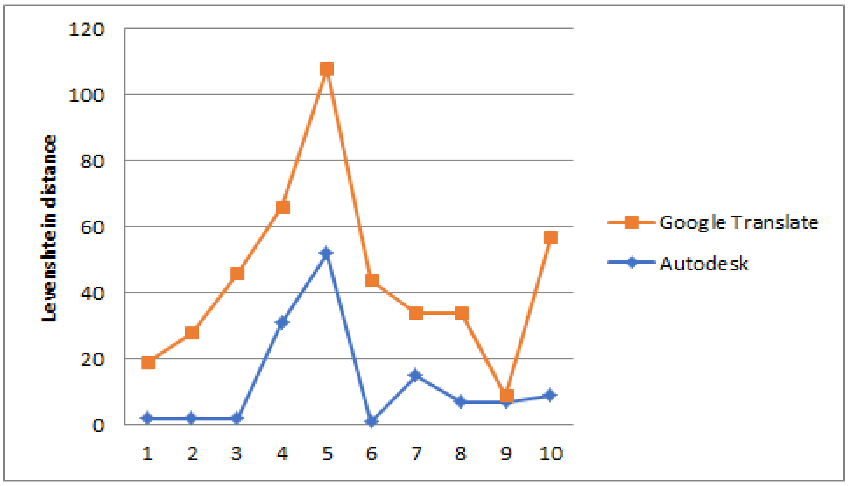


Figure 24. Levenshtein distance between Autodesk/Google Translate segments with errors and the “golden standard” (the horizontal axis shows the cardinal number of segments)

Although the share of fit-for-purpose segments would be higher if compared with the original content used for the training, the visualized data suggest that involvement of the output produced by an NMT system (e.g., Google Translate) into the training is likely to require more edits on the side of post-editors, as indicated by a longer distance from the "golden standard" in nearly all cases.

Finally, the segments used for the experimental study were compared and contrasted against the output produced by the SMT system Yandex (Table 50):

Autodesk	**Yandex**	**Similarity**	**LD_1 (av.)**	**LD_2 (av.)**	**Nr. of segm (Autodesk)**	**Nr. of segm (Yandex)**
Types of segments						
1. Ffp.	Ffp.	0,78	0	19,4	11	9
	Ade.	-	-	-		-
	Flu.	0,79	0	17		1
	Mix.	0,54	0	60		1
2. Ade	Ffp.	0,67	12,87	24,5	12	8
	Ade.	0,82	15	22		2
	Flu.	-	-	-		-
	Mix.	0,80	8	50		2
3. Flu.	Ffp.	0,78	3,17	21,92	17	12
	Ade.	0,86	2,6	20		3
	Flu.	0,68	1	30		1
	Mix.	0,64	2	27		1

Table 50: Autodesk vs. Yandex – comparison and contrast (EN-RU)

As well as in the previous case (Table 49), the similarity index of Batch 1 may be described as heterogeneous, and the LD between the raw output and the "golden standard" is rather long. This tendency keeps being reported in the Batches 2 and 3.

In order to better visualize the amount of editing required in those cases when the original segment was (machine) translated by Autodesk/Yandex and an error (or more) occurred in both cases, in Figure 25 we collected the LD values for all segments from Batches 2 and 3, excluding the cases when Google Translate output was fit-for-purpose:

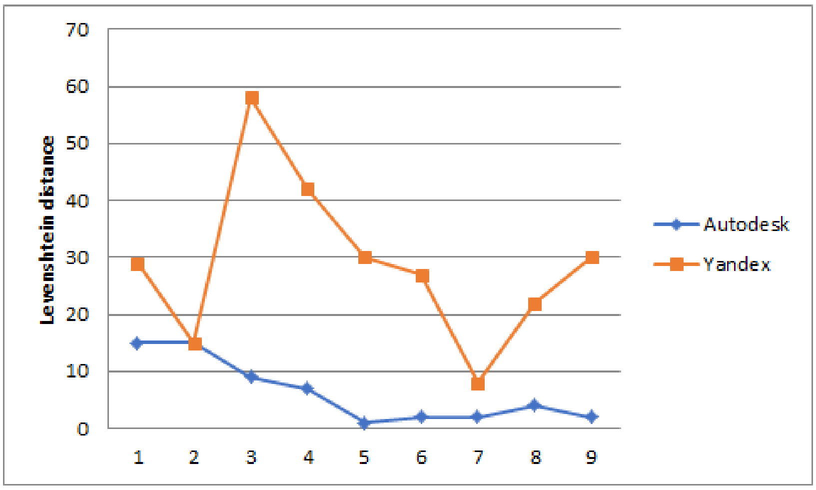


Figure 25. Levenshtein distance between Autodesk/Yandex segments with errors and the "golden standard" (the horizontal axis shows the number of segments)

As such, one more time it is possible to suggest that involvement of the output produced by an SMT system (e.g., Yandex) into the training is likely to imply more post-editing, although the share of the fit-for-purpose segment would be higher if compared with the original materials used for the training.

To conclude, out of all tested (N/S)MT engines, the performance of DeepL may be considered more accurate for the EN-ES language pair than the performance of Yandex, as the former is confirmed by a shorter LD from the "golden standard" and a higher amount of fit-for-purpose segments. In the case of the EN-RU language combination, Google Translate and Yandex systems demonstrate similar results, and application of either of them for the training purposes is likely to imply more post-editing than in the course of the present experimental study, since the LD between the newly generated (N/S)MT output and the "golden standard" is rather long. On the other hand, both alternative engines demonstrate a higher ratio of good-enough raw segments in comparison to the raw MT produced by Autodesk.

7.3. Adjusting the training proposal focus

Analysis of (N/S)MT systems performance provided us with an approximate estimate of what raw (N/S)MT output quality would be like, to what extent it would resemble the MT output generated by Autodesk MT engines, on the one hand, and the segments post-edited by Autodesk linguists (i.e., "golden standard"), on the other. In continuation, this section reflects on the training proposal design and suggests considerations regarding the scope of this proposal in light of (N/S)MT systems performance.

Evaluation of the obtained (N/S)MT output partially confirms the viewpoints voiced by the field experts in Section 7.1: the arrival of neural MT paradigm results in the increase of fit-for-purpose segments, and the decrease of segments with MT errors, especially in what concerns fluency issues. Judging from the data obtained in the previous section, in the EN-ES dataset the ratio of adequacy issues also shows a tendency to decline, although the same cannot be said about the EN-RU sample, where the ratio of such segments does not differ much from the reference. Further analysis revealed that DeepL performed better than Yandex in terms of similarity to the referent raw output and the "golden standard" for the EN-ES combination, while Google Translation and Yandex showed similar results in terms of resemblance to the referent raw output and the "golden standard" for the EN-RU combination.

This information may provide an interesting foundation for future research on or application of the suggested training proposal. According to the training outcomes described in Chapter 6, after the training the students with EN-ES language combination demonstrated an increase of fit-for-purpose segments and a decrease of over-edited segments in their PE output, while the share of under-edited segment did not report a statistically significant decrease. In other words, despite participation in the training, the trainees still demonstrated a tendency to leave out fluency/accuracy issues. In this case, if the training content comes from an NMT engine, it would seem logical to focus the training in PE mostly on detecting various types of adequacy errors, since fluency issues were reported as less frequent.

What concerns the EN-RU set of segments, after the training the students of this group showed a strong tendency towards an increase of fit-for-purpose segments and a decrease of under-edited segments in their PE output, while the share of over-edited segments did not change significantly. Under the circumstances, it seems possible to speculate that application of an NMT system which is likely to produce a larger number of fit-for-purpose segments would imply a higher probability of over-editings, since the trainees would feel tempted to improve the output that could be classified as "good-enough". To that end, the training activities should be specifically designed so as to provide the trainees with multiple opportunities to take an informed decision on the amount of post-editing and abstain from over-editing. On the other hand, the MT errors produced by an NMT engine are likely to require less editing than the errors produced by an SMT engine.

Concluding remarks

This chapter shared some general observations about the recent advances in the field of machine translation brought by neural machine translation systems, and the implications such changes might have on the suggested training proposal.

To forecast the possible consequences of alternative (N/S)MT systems for the training content, Autodesk raw MT output and post-edited segments used for the needs of the experimental study were contrasted against the output generated by DeepL (NMT) and Yandex (SMT) (for the EN-ES language pair), and by Google Translate (NMT) and Yandex (SMT) (for the EN-RU language pair). For the EN-ES dataset, the results of DeepL were very similar to the Autodesk raw MT reference, the Levenshtein distance between the raw segments generated by DeepL and the “golden standard” was shorter. In terms of output quality, the NMT system showed a strong tendency towards an increase of fit-for-purpose segments and decrease of segments with fluency/adequacy issues. As for the EN-RU combination, all aforementioned featured could be applied to the output produced by Google Translate and also by Yandex, despite the fact that the former applies neural principles of functioning, and the latter – statistical. Analysis of the possible impact of NMT on the proposal outcomes suggests that in order to raise the trainees’ awareness of differences in MT error typologies associated with a particular type of (N/S)MT engine, it may be beneficial to create training content based on the raw output generated by different types of (N/S)MT systems.

Although the findings about the more accurate performance of neural MT systems (as opposed to statistical MT systems) are consistent with current research in the field, we are fully aware of the fact that more data and investigation would be necessary to come up with clear guidelines on how to use NMT output for training needs. The analysis of (N/S)MT potential and limitations conducted in this chapter does not pretend to be exhaustive; its results rather contribute to the ongoing discussion about similarities and differences between SMT and NMT systems, and how both of them may be involved in the MTPE-related training course(s).

Conclusions

Hereafter we highlight the key findings and conclusions drawn after completion of all research phases. Special attention is paid to the research hypothesis and the objectives and aims that have been achieved. Additionally, application of the thesis outcomes is considered, the limitations and weaknesses of the conducted study are discussed, and predictions concerning the future lines of investigation are made.

Research outcomes

This doctoral thesis is an attempt to outline the scope of professional competencies of language experts engaged in the MTPE sector, and to use the collected first-hand data for drafting a training proposal aimed at the enhancement of PE competency of novice translators.

The thesis highlighted the fundamental mainstays of the state-of-play, namely the expansion of the MTPE model across the translation industry and the need for specialized training of university graduates in response to constantly emerging new challenges. The review of the EHEA principles, the scope of translators training and the recent changes in the translation studies paradigm served as the foundation for a survey-based investigation conducted among acting post-editors, and the subsequent experimental study that involved undergraduate translation students in the final years of their academic training. The survey sought answers to questions about the professional profiles of post-editors, their working conditions and routines, the ways to exercise their professional activity and opinions regarding similarities and differences between translation and post-editing. On the one hand, its outcomes facilitated familiarization of the trainees with the emerging profile of post-editor and the scope of professional expertise required for post-editing, and on the other – they indicated the key lines for drafting a corresponding training proposal that was further applied in the course of the experimental study. The study followed a pre-/post-test model and involved participants with different working language pairs. Such a measure provided us with sufficient evidence to consider the training proposal as language independent. A full-scale experimental study enabled us to test the hypothesis and examine the extent to which the research objectives and aims were achieved.

The results of the empirical experimental study validated our hypothesis that specialized basic training offered by the suggested proposal is bound to enhance the PE performance of novice translators who were not previously exposed to a post-editing workflow. It was expected that after the training the students would adopt the functional approach to PE and improve their PE performance indicators. As exposed in the study outcomes, the training resulted in the increase of PE proficiency in the part of PE output quality and throughput rates, while the attitude to MTPE-related issues was somewhat positive from the very beginning and did not undergo dramatic changes.

In continuation we offer an overview of the investigation and findings that provided the solid background for an informed decision concerning the research hypothesis and study objectives:

- **Post-editors' profiles and the scope of PE expertise**

In-depth analysis of MTPE actors and processes is highly beneficial for the industry and academia. Investigation of this kind is bound to produce a synergistic effect and propagate further research in the field. As such, first-hand information about the background, skills and working routines of language experts engaged in MTPE were considered as a valuable source of data for further study programmed in the framework of this thesis. To collect the relevant data on MTPE-related processes and profiles, our survey-based empirical investigation focused on four research themes: respondents' profiles and experience (e.g., the working language pair, throughput rates, academic background, years of experience), MTPE workflow (e.g., tools, reference materials and routines), decision-making and contrast of translators' vs. post-editors' profiles. The survey was administered using a questionnaire; the responses elicited facts, opinions and feelings.

The study results not only provided us with the necessary information for drafting a training proposal, but also allowed us to obtain a comprehensive picture of the MTPE field, and its implications for the industry and academia. In particular, the survey outcomes contributed to the awareness of translators' changing role in light of the recent developments in the MTPE sector and helped to customize training programs and market demands. The information concerning profiles and daily routines of professionals may be used by LSPs to adapt their expectations and improve their workflow. What is more, the results provided the empirical bases for outlining the scope of competencies currently deployed by post-editors, which may serve as a reference point for specifying translator training objectives by the academic sector.

- **Design and implementation of the training proposal**

A holistic approach to translator training is directly linked to the right balance between drafting a curriculum in conformity with the expectations of the translation industry, and enhancement of MTPE expertise that would enable translators to go beyond such expectations. Under such circumstances, the authentic feedbacks collected from the professional post-editors by means of a survey-based study, thorough consideration of the EHEA recommendations and competency-based training principles procured us with substantial content to draft a training proposal. The ultimate goal of such training was to provide its participants with a better understanding of the MTPE industry and to gain the proficiency required for efficient completion of post-editing jobs. It is for this reason that the trainees were provided with multiple opportunities to enhance their PE performance and get a deeper insight into social and professional characteristics of those translators who are currently engaged in MTPE projects.

The subjects of our experimental study were undergraduate translation students in their final year of academic training. This choice was based on the premises that translation competency of this category of students is characterized by sufficient level of acquired knowledge, skills, and attitudes that can be expected of novice translators.

The training objectives included introduction of the trainees to the concept of MTPE and the changes it brought to the translation industry; followed by enhancement of PE expertise that manifested itself in improved PE performance and positive attitudes towards MTPE-related issues. The study followed a pre-/post-test methodology, for which reason its efficiency was measured by evaluating the data produced by the trainees in the pre-training and post-training testing sessions. The training model was comprised of two training sessions: first, the trainees assisted an in-class session, which was followed by a remote training session performed individually by each student. The training agenda followed a logical layout and consisted of the ordered sequence of chunks. In conformity with the current research into the psychology of learning, a significant part of the training was performed by the participants autonomously. This measure contributed to holding the students accountable for their own academic success and professional development.

- **Training outcomes**

PE throughput/output results were first examined by means of descriptive analysis of values that characterized the subjects' PE performance in each of the testing sessions. Next, in the course of the inferential analysis the obtained values were scrutinized to confirm or discard the hypothesis that study results were inter-dependent and did not happen by chance. The collected evidence indicated to a statistically significant increase of PE throughput rate and the number of fit-for-purpose segments in the output of all participants after undertaking the proposed training. It is also worth mentioning that when analyzing associative correlations among different types of PE performance data, in TS 1 a strong negative correlation was reported by fit-for-purpose vs. over-edited segments, implying that more "accurate" post-editors did not show a tendency to over-edit. Even so, in TS 2 a strong negative correlation was reported by fit-for-purpose segments vs. under-edited segments, since more "accurate" post-editors showed a tendency towards production of fewer under-edited segments, suggesting another effect of the training. In what concerns qualitative values yielded by the participants before and after the training, a conclusion may be drawn that the majority of the participants broadly welcomed the advances made by MT to the translational landscape.

At the end of the experimental study, the students' feedback on the perceived effect of the training was collected. The obtained answers were assigned to one of two batches: (1) evaluation of the training, when the trainees shared their ideas on the acquired PE skills, the impact of MT on the industry, and their feelings about PE as a professional activity; (2) worries and concerns regarding the training, focused mostly on limited familiarity with MTPE processes and tasks and criticality of more in-depth training. After the examination of correlations between the students' PE performance and attitude towards MT, an observation was made that although the throughput rate of the participants seemed to increase irrespectively of their attitude to MT, those students who remained negative in their attitude towards MT demonstrated throughput rates below average in both testing sessions.

- **NMT perspective of the training**

The empirical experimental study was based on an SMT engine output; however, given the rise of NMT systems in the last few years, we tried to reflect on how and to what extent the training proposal design and outcomes would change should the training corpus be generated by an NMT engine.

To this end, similarity index between the referent raw MT output strings and the ones produced by an NMT engine was examined, and the Levenshtein distance between the "golden standard" and the raw NMT output was calculated. In this way, we simulated the used of an alternative engine for the training needs, and the corresponding adjustments of the training proposal were suggested. Application of NMT systems for generating translation in each of the target languages resulted in the increase of fit-for-purpose MT segments, and the decrease of segments with MT errors, especially with fluency issues. Additionally, in the EN-ES dataset the proportion of adequacy issues also tended to decline. However, the proportion of such issues in the EN-RU dataset does not differ much from the referent raw MT output. Consequently, it seems logical to suggest that if the training proposal made use of segments generated by an NMT system, then those students whose profiles were similar to the ones of Group 1 (EN-RU) should focus more on abstinence from over-editing such increased amount of good-enough segments (as this group did not report a statistically significant decrease in the number of over-edited segments after the training). On the other hand, those students whose profiles are similar to the ones of Group 2 (EN-ES) should be trained to detect various types of mostly adequacy errors (given the fact that the participants of this group did not report a statistically significant decrease in the number of under-edited segments after the training).

To summarize, enhancement of PE performance happened in conformity with the constructivist framework and the principles of programmed learning. The key characteristics of the proposal are its ability to be adapted to the individual learning rhythm of each student and give immediate feedback, which provides the trainees with a sufficient amount of experiential learning and, therefore, contributes to PE competency enhancement. It is also important to stress that the suggested proposal may be alternated and adapted to the specific needs of each particular project and is expected to be of use for teaching staff and those in charge of in-house training.

The outcomes of the empirical study conducted in the framework of this research made impacts on conceptual, methodological and analytical levels. Shedding light on post-editors' profiles and the scope of professional expertise contributed to the conceptual dimension of MTPE-related research, as did drafting a proposal for PE competency enhancement. On the methodological level, baseline training that goes in conformity with EHEA requirements is bound to expand trainees' proficiency and boost competitiveness of novice translators in the labor market. Finally, detailed examination of quantitative and qualitative data yielded by the experimental study, as well as the correlation between the two provides us with empirical evidence on the impact of the suggested training on the participants, and showcases analytical practices applied by industry and academia.

The survey results demonstrate that the scope of post-editors' expertise fits within translation competencies models, for which reason translation students in the last year of their Bachelor's program(s) have a predisposition towards PE competency development. Such predisposition manifests itself in a positive attitude towards MT, the capability to grasp the basic principles of post-editing and improve their performance after undertaking baseline training, as demonstrated by the experimental study results.

The proposed training model contains theoretical and practical modules and was aimed at PE competency acquisition. In case the model is used for more in-depth training, its flexibility allows for incorporation of modules that focus on professional aspects of post-editing and trainees' instrumental competencies. The suggested training proposal may be customized in conformity with the trainees' academic backgrounds, language pairs, or the type of MT engine used to generate the training corpus.

Research limitations

The empirical studies conducted in conformity with the research objectives of the present thesis are not free of certain limitations which prevent us from generalizing the achieved results.

In what concerns preparation and conduct of the survey, the main limitation had to do with an inability to make assumptions concerning the total population rate, since measuring the share of MTPE projects performed worldwide may seem too ambitious. However, to compensate for this shortcoming, the researcher made an effort and used all available communication channels to reach potential survey participants by means of an Internet-mediated questionnaire. The call for participation was distributed through databases of LSPs collected by academic institutions, professional associations and/or federations of translators. In addition, the relevant links to the questionnaire were published on a number of social media platforms. On the other hand, the variety of communication channels resulted in the impossibility to gauge the exact response rate and to make a claim on the representative coverage.

Convenience sampling and an impossibility to confirm respondents' identity may be considered two other limitations of the present study. Even so, we believe that the total number of the filled-in questionnaires is sufficient for fairly complete and reliable analysis of professional profiles and routines performed by the covered cross-section of translators currently engaged in the MTPE sector.

As for the full-scale empirical study which involved undergraduate translation students from Universitat Autònoma de Barcelona and Kharkiv National Aerospace University with EN-ES and EN-RU as their working language pairs, the variations in the academic programs and differences in training methodologies may be considered other limitations to the study. Despite the similar range of disciplines and courses covered by the students, there may have been divergences between what was stated in the plans and what was actually put to practice in the classroom, as well as certain modifications and customization of the training content by academic instructors so as to better meet the needs of each group.

However, even though heterogeneity of the academic programs might be a constraint, the study outcomes prove the efficiency of the suggested training proposal and its positive influence not only on PE performance indicators but also on the trainees' MTPE-related attitudes and satisfaction levels.

Applicability of study results

The present thesis is an authentic example of applied research focused on the solution of practical problems that exist in the translation industry and the academic sector. Its primary goals were to provide a snapshot of the professional profiles of those language experts who are engaged in the MTPE sector, to outline the scope of PE expertise, to develop a sharable approach to its enhancement, to describe the implementation of the study design, and to share suggestions regarding the procedures and techniques aimed at stimulation of PE competency acquisition, as well as its outcomes.

Thinking about the applicability of the research results, the academic and pedagogic fields seem to be the main beneficiaries who may take advantage of the survey results and use them as a starting point to draw up their own proposals for undergraduate and postgraduate training in PE. However, bearing in mind constant changes happening in the professional market, it is not enough to use the study results as the only reference. A training program would only bring fruit as long as there is a right balance between the training content, and the translation industry requirements.

Furthermore, the research findings may also be beneficial for a broad range of MTPE market players, and in particular to novice translators who want to familiarize themselves with post-editing and become more competitive in the labor market, and to LSPs who may gain a better insight into the common routines, PE-related skills and competencies, opinions and concerns of their vendors and adapt, if possible, their workflow correspondingly.

On the whole, the applicability of the study outcomes consists of the following:

- the findings contribute to the awareness of translators' changing role in light of the emerging developments in the MTPE sector and the on-going research on post-editors' profiles;
- both the survey and the training proposal can be used for the actualization and adjusting the translators training syllabi so that the latter keep the pace with current practices;
- the experimental study outcomes establish a common reference-point to serve as a clear guideline that enhances more efficient performance from anyone utilizing this model in academic context; however, we wholeheartedly agree with the belief that for optimal results the training program should be tailored for a particular PE project; on top of that the suggested proposal may serve as a baseline model for a broad range of PE-related projects and training modules, as it permits to emphasize various characteristics of the latter;

- although the training participants demonstrated advances in terms of PE performance after the training, it seems fair to pinpoint that when post-editing, students from Group 1 (EN-RU) were inclined to commit errors of a different nature than students from Group 2 (EN-ES), hence the results call for further adaptation of the training proposal for specific needs of each language pair;
- comparison of the output of the statistical MT engine used for the study purposes with the output of alternative neural and statistical MT engines helped all those interested to make an informed decision about how the use of NMT systems, which could have influenced the training proposal focus;
- MTPE experts and researchers could take advantage of the collected data to compare them to their own findings and embark on an in-depth exploration of different facets of this phenomenon, such as correlation of years of experience in PE vs. typical workflow routines, throughput rates and/or satisfaction levels, prioritization of PE-related skills, or further exploration of decision-making triggers.

It seems essential to positively influence the natural skepticism towards MT and PE training, and to that point to suggest first-hand data of post-editors' profiles and a training baseline that can be applied for any language pair on condition of the available corpus. We believe that this investigation bridges the gap between the academic and professional fields and helps to train novice post-editors and all those who aspire for additional MTPE-related training in conformity with the demands and requirements of the translation industry.

Future lines of investigation

The outcomes exposed in this work contribute to the investigation of changes brought to the translation landscape by machine translation and offer a solid foundation that could be used as a starting point for further research in the field of MTPE-related competencies and skills enhancement. In particular, the thesis outcomes give rise to a set of exploration opportunities, such as:

- to invite students with other language combinations and/or academic backgrounds (e.g., Arts vs. Sciences) to undertake the suggested training proposal and deduce special needs of such trainees, as well as possible lines of improvement of the training;

- to arrange one-to-one interviews with acting post-editors and collect a more reliable set of data regarding the issues raised in the survey, as well as inquire about their unmet needs and difficulties they come across when performing PE, and primary concerns; such investigation could be followed by dissemination of this information for the sake of further advances in the MTPE sector;
- to initiate an investigation aimed at researching the broad range of factors that can influence the effect of the proposal, such as target languages, the type of engine used for MT purposes, students' academic backgrounds, available resources and evaluation criteria that could facilitate selection of teaching content, etc.;
- to interview professional post-editors as well as undergraduate/postgraduate students with experience in PE about their preferences and recommendations on how the training content could be collected, structured and put into practice.

The abovementioned avenues of exploration imply that MTPE-focused theory and practice have a long way to go. But as once said by Seneca: *every new beginning comes from some other beginning's end*, so for the time being this research is considered a full-fledged dissertation which meets all the necessary requirements, although the avenues of further investigation are many. As such, the author wholeheartedly hopes to continue the in-depth analysis of the intricate combinations between translation studies and technology, both of which have paved the way for the rise of MTPE in the future.

Bibliography

Allen, J., 2003. Post-editing. In *Benjamins Translation Library*, *35*, pp.297-318.

ANECA. 2007. June 28. REFLEX. Informe ejecutivo: El profesional flexible en la Sociedad del Conocimiento. *Agencia Nacional de la Evaluación de la Calidad y Acreditación (ANECA): Unidad de Estudios.* Available at: http://www.aneca.es/var/media/151847/informeejecutivoaneca_jornadasreflexv20.pdf (Last consulted on 16.05.2016).

Aranberri-Monasterio, N. and O'Brien, S., 2010. Evaluating RBMT output for-ing forms: A study of four tar-get languages. In *Evaluation of Translation Technology*, *8*, p.105.

Arenas, A.G., 2012. *Productivity and quality in the post-editing of outputs from translation memories and machine translation* (Doctoral dissertation, Universitat Rovira i Virgili).

Association of American Colleges and Universities (AACU), Washington, Dc, 2002. *Greater Expectations: A New Vision for Learning as a Nation Goes to College. National Panel Report*. Association of American Colleges and Universities.

Austermuehl, F., 2013. Future (and not-so-future) trends in the teaching of translation technology. In *Revista Tradumàtica (11),* pp.326-337.

Bahdanau, D., Cho, K. and Bengio, Y., 2014. Neural machine translation by jointly learning to align and translate. In *International Conference on Learning Representations*, ICLR 2015, San Diego, California, 2015.

Baker, M., 1995. Corpora in translation studies: An overview and some suggestions for future research. In *Target. International Journal of Translation Studies*, *7* (2), pp.223-243.

Barblan, A. and Fayant, C., ed., 2001. Salamanca Convention 2001: the Bologna process and the European higher education area, EUA Genève.

Barnett, C., 2001. Culture, policy, and subsidiarity in the European Union: from symbolic identity to the governmentalisation of culture. In *Political geography*, *20*(4), pp.405-426.

Baron, J., 2010. Cognitive biases in moral judgments that affect political behavior. In *Synthese*, *172*(1), p.7.

Beaton, A. and Contreras, G., 2010, October. Sharing the Continental Airlines and SDL post-editing experience. In *Proceedings, Ninth Conference of AMTA, Denver, Colorado*.

Becker, G.S. 1993. Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education (3rd ed.), Chicago: The University of Chicago Press.

Belam, J., 2003, September. Buying up to falling down: A deductive approach to teaching post-editing. In *Proceedings of MT Summit IX*, pp. 1-10.

Beneitone, P., Esquetini, C., González, J., Maleta, M.M., Siufi, G. and Wagenaar, R. eds., 2007. *Reflections on and outlook for higher education in Latin America: Final report tuning Latin America project 2004-2007*. Universidad de Deusto.

Bergen Communiqué, 2005. The European higher education area–achieving the goals. In *Communiqué of the conference of European ministers responsible for higher education*, pp. 19-20.

Blatz, J., Fitzgerald, E., Foster, G., Gandrabur, S., Goutte, C., Kulesza, A., Sanchis, A. and Ueffing, N., 2003. Confidence estimation for statistical machine translation. In *Johns Hopkins Summer Workshop Final Report*.

Bojar, O., Buck, C., Callison-Burch, C., Federmann, C., Haddow, B., Koehn, P., Monz, C., Post, M., Soricut, R., and Specia, L. 2013. Findings of the 2013 workshop on statistical machine translation. In *Proceedings of the 2013 workshop on statistical machine translation*, Sofia, Bulgaria, 8-9 June, pp. 1-44.

Bojar, O., Buck, C., Federmann, C., Haddow, B., Koehn, P., Leveling, J., Monz, C., Pecina, P., Post, M., Saint-Amand, H. and Soricut, R., 2014. Findings of the 2014 workshop on statistical machine translation. In *Proceedings of the ninth workshop on statistical machine translation*, Baltimore, Maryland, USA, 26-27 June, pp. 12-58.

Bojar, O., Chatterjee, R., Federmann, C., Graham, Y., Haddow, B., Huck, M., Yepes, A.J., Koehn, P., Logacheva, V., Monz, C. and Negri, M., 2016. Findings of the 2016 Conference on Machine Translation. In *ACL 2016 FIRST CONFERENCE ON MACHINE TRANSLATION (WMT16).* The Association for Computational Linguistics, pp. 131-198.

Bologna Working Group on Qualifications Frameworks. 2012. Report by the EHEA Working Group on Qualifications Framework. In: *EHEA Ministeria Conference. Bucharest, Hungary.*

Borg, W. R., and Gall, M. D. 1989. *Educational research. An introduction* (5th ed.). White Plains, NY: Longman.

Boshuizen, H.P., 2004. Does practice make perfect? In *Professional learning: Gaps and transitions on the way from novice to expert,* Springer, Dordrecht, pp. 73-95.

Bruner, J.S., 1966. *Toward a theory of instruction* (Vol. 59). Harvard University Press.

Bunk, G., 1994. La transmisión de las competencias en la formación y perfeccionamiento profesionales de la RFA. In *Revista europea de formación profesional*, (1), pp.8-14.

Burchardt, A. and Lommel, A., 2014. Practical guidelines for the use of MQM in scientific research on translation quality. Available at: http://www.qt21.eu/downloads/MQM-usage-guidelines.pdf (Last consulted on 15.07.2017)

Cadwell, P., Castilho, S., O'Brien, S. and Mitchell L. 2016. Human factors in machine translation and post-editing among institutional translators. In *Translation Spaces,* 5, pp. 222-243.

Callender, P., 1969. *Programmed learning: its development and structure*. Longman.

Cano García, M.E., 2008. La evaluación por competencias en la educación superior. In *Profesorado. Revista de curriculum y formación de profesorado, 12* (3), pp.1-16.

Casacuberta Nolla, F. and Peris Abril, Á., 2017. Traducció automàtica neuronal. In *Revista Tradumàtica* (15), pp.66-74.

Casacuberta, F., Civera, J., Cubel, E., Lagarda, A.L., Lapalme, G., Macklovitch, E. and Vidal, E., 2009. Human interaction for high-quality machine translation. In *Communications of the ACM*, *52* (10), pp.135-138.

Castilho, S., Moorkens, J., Gaspari, F., Calixto, I., Tinsley, J. and Way, A., 2017. Is neural machine translation the new state of the art? In *The Prague Bulletin of Mathematical Linguistics*, *108 (1),* pp.109-120.

Chan, A., 2010. Perceived benefits of translator certification to stakeholders in the translation profession: A survey of vendor managers. In *Across Languages and Cultures*, *11 (1),* pp.93-113.

CHEERS. 2003. Careers after higher education: A European research study. Higher Education and Graduate Employment in Europe – European Graduate Survey. Available at: http://www.uni-kassel.de/einrichtungen/de/incher/ (Last consulted on 16.05.2016).

Chesterman, A., 1993. From 'is' to 'ought': Laws, norms and strategies in translation studies. In *Target. International Journal of Translation Studies*, *5 (1),* pp.1-20.

Chesterman, A., 2006. Questions in the sociology of translation. In *Benjamins Translation Library*, *68*, p.9.

Chesterman, A., 2009. The name and nature of translator studies. *HERMES-Journal of Language and Communication in Business*, *22 (42),* pp.13-22.

Cho, K., Van Merriënboer, B., Bahdanau, D. and Bengio, Y., 2014. On the properties of neural machine translation: Encoder-decoder approaches. Available at: https://arxiv.org/abs/1409.1259 (Last consulted on 10.04.2018).

Cho, K., Van Merriënboer, B., Gulcehre, C., Bahdanau, D., Bougares, F., Schwenk, H. and Bengio, Y., 2014. Learning phrase representations using RNN encoder-decoder for statistical machine translation. Available at: https://www.aclweb.org/anthology/D14-1179 (Last consulted on 20.04.2018).

COM. 2005. Key competences for lifelong learning: European reference framework. Available at: http://ec.europa.eu/dgs/education_culture/publ/pdf/ll-learning/keycomp_en.pdf (Last consulted on 26.05.2010).

Crego, J., Kim, J., Klein, G., Rebollo, A., Yang, K., Senellart, J., Akhanov, E., Brunelle, P., Coquard, A., Deng, Y. and Enoue, S., 2016. SYSTRAN's Pure Neural Machine Translation Systems. Available at: https://arxiv.org/abs/1610.05540 (Page consulter on 11.06.2018).

Creswell, J.W. and Plano Clark, V.L., 2011. Choosing a mixed methods design. In *Designing and conducting mixed methods research*, pp.53-106.

Creswell, J.W., Plano Clark, V.L., Gutmann, M.L. and Hanson, W.E., 2003. Advanced mixed methods research designs. In *Handbook of mixed methods in social and behavioral research, 209*, p.240.

Curaj, A., Scott, P., Vlasceanu, L. and Wilson, L. eds., 2012. *European higher education at the crossroads: between the Bologna process and national reforms*. Springer Science & Business Media.

Danks, J.H., Shreve, G., Fountain, S., McBeath, M. (eds.). 1997. *Cognitive processes in translation and interpreting* . Applied Psychology (Vol. 3). Thousand Oaks: Sage Publications, Inc.

Dardenne, B. and Leyens, J.P., 1995. Confirmation bias as a social skill. In *Personality and Social Psychology Bulletin, 21 (11),* pp.1229-1239.

De Almeida, G. and O'Brien, S., 2010. Analyzing post-editing performance: correlations with years of translation experience. In *Proceedings of the 14th annual conference of the European association for machine translation,* pp. 26-28.

De Almeida, G., 2013. *Translating the post-editor: an investigation of post-editing changes and correlations with professional experience across two Romance languages*. (Doctoral dissertation, Dublin City University).

De Cecco, J.P. and Crawford, W.R., 1974. *The psychology of learning and instruction educational psychology*. Prentice-Hall.

De Miguel Díaz, M., 2005. *Modalidades de enseñanza centradas en el desarrollo de competencias: orientaciones para promover el cambio metodológico en el espacio europeo de educación superior*. Servicio de Publicaciones: Universidad de Oviedo.

De Miguel Díaz, M., Alfaro Rocher, I., Apodaca Urquijo, P., Arias Blanco, J., García Jiménez, E. and Lobato Fraile, C., 2006. *Metodologías de enseñanza y aprendizaje para el desarrollo de competencias: orientaciones para el profesorado universitario ante el Espacio Europeo de Educación Superior*. Madrid: Alianza editorial.

Delgado García, A.M. (coord), Borges Bravo, R., García Alberto, J., Oliver Cuello, R., Salomón Sancho, L., 2005. *Competencias y diseño de la evaluación continua y final en el Espacio Europeo de Educación Superior*. Programa de estudios y análisis. Madrid: Dirección General de Universidades, MEC.

DePalma, D. and Kelly, N., 2009. Project management for crowdsourced translation: how user-translated content projects work in real life. In *Translation and localization project management: The art of the possible,* pp. 379-408.

DePalma, D.A., Sargent, B.B. and Beninatto, R.S., 2006. Can't read, won't buy: Why language matters on global websites. *An International Survey of Global Consumer Buying Preferences.* Available at:

https://www.commonsenseadvisory.com/portals/_default/knowledgebase/articleimages/060926_r_global_consumer_preview.pdf (Last consulted on 20.12.2015)

DePalma, D.A., Hegde, V., Pielmeier, H., Stewart, R.G. and Hedge, V., 2013. The language services market: 2013. Lowell, MA: Common Sense Advisory.

Depraetere, I., 2010. What counts as useful advice in a university post-editing training context? Report on a case study. In *EAMT 2010: proceedings of the 14th annual conference of the European association for machine translation*, Saint-Raphaël, France.

Días-Barriga, A.Y.H. and Hernández, R., 2004. *Estrategias docentes para un aprendizaje significativo: una interpretación constructivista.* Ed. McGraw-Hill: México.

Doherty, S. and Kenny, D., 2014. The design and evaluation of a statistical machine translation syllabus for translation students. In *The Interpreter and Translator Trainer*, *8* (2), pp.295-315.

Doherty, S. and Moorkens, J., 2013. Investigating the experience of translation technology labs: pedagogical implications. In *Journal of Specialised Translation*, *19*, pp.122-136.

Doherty, S., 2017. Issues in human and automatic translation quality assessment. In *Human Issues in Translation Technology: The IATIS Yearbook*, p.131.

Doherty, S., O'Brien, S. and Carl, M., 2010. Eye tracking as an MT evaluation technique. In *Machine translation*, *24 (1),* pp.1-13.

Duchesne, S. and McMaugh, A., 2015. *Educational psychology for learning and teaching*. Cengage AU.

Duffy, T.M., and Jonassen, D.H., eds., 2013. *Constructivism and the technology of instruction: A conversation*. Routledge.

European Commission. 2004. Competencias Clave para un Aprendizaje a lo Largo de la Vida. Un Marco de Referencia Europeo. Bruselas: Dirección Geberal de Educación y Cultura.

European Master in Translation competence framework. 2017. Available at: https://ec.europa.eu/info/sites/info/files/emt_competence_fwk_2017_en_web.pdf (Last consulted on 20.04.2017).

Fallows, S. and Steven, C., 2000. Building employability skills into the higher education curriculum: a university-wide initiative. In *Education+ training*, *42* (2), pp.75-83.

Federico, M., Cattelan, A. and Trombetti, M., 2012. Measuring user productivity in machine translation enhanced computer assisted translation. In *Proceedings of the Tenth Conference of the Association for Machine Translation in the Americas (AMTA)* (pp. 44-56). Madison, WI: AMTA.

Fedorov, A.V., 1968. Introduction à la théorie de la traduction. *École Supérieure de Traducteurs et d'Interprètes, Bruxelles: ESIT*.

Fernández, D.M. and Hughes, S., 2013. Competences and foreign language teacher education in Spain. In *Competency-based Language Teaching in Higher Education*, pp. 63-75. Springer, Dordrecht.

Flanagan, M. and Christensen, T.P., 2014. Testing post-editing guidelines: how translation trainees interpret them and how to tailor them for translator training purposes. In *The Interpreter and Translator Trainer*, *8 (2),* pp.257-275.

Fleming, M. 2009. Perspectives on the use of competence statements in the teaching of the English language. In *English language teaching in the European Credit Transfer System: Facing the challenge,* ed. M.L. Pérez Cañado, 75-92. Frankfurt am Main: Peter Lang.

Flórez, S. and Alcina, A., 2011. Free/Open-Source Software for the Translation Classroom: A Catalogue of Available Tools. In *The Interpreter and Translator Trainer*, *5 (2),* pp.325-357.

Fowler, F.J., 1995. *Improving survey questions: Design and evaluation* (Vol. 38). Sage.

Fox, O., 2000. The use of translation diaries in a process-oriented translation teaching methodology. In *Benjamins Translation Library*, *38*, pp.115-130.

Garcia, I., 2010. Is machine translation ready yet? In *Target. International Journal of Translation Studies*, *22 (1),* pp.7-21.

Gardner, H., 1987. *The mind's new science: A history of the cognitive revolution*. Basic Books.

Gaspari, F., Almaghout, H. and Doherty, S., 2015. A survey of machine translation competences: Insights for translation technology educators and practitioners. In *Perspectives*, *23* (3), pp.333-358.

Gaspari, F., Toral, A., Naskar, S.K., Groves, D. and Way, A., 2014. Perception vs reality: Measuring machine translation post-editing productivity. In *Proc. Third Workshop on Post-Editing Technology and Practice*.

Gile, D., 1990. Scientific research vs. personal theories in the investigation of interpretation. In *Aspects of applied and experimental research on conference interpretation (28),* Udine, Campanotto, p. 41

Gile, D., 1995. *Basic concepts and models for translator and interpreter training*. Amsterdam y Filadelfia: John Benjamins Publishing Company.

Gile, D., 1998. Observational studies and experimental studies in the investigation of conference interpreting. In *Target. International Journal of Translation Studies, 10 (1)*, pp.69-93.

Glasgow Declaration, 2005. *Strong Universities for a Strong Europe*. European University Association, Brussels.

Gonzales, J. and Wagenaar, R., 2003. Tuning educational structures in Europe: final report. *Phase I*. Universidad de Deusto.

Gouadec, D., 2007. *Translation as a Profession* (Vol. 73). John Benjamins Publishing.

Graham, Y., Baldwin, T., Moffat, A. and Zobel, J., 2013. Continuous measurement scales in human evaluation of machine translation. In *Proceedings of the 7th Linguistic Annotation Workshop and Interoperability with Discourse*, pp. 33-41.

Graham, Y., Baldwin, T., Moffat, A. and Zobel, J., 2013. Crowd-Sourcing of Human Judgments of Machine Translation Fluency. In *Proceedings of the Australasian Language Technology Association Workshop 2013 (ALTA 2013)*, pp. 16-24.

Graz Declaration, 2003. *Forward from Berlin: The Role of Universities*. European University Association, Brussels Office.

Green, R., 1982. The MT errors which cause most trouble to posteditors. In *Lawson (ed.), Practical experience of mahine translation*, pp.101-104.

Gregorio Guirles, J.R. and Ramón, J., 2002. El constructivismo y las matemáticas. *Sigma: Revista de Matemáticas, Vitoria, 2*, pp.113-129.

Grognet, A.G. and Crandall, J., 1982. Competency-based curricula in adult ESL. *ERIC/CLL News Bulletin*, *6 (1)*, pp.3-4.

Groves, D., 2008. Bringing humans into the loop: localization with machine translation at Traslan. In *Proceedings of the Conference of the American Machine Translation Association (AMTA). Waikiki, Hawaii*, pp. 11-22.

Groves, R.M., Presser, S. and Dipko, S., 2004. The role of topic interest in survey participation decisions. *Public Opinion Quarterly*, *68 (1)*, pp.2-31.

Guba, E.G. and Lincoln, Y.S., 1994. Competing paradigms in qualitative research. *Handbook of qualitative research*, *2 (163-194)*, p.105.

Guerberof, A., 2008. Productivity and quality in the post-editing of outputs from translation memories and machine translation: A pilot study. *Minor Dissertation. Tarragona: Universitat Rovira i Virgili*.

Guerberof, A., 2009. Productivity and quality in MT post-editing. In *MT Summit XII-Workshop: Beyond Translation Memories: New Tools for Translators MT*.

Guerberof Arenas, A., 2010. Project management and machine translation. *Multilingual computing & technology*, *21* (3), p.34.

Guerberof, A., 2017. Quality is in the eyes of the reviewer. *Translation in Transition: Between cognition, computing and technology*, *133*, p.187.

Guerberof Arenas, A., Depraetere, H. and O'Brien, S., 2012. What we know and what we would like to know about post-editing. In *Revista Tradumàtica, (10),* pp.0211-218.

Guzmán, R., 2007. Manual MT Post-editing. "If it's not Broken, don't Fix it". In *Translation Journal (Vol. 11, No. 4).* Available at: https://translationjournal.net/journal/42mt.htm (Last consulted on 10.10.2015).

Hatch, J.A., 2002. *Doing qualitative research in education settings*. Suny Press.

Hermans, T., 1985. *The manipulation of literature. Studies in literary translation*. Croom Helm, pp. 1-250.

Hernández Rojas, G. and Díaz Barriga, F., 2013. Una mirada psicoeducativa al aprendizaje: qué sabemos y hacia dónde vamos. *Sinéctica, (40),* pp.01-19.

Hernández Sampieri, R., Fernández Collado, C. and Baptista Lucio, P., 2006. *Metodología de la investigación.(Vol. 3).* México: McGraw-Hill.

Holmes, J.S., 1972. The name and nature of translation studies. In *Translated*, *2*.

Howatt, A.P.R., 1969. *Programmed learning and the language teacher: some implications and suggestions for the use of programmes in the teaching of a foreign language*. Longmans.

Humphreys, D., 2005. Why integrative learning? Why now? *Peer Review, 7 (4),* p.30-31.

Hurtado Albir, A., 1999. La competencia traductora y su adquisición. Un modelo holístico y dinámico. In *Perspectives: Studies in Translatology*, *7 (2),* pp.177-188.

Hurtado Albir, A., 2001. *Traducción y traductología*. Cátedra.

Hurtado Albir, A., 2007. Competence-based curriculum design for training translators. In *The interpreter and translator trainer*, *1 (2),* pp.163-195.

Hurtado Albir, A. ed., 2017. *Researching translation competence by PACTE group* (Vol. 127). John Benjamins Publishing Company.

Inghilleri, M., 2005. The sociology of Bourdieu and the construction of the 'object' in translation and interpreting studies. In *The Translator*, *11 (2),* pp.125-145.

ISO (International Organization for Standardization), 2015. ISO 17100: 2015 Translation services–requirements for translation services.

Ivankova, N.V., Creswell, J.W. and Plano Clark, V.L., 2007. Foundations and approaches to mixed methods research. In *First steps in research. Pretoria: Van Schaik*, pp.253-282.

Jakobsen, A.L., 1999. Logging target text production with Translog. In *Copenhagen studies in language.* Samfundslitteratur, pp. 9-20.

Jiménez Raya, M., 2008. Technology-mediated professional develpoment for modern language teachers. In *Studies in honour of Neil Mclaren: a man for all seasons,* Universidad de Granada, pp. 47-58.

Jiménez Raya, M., 2013. Pedagogía de la experiencia en la universidad: Una apuesta por el espacio de lo posible en la formación para la autonomía en la profesión docente [Pedagogy of experience at the university: A commitment to the space of possibility in teacher development for autonomy]. In *Ensino para Autonomia: Inovando a Formação Profissional*, pp.93-123.

Johnson, R. and Whitelock, P., 2003. Machine translation as an expert task. In *Readings in Machine Translation*, p.233.

Joint Quality Initiative, 2004. Dublin descriptors. *JQI.-The Joint Quality Initiative Working document. Shared Dublin descriptors for the Bachelor's, Master's and Doctoral awards*.

Jonassen, D.H. and Wang, S., 1992. Acquiring structural knowledge from semantically structured hypertext. In *J. Comput.-Based Instruct., 20 (1),* pp. 1-8.

Kalchbrenner, N. and Blunsom, P., 2013. Recurrent continuous translation models. In *Proceedings of the 2013 Conference on Empirical Methods in Natural Language Processing*, pp. 1700-1709.

Kantún, M.A., 2005. El aprendizaje significativo en la formación del profesional de enfermería. *Rev Des Cientif Enferm, 13 (10),* pp.314-316.

Kelly, D., 2005. A Handbook for Translator Trainers, Translation Practices Explained Series. *Manchester: St. Jerome.*

Kenny, D. and Doherty, S., 2014. Statistical machine translation in the translation curriculum: overcoming obstacles and empowering translators. In *The Interpreter and translator trainer, 8 (2),* pp.276-294.

Kenny, D., 1998. Corpora in translation studies. In *Routledge encyclopedia of translation studies,* pp.50-53.

Kiraly, D.C., 1995. *Pathways to translation: Pedagogy and process* (No. 3). Kent State University Press.

Kiraly, D., 2000. *A social constructivist approach to translator education: Empowerment from Theory to Practice*. St. Jerome Pub.

Knapper, C. and Cropley, A.J., 2000. *Lifelong learning in higher education*. Psychology Press.

Koehn, P., 2009. *Statistical machine translation*. Cambridge University Press.

Koehn, P., 2010. *Empirical methods for splitting compound words with application to machine translation*. U.S. Patent No. 7,711,545.

Koehn, P. and Monz, C., 2006. Manual and automatic evaluation of machine translation between European languages. In *Proceedings of the Workshop on Statistical Machine Translation.* Association for Computational Linguistics, pp. 102-121.

Koehn, P. and Senellart, J., 2010. Convergence of translation memory and statistical machine translation. In *Proceedings of AMTA Workshop on MT Research and the Translation Industry,* pp. 21-31.

Koponen, M., 2012, June. Comparing human perceptions of post-editing effort with post-editing operations. In *Proceedings of the seventh workshop on statistical machine translation,* Association for Computational Linguistics, pp. 181-190.

Koponen, M., Aziz, W., Ramos, L. and Specia, L., 2012. Post-editing time as a measure of cognitive effort. In *Proceedings of WPTP*, pp.11-20.

Krings, H.P. and Koby, G.S., 2001. Repairing texts. In *Empirical Investigations of Machine Translation Post-Editing Processes.* Kent, Ohio: Kent State UP.

Kumar, S. and Phrommathed, P., 2005. *Research methodology,* Springer US, pp. 43-50.

Lagoudaki, E., 2008. The value of machine translation for the professional translator. In *Proceedings of the 8th Conference of the Association for Machine Translation in the Americas,* pp. 262-269.

Langdridge, D. and Hagger-Johnson, G., 2009. *Introduction to research methods and data analysis in psychology*. Pearson Education.

Lavorel, B., 1982. Experience in English-French post-editing. In *Lawson (ed.), Practical experience of mahine translation*, pp.105-109.

Le Boterf, G., 2000. *Construire les compétences individuelles et collectives*. Eyrolles : Livres Outils.

LeBlanc, M., 2013. Translators on translation memory (TM). Results of an ethnographic study in three translation services and agencies. In *Translation & Interpreting*, *5 (2),* pp.1-13.

LeBlanc, M., 2017. ‘I can’t get no satisfaction!’ Should we blame translation technologies or shifting business practices? In *Human issues in translation technology,* Routledge, pp. 63-80.

Ledford Jr, G.E., 1995. Paying for the skills, knowledge, and competencies of knowledge workers. *Compensation & Benefits Review, 27 (4),* pp.55-62.

Li, D., 2000. Tailoring translation programs to social needs: a survey of professional translators. *Target. International Journal of Translation Studies, 12 (1),* pp.127-149.

Locke, N.A., 2012. Navigating the Absurd. *The Big Wave of Language Technology, 2.*

Locke, N.A., 2017. Translators Training: Navigating the Absurd. Published in #*Smart Reads on the Translation Industry* (Isabella Massardo) Available at: https://massardo.com/blog/translator-training/ (Last consulted on 15.08.18)

Loffler-Laurian, A.M., 1983. Pour une typologie des erreurs dans la traduction automatique. In *Multilingua – Journal of Cross-Cultural and Interlanguage Communication*, *2 (2)*, pp.65-78.

Loffler-Laurian, A.M., 1985. Traduction automatique et style (Machine Translation and Style). *Babel: International Journal of Translation*, *31 (2)*, pp.70-76.

Lommel, A., Uszkoreit, H. and Burchardt, A., 2014. Multidimensional Quality Metrics (MQM). In *Revista Tradumàtica*, (12), pp.0455-463.

Luong, M.T., Pham, H. and Manning, C.D., 2015. Effective approaches to attention-based neural machine translation. Available at: https://arxiv.org/abs/1508.04025 (Last consulted on 06.06.2018).

MacCoun, R.J., 1998. Biases in the interpretation and use of research results. In *Annual review of psychology*, *49 (1)*, pp.259-287.

Machine Translation (MT) Market Analysis by Application (Automotive, Military & Defense, Electronics, IT, Healthcare), By Technology (Rule-Based Machine Translation (RBMT), Statistical Machine Translation (SMT)) and Segment Forecasts to 2022. Grand View Research, 2015. Available at: https://www.grandviewresearch.com/press-release/global-machine-translation-market (Last consulted on 30.04.18).

Mackiewicz, W., 2002. Lifelong foreign language learning. In *European Seminar on Foreign Language Learning Needs in Education Systems*, pp. 5-7.

Manjón, J.V.G. and López, M.D.C.P., 2008. Espacio Europeo de Educación Superior: competencias profesionales y empleabilidad. In *Revista Iberoamericana de Educación*, *46* (9), p.4.

Marinelli C., Translators Training: a Recruiter's Point of View, 2017. Published in #*Smart Reads on the Translation Industry* (Isabella Massardo) Available at: https://massardo.com/blog/translatorstraining-recruiters-point-view/ (Last consulted on 15.08.18)

Márquez, M.E., 2005. Reflexiones sobre el proceso de enseñanza-aprendizaje en la medicina desde las teorías socio históricas. In *Rev. Facultad de Medicina; 5 (1).*

Márquez, M.E., 2007. Reflexiones sobre el proceso de enseñanza-aprendizaje de la medicina desde las teorías socio históricas. In *Rev. Fac. Med*, *5 (1).*

Martin-Mor, A., and Piqué i Huerta, R. 2017. MTradumàtica i la formació de traductors en Traducció Automàtica Estadistica. In *Revista Tradumàtica (15)*, pp.97-115.

Martínez J.R., Cibanal, L. and Jesús Pérez, M., 2010. *Metodología y aprendizaje en el espacio europeo de educación superior*. Universidad de Alicante.

Martínez Martín, M., 2006. Formación para la ciudadanía y educación superior. In *Revista Iberoamericana de Educación (OEI), 2006, num. 42*, p. 85-102.

Martínez, R.A., 2010. "Spanglish" as Literacy Tool: Toward an Understanding of the Potential Role of Spanish-English Code-Switching in the Development of Academic Literacy. In *Research in the Teaching of English*, pp.124-149.

Martín-Mòr, A., Piqué, R., Sánchez-Gijón, P., 2016. *Tradumàtica. Tecnologies de la traucció*. Biblioteca de traducció i interpretació, Romanyà Valls.

Massardo, I., van der Meer, J., O'Brien, S., Hollowiid, F., Aranberri, N. and Drescher, K., 2016. *MT post-editing guidelines*. TAUS Signature Editions, Amsterdam.

Matthews, B. and Ross, L., 2010. *Research methods*. Longman/Pearson Education.

McElhaney, T. and Vasconcellos, M., 1988. The translator and the postediting experience. In *Technology as Translation Strategy,* Binghamton, NY: State University of New York at Binghamton (SUNY), pp.140-148.

McLaren, B.M., Bollen, L., Walker, E., Harrer, A. and Sewall, J., 2005, May. Cognitive tutoring of collaboration: Developmental and empirical steps towards realization. In *Proceedings of the 2005 conference on Computer support for collaborative learning: learning 2005: the next 10 years!* International Society of the Learning Sciences, pp. 418-422.

Melby, A., Fields, P., Hague, D.R., Koby, G.S. and Lommel, A., 2014. Defining the landscape of translation. In *Revista Tradumàtica, (12),* pp.0392-403.

Mertens, D.M., 2014. *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods*. Sage publications.

Mesa-Lao, B., 2013. *Introduction to post-editing.* The CasMaCat GUI. SEECAT project. Center for Research and Innovation in Translation and Translation Technology, Copenhagen Business School, Denmark.

Miedes Ugarte, B. and Galan García, A., 2006. *La aplicación del ECTS en Relaciones Laborales: un atisbo de los cambios necesarios para alcanzar la convergencia.* Actas de las Jornadas de Trabajo sobre Experiencias Piloto de Implantación del Crédito Europeo en las Universidades Andaluzas.

Miguel Díaz, M.D., 2006. *Metodologías de enseñanza y aprendizaje para el desarrollo de competencias.* Orientaciones para el profesorado universitario ante el Espacio Europeo de Educación Superior. Madrid: Alianza.

Moore, D.R., Cheng, M.I. and Dainty, A.R., 2002. Competence, competency and competencies: performance assessment in organizations. In *Work study, 51* (6), pp.314-319.

Moorkens, J., O'Brien, S., da Silva, I.A., de Lima Fonseca, N.B. and Alves, F., 2015. Correlations of perceived post-editing effort with measurements of actual effort. In *Machine Translation*, *29 (3-4),* pp.267-284.

Morin, E., 2001. *Los siete saberes necesarios para la educación del futuro*. Barcelona: UNESCO. Paidós.

Morin, A., 2002. Right hemispheric self-awareness: A critical assessment. In *Consciousness and Cognition, 11* (3), pp.396-401.

Muños Miquel, A., 2014. *El perfil del traductor médico: análisis y descripción de competencias específicas para su formación* (Doctoral dissertation, Universitat Jaume I).

Neubert, A., 2000. Competence in language, in languages, and in translation. *Benjamins Translation Library*, *38*, pp.3-18.

Neunzig, W., 1997. Der Computer als Hilfsmittel beim Erwerb kognitiver Übersetzungsstrategien. *Fleischmann, E.(ed.), 1997*, pp.377-384.

Neunzig, W., 1999. *Sobre la investigación empírica en traductología: Cuestiones epistémicas y metodológicas*.

Niño, A., 2009. Machine translation in foreign language learning: Language learners' and tutors' perceptions of its advantages and disadvantages. *ReCALL*, *21*(2), pp.241-258.

Nord, C., 1991. Scopos, loyalty, and translational conventions. *Target. International Journal of Translation Studies, 3 (1)*, pp.91-109.

Nord, C., 2013. Functionalism in translation studies. In *The Routledge Handbook of Translation Studies*, Routledge, pp. 219-230.

Nordhaug, O., 1993. *Human capital in organizations: Competence, training, and learning*. Oslo: Scandinavian university press.

Nunez Vieira, L. and Specia, L., 2011. A review of translation tools from a post-editing perspective. In *3rd joint EM+/CNGL Workshop bringing MT to the user: Research meets translators (JEC)*, pp.33-42.

O'Brien, S., 2002. Teaching post-editing: a proposal for course content. In *6th EAMT Workshop Teaching Machine Translation*, pp. 99-106.

O'Brien, S., 2006. *Machine-translatability and post-editing effort: An empirical study using Translog and Choice Network Analysis* (Doctoral dissertation, Dublin City University).

O'Brien, S., 2009. Eye tracking in translation process research: methodological challenges and solutions. In *Methodology, Technology and Innovation in Translation Process Research*, *38*, pp.251-266.

O'Brien, S., 2011. Towards predicting post-editing productivity. In *Machine translation, 25* (3), p.197.

O'Brien, S. and Saldanha, G., 2014. *Research methodologies in translation studies*. Routledge.

O'Brien, S. and Schäler, R., 2010. Next generation translation and localization: Users are taking charge. In: *Translating and the Computer 32, 18-19*, London.

O'Sullivan, C., 2007. Multilingualism at the multiplex: a new audience for screen translation? In *Linguistica Antverpiensia, New Series–Themes in Translation Studies, (6).*

OECD. 2005. The definition and selection of key competencies. Available at: https://www.oecd.org/pisa/35070367.pdf (Last consulted on 11.05.16).

Offersgaard, L., Povlsen, C., Almsten, L. and Maegaard, B., 2008. Domain specific MT in use. In *Proceedings of the 12th EAMT conference*, pp.22-23.

Olohan, M., 2007. Economic Trends and Developments in the Translation Industry: What Relevance for Translator Training?. *The Interpreter and Translator Trainer, 1 (1),* pp.37-63.

Organisation for Economic Co-operation and Development (OECD), 2005. The definition and selection of key competencies: Executive summary.

Orozco Jutorán, M., 2000. *Instrumentos de medida de la adquisición de la competencia traductora: Construcción y validación* (Tesis doctoral, Universitat Autònoma de Barcelona).

PACTE Research Group, 2000. Acquiring translation competence: hypotheses and methodological problems of a research project. In *Investigating Translation.* Amsterdam: John Benjamins, pp.99-106.

PACTE Research Group, 2014. First results of PACTE group's experimental research on translation competence acquisition: the acquisition of declarative knowledge of translation. In *MonTI. Monografías de Traducción e Interpretación*, pp.85-115.

Palomino, W., Delgado, Z. and Valcarcel, L., 1996. Enseñanza termodinámica: un enfoque constructivista. In *II encuentro de físicos en la región Inka UNSAAC,* Perú.

Pedraja, M.J., 2001. El conductismo de Edward C. Tolman: Un cordero con piel de lobo. In *Revista de Historia de la Psicología, 22 (2),* pp.135-170.

Pennock-Speck, B., 2009. European convergence and the role of ICT in English Studies at the Universitat de València: Lessons learned and prospects for the future. In *English language teaching in the European credit transfer system: Facing the challenge*, pp.169-185.

Perez Cañado, M.L. 2013. Adapting to a Competency-Based Model in Tertiary Education: Lessons Learned from the European Project ADELEEES. In *Competency-based Language Teaching in Higher Education,* ed. Perez Cañado, M.L. Jaen: University of Jaen.

Pérez Gómez, Á., 2009. *Aprender en la universidad* (Vol. 1). Ediciones Akal.

Pérez Gómez, Á., 2010. Aprender a educar. Nuevos desafíos para la formación de docentes. In *Revista interuniversitaria de formación del profesorado 24, no. 2.*

Pérez Gómez, A., Gómez, E.S., Fernández, M.S. and Núñez, M.S., 2009. *Los títulos universitarios y las competencias fundamentales: los tres ciclos*. Ediciones Akal

Perrenoud, P., 2004a. Adosser la pratique réflexive aux sciences sociales, condition de la professionnalisation. In *Éducation permanente*, *160 (3)*, pp.35-60.

Perrenoud, P., 2004b. *Diez nuevas competencias para enseñar: invitación al viaje* (Vol. 196). Graó.

Perrenoud, P., 2008. Préface. In *Compétences et contenus* (pp. 7-14). De Boeck Supérieur.

Piaget, J., 1969a. *Psicología y pedagogía*. Barcelona: Ed. Ariel.

Piaget, J., 1969b. *The mechanisms of perception*. Routledge & Kegan Paul, London.

Piaget, J., 1970. *Science of education and the psychology of the child*. The Essential Piaget. Northvale, NJ: JasonAronson.

Piqué Huerta, R. and Colominas, C., 2013. Les tecnologies de la traducció en la formació de grau de traductors i intèrprets. In *Revista Tradumàtica*, (11), pp.297-312.

Plitt, M. and Masselot, F., 2010. A productivity test of statistical machine translation post-editing in a typical localisation context. In *The Prague bulletin of mathematical linguistics*, *93*, pp.7-16.

Poblete Ruiz, M., 2006. Las competencias, instrumento para un cambio de paradigma. In *Investigación en educación matemática: actas del X Simposio de la Sociedad Española de Investigación en Educación Matemática, Huesca, 6-9 de septiembre de 2006*. Instituto de Estudios Altoaragoneses, pp. 83-106.

Popovic, M., Lommel, A., Burchardt, A., Avramidis E. and Uszkoreit, H., 2014. Relations between different types of post-editing operations, cognitive effort and temporal effort. In *Proceedings of the 17th Annual Conference of the European Association for Machine Translation (EAMT 14)*, pp.191-198.

Presas, M., 2000. *Bilingual competence and translation competence*. Benjamins Translation Library, 38, pp.19-32.

ProjecTA, 2015. *Los proyectos de traducción con traducción estadística y posedición: ProjecTA*. Póster presentado en el congreso AIETI7 Nuevos horizontes en los Estudios de Traducción e Interpretación, Málaga.

Pym, A., 2002. Training language service providers: local knowledge in institutional contexts. *Training the Language Services Provider for the New Millennium*, Porto: Universidad do Porto, pp.21-30.

Pym, A., 2003. Redefining translation competence in an electronic age. In defense of a minimalist approach. *Meta: journal des traducteurs/Meta: Translators' Journal, 48 (4),* pp.481-497.

Pym, A., 2004. *The moving text: Localization, translation, and distribution* (Vol. 49). John Benjamins Publishing.

Pym, A., 2012. Democratizing translation technologies: The role of humanistic research. In *Language and Translation Automation Conference, (1),* pp.14-29.

Pym, A., 2013. Translation skill-sets in a machine-translation age. Available at: http://usuaris.tinet.cat/apym/on-line/training/2012_competence_pym.pdf (Last consulted on 15.07.18)

Qualifications Framework in the EHEA, 2009. Available at: http://www.ehea.info/cid102842/qualifications-frameworks-in-the-ehea-2009.html (Last consulted on 15.07.18)

Ramos, L.C., 2010. Post-editing free machine translation: from a language vendor's perspective. In *Proceedings of the Conference of the American Machine Translation Association (AMTA).* Denver, CO: AMTA.

Rasinger, S.M., 2013. *Quantitative research in linguistics: An introduction*. A&C Black.

Ray, R., DePalma, D.A. and Pielmeier, H., 2013. Common Sense Advisory: The Link between Price and Translation Quality. Available at: http://www.commonsenseadvisory.com/Portals/_default/Knowledgebase/ArticleImages/130219_R_Price_Quality_Preview.pdf (Last consulted on 17.07.2016)

Rea, L. and Parker, R., 2005. Selecting a representative sample. In *Designing and conducting survey research: A comprehensive guide*, pp.157-176.

Reichardt, C.S. and Rallis, S.F., 1994. The relationship between the qualitative and quantitative research traditions. *New Directions for Evaluation (61),* pp.5-11.

Reiß, K. and Vermeer, H.J., 1984. *Grundlegung einer allgemeinen Translationstheorie* (Vol. 147). Walter de Gruyter.

Richards, J.C. and Rodgers, T.S., 2014. *Approaches and methods in language teaching*. Cambridge university press.

Rico Pérez, C. and Díez Orzas, P.L., 2013. EDI-TA: Training methodology for Machine Translation Post-editing. *Multilingualweb-LT Deliverable 4.1. 4. Annex II.*

Rico Pérez, C. and Torrejón, E., 2012. Skills and Profile of the New Role of the Translator as MT Post-editor. In *Revista Tradumàtica* (10), pp.166-178.

Rico Pérez, C., 2012. A Flexible Decision Tool for Implementing Post-editing Guidelines. In *The International Journal of Localisation. Localisation Focus. Vol.11, Issue 1*. pp.54-66.

Rico, C., 2017. The ePortfolio: constructing learning in translation technology. In *The Interpreter and Translator Trainer, 11 (1),* pp.79-95.

Robinson, D., 1991. *The translator's turn*. JHU Press.

Rodríguez Esteban, A., 2008. Las competencias en el Espacio Europeo de Educación Superior: tipologías. In *Humanismo y Trabajo Social. Volumen 006*. Universidad de León, pp.139-153.

Rojas Valenciano, L., 2006. El enfoque constructivista en el curriculum de enfermería: motivación, dificultades y demandas que enfrenta el o la docente. *Enfermería Actual en Costa Rica, 5 (9).*

Rojo, A. 2013. *Diseños y métodos en la investigación en traducción*. Editorial SINTESIS.

Rorty, R., 1979. *Philosophy and the Mirror of Nature*. Princeton University Press.

Rossi, C., 2017. Introducing statistical machine translation in translator training: from uses and perceptions to course design, and back again. In *Revista Tradumàtica* (15), pp.0048-62.

Rué, D. and Martínez, M., 2005. Las titulaciones UAB en el Espacio Europeo de Educación Superior. *Sistema Europeo de Transferencia de Créditos, Colección Eines, 1*.

Ruokonen, M. and Koskinen, K., 2017. Love letters or hate mail? Translators' technology acceptance in the light of their emotional narratives. In *Human issues in translation technology,* Routledge, pp. 26-42.

Rychen, D.S. and Salganik, L.H. eds., 2003. *Key competencies for a successful life and well-functioning society*. Hogrefe Publishing.

Sachinis, M., 2011. *Curriculum Renewal in Greek Taught Postgraduate Translation Courses: Aligning Student Needs and Translation Market Requirements.* (Doctoral thesis, Imperial College London).

Salamanca Convention 2001. *European University Association, 2001. The Bologna process and the European Higher Education Area*. Geneva: European University Association.

Saldanha, G., and O'Brien, S. 2014. *Research methodologies in translation studies*. Routledge.

Sánchez-Gijón, P. and Torres Hostench, O., 2014. MT Post-editing into the mother tongue or into a foreign language?. In *Workshop on Post-Editing Technology and Practice-AMTA.*

Sánchez-Gijón, P., 2016. La posedición: hacia una definición competencial del perfil y una descripción multidimensional del fenómeno. *Sendebar, 27*, pp.151-162.

Sandrock, U., 1982. Thinking Aloud Protocols (TAPs) – Ein instrument zur decomposition des komplexen Prozesses "Übersetzen". (*Tesis Doctoral inédita. Universität Kassel, Alemania).*

Schäfer, F., 2003. MT post-editing: How to shed light on the" unknown task" Experiences made at SAP. In *8th international workshop of the European Association for Machine Translation (EAMT 03).* Dublin City University, Dublin, Ireland, May 15-17.

Schwandt, T.A., 1994. Constructivist, interpretivist approaches to human inquiry. In *Handbook of qualitative research*, *1*, pp.118-137.

Sela-Sheffy, R., 2005. How to be a (recognized) translator: Rethinking habitus, norms, and the field of translation. In *Target. International Journal of Translation Studies, 17 (1)*, pp.1-26.

Senez, D., 1998. Post-editing service for machine translation users at the European Commission. In *Translating and the Computer*, *20*.

Sennrich, R. and Haddow, B., 2016. Linguistic input features improve neural machine translation. In *Proceedings of the First Conference on Machine Translation*, Berlin, Germany, pp.83-91.

Sennrich, R., Haddow, B. and Birch, A., 2016. Edinburgh neural machine translation systems for wmt 16. In *Proceedings of the First Conference on Machine Translation (WMT16),* Berlin, Germany.

Simard, M., Ueffing, N., Isabelle, P. and Kuhn, R., 2007. Rule-based translation with statistical phrase-based post-editing. In *Proceedings of the Second Workshop on Statistical Machine Translation.* Association for Computational Linguistics, pp. 203-206.

Smith, V.L., 2005. Racionalidad constructivista y ecológica en economía: discurso pronunciado en el acto de entrega del premio Nobel de Economía 2002. *RAE: Revista Asturiana de Economía (32),* pp.197-273.

Snell-Hornby, M., 1991. Translation studies: art, science or utopia?. *K. van Leuven-Zwart and T. Naaijkens (eds),* pp.13-23.

Snell-Hornby, M., Pöchhacker, F. and Kaindl, K. eds., 1994. *Translation Studies: An Interdiscipline: Selected papers from the Translation Studies Congress,* Vienna, 1992 (Vol. 2). John Benjamins Publishing.

Specia, L., 2011, May. Exploiting objective annotations for measuring translation post-editing effort. In *Proceedings of the 15th Conference of the European Association for Machine Translation*, pp. 73-80.

Specia, L. and Farzindar, A., 2010. Estimating machine translation post-editing effort with HTER. In *Proceedings of the Second Joint EM+/CNGL Workshop Bringing MT to the User: Research on Integrating MT in the Translation Industry (JEC 10),* pp. 33-41.

Specia, L., Raj, D. and Turchi, M., 2010. Machine translation evaluation versus quality estimation. *Machine translation*, *24 (1)*, pp.39-50.

Sutskever, I., Vinyals, O. and Le, Q.V., 2014. Sequence to sequence learning with neural networks. In *Advances in neural information processing systems,* pp. 3104-3112.

Talyzina, N.F., 1981. *The psychology of learning: Theories of learning and programmed instruction*. Progress Publishers.

Tatsumi, M., 2010. *Post-editing machine translated text in a commercial setting: Observation and statistical analysis* (Doctoral dissertation, Dublin City University).

TAUS Error Typology Guidelines, 2013. Available at: https://www.taus.net/academy/best-practices/evaluate-best-practices/error-typology-guidelines (Last consulted on 15.07.2018).

TAUS Machine Translation Market Report, 2017. Available at: https://www.taus.net/think-tank/reports/translate-reports/taus-machine-translation-market-report-2017 (Last consulted on: 30.04.2018).

Teixeira, C.S., 2014a. Perceived vs. measured performance in the post-editing of suggestions from machine translation and translation memories. In *Third Workshop on Post-Editing Technology and Practice*, p.45.

Temizöz, Ö., 2013. *Postediting machine translation output and its revision: Subject-Matter Experts versus Professional Translators* (Doctoral dissertation, Universitat Rovira i Virgili).

Terrón-López, M.J. and García-García, M.J., 2013. Assessing transferable generic skills in language degrees. In *Competency-based language teaching in higher education* Springer, Dordrecht, pp.151-167.

Thicke, L., 2011. Improving MT results: a study. *MultiLingual*, *22 (1),* p.37.

Thorndike, E.L., 1920. Intelligence and its uses. In *Harper's magazine*.

Toury, G., 1995. *Descriptive Translation Studies and beyond: revised edition* (Vol. 100). John Benjamins Publishing.

Tudor, I., 2006. *Trends in higher education language policy in Europe: The case of English as a language of instruction*. Communication à un colloque: Challenges of Multilingual Societies', 9-10 juin: ECORE, Université Libre de Bruxelles.

Tuning General Brochure. Final Version. 2007. Available at: http://www.unideusto.org/tuningeu/images/stories/documents/General_Brochure_final_version.pdf (Last consulted on 11.05.16).

Turchi, M., Negri, M. and Federico, M., 2014. Data-driven annotation of binary MT quality estimation corpora based on human post-editions. IN *Machine translation*, *28 (3-4)*, pp.281-308.

Turchi, M., Negri, M. and Federico, M., 2015. MT Quality Estimation for Computer-assisted Translation: Does it Really Help? In *Proceedings of the 53rd Annual Meeting of the Association for Computational Linguistics and the 7th International Joint Conference on Natural Language Processing (Volume 2: Short Papers)* (Vol. 2), pp.530-535.

Van Dam, H. and Zethsen, K.K., 2010. Translator status: Helpers and opponents in the ongoing battle of an emerging profession. In *Target. International Journal of Translation Studies*, *22 (2),* pp.194-211.

Vasconcellos, M., 1986. Functional considerations in the postediting of machine-translated output. In *Computers and translation*, *1 (1),* pp.21-38.

Vasconcellos, M., 1987. A comparison of MT post-editing and traditional revision. In *Proceedings of the 28th Annual Conference of the American Translators Association,* Medford, NJ: Learned Information, pp.409-415.

Vashee, K., 2013. Understanding the economics of machine translation. In *Translation Spaces*, *2 (1),* pp.125-149.

Veale, T. and Way, A., 1997. Gaijin: A bootstrapping, template-driven approach to example-based MT. In *Proc. of the NeMNLP97*.

Vehovar, V. and Manfreda, K.L., 2008. Overview: online surveys. In *The SAGE handbook of online research methods,* pp.177-194.

Vié, A., Villarejo Muñoz, L., O'Regan, J. and Farrús Cabecerán, M., 2011. *Apertium Advanced Web Interface: A first step towards interactivity and language tools convergence.* International Workshop on Free/Open-Source Rule-Based Machine Translation, Barcelona.

Vié, B., Nuissier, O. and Ducrocq, V., 2011. Cloud-resolving ensemble simulations of Mediterranean heavy precipitating events: uncertainty on initial conditions and lateral boundary conditions. In *Monthly Weather Review*, *139 (2),* pp.403-423.

Vigier Moreno, F.J., 2007. *El nombramiento de Intérprete Jurado de Inglés mediante acreditación académica: estudio de la formación específica en España*. Trabajo de investigación tutelar: Universidad de Granada.

Vigier Moreno, F.J., 2010. *El nombramiento de traductores-intérpretes jurados de inglés mediante acreditación académica: descripción de la formación específica y del grado de satisfacción de los egresados*. Universidad de Granada.

Villa, A., and Poblete, M., 2007. *Aprendizaje basado en competencias. Una propuesta para la evaluación de las competencias genéricas.* Bilbao: Ediciones Mensajero.

Villa, V., 2011. *Constructivismo y teorías del derecho*. Universidad Nacional Autónoma de México.

Visauta, B., 1989. La entrevista. In *Técnicas de investigación social*, *1,* pp.235-257.

Wagner, E., 1985. Rapid post-editing of Systran. In *Tools for the Trade, Translating and the Computer*, *5*, pp.199-213.

Wagner, E., 2010. Survey research. In *Continuum companion to research in applied linguistics*, edited by B. Paltridge, and A. Phakiti, pp. 22–38.

Wellmon, C., 2008. Languages, cultural studies, and the futures of foreign language education. In *The Modern Language Journal*, *92 (2)*, pp.292-295.

Wolf, M., 2011. Mapping the field: Sociological perspectives on translation, Available at: https://www.degruyter.com/view/j/ijsl.2011.2011.issue-207/ijsl.2011.001/ijsl.2011.001.xml (Last consulted on 28.09.2016).

Wolf, M. and Fukari, A. eds., 2007. *Constructing a sociology of translation* (Vol. 74). John Benjamins Publishing.

Wu, Y., Schuster, M., Chen, Z., Le, Q.V., Norouzi, M., Macherey, W., Krikun, M., Cao, Y., Gao, Q., Macherey, K. and Klingner, J., 2016. Google's neural machine translation system: Bridging the gap between human and machine translation. Available at: https://arxiv.org/abs/1609.08144 (Last consulted on 08.07.2018).

Yániz, C., 2008. *Las competencias en currículo universitario: implicaciones para diseñar el aprendizaje y para la formación del profesorado*. Revista de docencia universitaria.

Zabalza, M.A., 2003. *Trabajar por competencias: implicaciones para la práctica docente.* ICE. Programa de Formación de profesores noveles. Universidad de Santiago de Compostela. Santiago de Compostela.

Zabalza, M.A., 2004. *Guía para la planificación didáctica de la docencia universitaria en el marco del EEES*. Documento de trabajo.

Zabalza, M.A., 2009. *O ensino universitário*. Artmed Editora.

Zabalza, M.Á., 2016. Ser profesor universitario hoy. In *La cuestión universitaria (5),* pp.68-80.

Zampieri, M. and Vela, M., 2014. Quantifying the Influence of MT Output in the Translators' Performance: A Case Study in Technical Translation. In *Proceedings of the EACL 2014 Workshop on Humans and Computer-assisted Translation*, pp. 93-98.

Zaretskaya A., 2017. Machine Translation PostEditing at TransPerfect – the ‘Human’ Side of the Process. In *Revista Tradumatica (15),* pp.116-123.

Zetzsche, J., 2012. *MT Post-Editing Made Easy*. The Tool Box. Premium Edition.

Zhechev, V., 2014. Analysing the post-editing of machine translation at Autodesk. In *Post-Editing of Machine Translation: Processes and Applications.* Newcastle upon Tyne: Cambridge Scholars Publishing, pp.2-23.

Appendices

Appendix I. Sharing Post-Editing Practices (the questionnaire)

Link I.1.
https://www.surveymonkey.com/r/Preview/?sm=A6RIjglOBuoncTZNdlA_2B1JnugsK6TuhX2xn2gv8U5JxMiHiQr3GpfyEvaeWHJmQ1

Appendix II. Pilot study results

Table II.1. Pilot study (PE performance)

	TS 1				**TS 2**			
	Ffp. segm.	**Over.ed. segm.**	**Under.ed. segm.**	**WPH rate**	**Ffp. segm.**	**Over.ed. segm.**	**Under.ed. segm.**	**WPH rate**
Subject 1	14	1	5	514	12	0	8	1489
Subject 2	9	6	5	722	12	1	7	2010
Subject 3	11	4	5	738	14	5	1	868
Subject 4	12	3	5	628	14	2	4	920
Subject 5	5	8	7	638	16	1	3	1164
Subject 6	4	13	3	974	18	0	2	2581
Subject 7	5	7	8	689	12	0	8	1247
Subject 8	7	5	8	780	11	5	4	1582
Mean	**8,4**	**5,9**	**5,8**	**710,4**	**13,6**	**1,8**	**4,6**	**1482,6**

Table II.2. Pilot study (the questionnaire)

Q.1: What is your attitude regarding the usage of MT in translation/localization industry? (1 – very negative, 2 – negative, 3 – positive, 4 – very positive)

Q.2: Do you agree with this statement: "Machine translated and post-edited output of less-than-maximum quality is good enough to be delivered to the client as a complete job"? (1 – a strongly disagree, 2 – a disagree, 3 – I agree , 4 – I fully agree)

Q.3: As a novice translator, would you be interested in performing PE jobs on a regular basis? (1 – no, 2 – rather not, 3 – maybe yes, 4 – yes)

	Q.1		**Q.2**		**Q.3**	
	TS 1	**TS 2**	**TS 1**	**TS 2**	**TS 1**	**TS 2**
Subject 1	3	3	1	2	1	1
Subject 2	4	3	2	3	2	2
Subject 3	3	3	2	1	2	1
Subject 4	3	3	1	1	3	3
Subject 5	3	2	3	3	2	2
Subject 6	3	3	2	2	2	1
Subject 7	3	3	3	2	3	2
Subject 8	3	3	3	3	3	2

Appendix III. Experimental study corpus, instruments and tools

Table III.1.1. Evaluation assignments (EN-RU, TS 1 and TS 2)

Segm. nr.	Source segment	Target segment (Raw MT for evaluation)
TS 1		
1	While certified hardware does not guarantee a particular system will meet your particular needs, it does reflect that the hardware supports the advanced features in the latest release.	При сертифицированного аппаратного обеспечения конкретной системы не будет соответствовать конкретному случаю, это означает, что аппаратное обеспечение, поддерживающий расширенный элемент в последней версии.
2	Changing the locations of the features with the Properties window	Изменение местоположений элементов с помощью окна свойств
3	The document file size may be large.	Документ размер файла может быть большими.
4	Unlike at attach time, the system does not warn you of a coordinate system mismatch when you do this change.	В отличие от во время вставки, система не отображать предупреждение, системы координат несоответствие при этом изменяется.
5	A similar situation occurs if you change the GIS coordinate system of the host drawing or referenced drawing.	Подобная ситуация возникает при изменении ГИС систему координат Файл-владелец чертежа или чертеж внешней ссылки.
6	You may need to restart AutoCAD to activate the plug-in.	Возможно, для активации модуля нужно будет перезапустить AutoCAD.
7	This paragraph must replace the preceding paragraph if the ECO for the warning is approved.	Это Абзац необходимо заменить перед абзацем, если для предупреждение утверждения запроса на изменение.
8	Because of the coordinate system mismatch, the points in the referenced drawing file do not transform to the coordinate system of the host drawing.	Так как несоответствие системы координат точки в связанный файл чертежа не преобразование системы координат Файл-владелец чертежа.
9	Case 1: No geographic location is assigned to the drawing file.	Случай 1. Файлу чертежа не назначено географическое местоположение.
10	Assign the geographic location again, using the current version of AutoCAD.	Необходимо повторно назначить географическое местоположение с использованием текущей версии AutoCAD.
TS 2		
1	Case 2: The geographic location was assigned to the drawing file using an earlier version of AutoCAD.	Случай 2. Географическое местоположение назначено файлу чертежа с использованием более ранней версии AutoCAD.
2	It is not possible to test all combinations of hardware that can go into a computer, if your hardware is not listed, it does not mean it cannot run the latest release of an AutoCAD-based product.	Невозможно проверить все комбинации оборудование, можно перейти на компьютере, если оборудование не указан в списке, он не означает, что невозможно выполнить последней версии продукта,

		основанного на AutoCAD.
3	A default color scheme based on LAS classification values is provided.	Предоставляется цветовая схема по умолчанию с учетом заданных значений классификации LAS.
4	The Design Feed panel opens and the view changes to the way it was when the comment was posted.	Откроется панель для проектирования и изменения вида на версию, которая была в хранилище при комментарий был размещен.
5	When the Featured Apps tab plug-in has been installed, a new tab is available on the ribbon.	При установке подключаемого модуля вкладки "Активные приложения" на ленте появляется новая вкладка.
6	You may need to restart AutoCAD to activate the plug-in.	Возможно, для активации модуля нужно будет перезапустить AutoCAD.
7	Login to Autodesk 360, or create an account, if necessary.	Выполните вход в Autodesk 360 или, если нужно, создайте учетную запись.
8	Depending on the document file type, not all comment types may be available.	В зависимости от типа файла документа не все типы "Комментарий".
9	In the Design Feed panel, each comment is numbered in the order posted and shows the type of comment:	В проекте " подачи каждого комментария не нумеруются в порядке, размещенные и отображает тип комментарий:
10	You may need to restart AutoCAD to activate the plug-in.	Возможно, для активации модуля нужно будет перезапустить AutoCAD.

Table III.1.2. Post-editing assignments (EN-RU, TS 1 and TS 2)

Segm. nr.	**Source segment**	**Target segment (Raw MT for post-editing)**
TS 1		
1	To Work With Pressing or Pulling Bounded Areas	Работа со сжатием или вытягиванием ограниченных областей
2	Create a Solid Object by Pressing or Pulling a Bounded Area	Создание твердотельного объекта путем сжатие или вытягивание ограниченной области
3	Rendered images take longer to process, but the image quality is better.	Визуализированные изображения обрабатываются дольше, но качество изоброжения лучше.
4	For custom routines, the CTAB system variable can also be useful.	Для выполнения рутинных пользовательских операций системная переменная CTAB можно использовать, также.
5	Displays the file tabs in the application.	Отображение вкладок в окне приложения.
6	In the Geographic Location dialog box, in the Search box, type the name of a landmark near your location and click Search.	В диалоговом окне "Географическое положение", в поле поиска введите название ориентира вблизи нужного местоположения и щелкните "Поиск".
7	The 3D Warehouse browser may have problems connecting to the internet, if your network uses a proxy server that	При подключении обозревателя 3D-хранилища к Интернету могут возникнуть проблемы, если в сети используется

	requires authentication.	прокси-сервер требует проверки подлинности.
8	Click Open to import the file as a block.	Щелкните "Открыть", чтобы импортировать файл в виде блока.
9	Closes the Point Cloud Manager palette.	Закрытие палитры Диспетчера облака точек.
10	Specifies geographic location information for a drawing file.	Задание информации о географическом положении для файла чертежа.
11	{1}Image tab {2}Clipping panel {3}Create Clipping Boundary{4}. {5}	{1}Вкладка "Изображение" {2}панель "Осечение" {3}Создать контур подрезки{4}.{5}
12	Multi-functional grip options are not available.	Параметры многофункциональных ручек недоступен.
13	On the Command line, you can search for named objects such as blocks, hatches, layers, or styles, and then initiate an appropriate action by selecting them.	В командной строке можно выполнить поиск именованные объекты, такие как блоки, штриховки, слои или стили, а затем запустить соответствующую операцию, выбрав нужный объект.
14	Click {1}Insert tab {2}Reference panel {3}> External References{4}.	Выберите {1}вкладка "Вставка" {2}панель "Ссылка" {3} "Внешние ссылки"{4}.
15	To Work with the Coordinate Display on the Status Bar	Работа с отображения координат в строке состояния
16	The current drawing is associated with one or more standards (DWS) files.	Текущий чертеж связан с одним или несколькими файлами стандартов (DWS).
17	Inserts a position marker at the position corresponding to your current location.	Вставляет маркер в положение, соответствующее текущее местоположение.
18	As much as possible, layer names are kept the same.	По возможности сохраняются имена слоев.
19	Follow these steps to access more linetypes:	Выполните следующие действия, чтобы получить доступ к несколько типов линий:
20	After the drawing is uploaded to Autodesk 360, a URL is generated for the drawing.	После того, как чертеж загружен в Autodesk 360, будет сгенерирован URL-адрес .
TS 2		
1	While the command is active, right-click to display additional options from a context menu.	При активной команде щелкните правой кнопкой мыши для отображения контекстного меню с дополнительными параметрами.
2	Right-click the layout, and click Page Setup Manager.	Щелкните лист правой кнопкой мыши и выбрать "Диспетчер параметров листов".
3	Switching between color schemes is not available in some AutoCAD-based products.	Переключение между Цветовыми схемами доступно в некоторых продуктах на основе AutoCAD.
4	Displays the map as a series of satellite images.	Отображение карты в виде последовательности спутниковые изображения.
5	The exact size of the text box is not critically important.	Точный размер текста critically важно.
6	For quick access to the most common properties, use the Properties panel on the Home tab.	Для быстрого доступа к наиболее обычным свойствам, используйте панель "Свойства" на вкладке "Главная".

7	On the Featured Apps tab, click an App button on the ribbon tab.	На вкладке "Активные приложения", нажмите кнопку "Приложение" на вкладку ленты.
8	Enter the time in seconds or fractions of a second.	Введите время в секундах или дробей в секунду.
9	In the Geographic Location dialog box, enter the values in the Latitude and Longitude boxes.	В диалоговом окне "Географическое положение" введите значения в поле "Широта" и "Долгота".
10	Stylizes each point based on the intensity value of the point.	Стилизация каждой точки с учетом значения интенсивности для данной точки.
11	{1}Annotate tab{2}Dimensions panel {3}Update{4}. {5}	{1}Вкладка "Аннотации"{2}панель "Размеры"{3}Обновить{4}. {5}
12	The Featured Apps tab displays an RSS feed of featured or suggested apps.	На вкладке "Активные приложения" отображаются RSS-канала активных или рекомендуемых приложений.
13	Controls the shadows displayed in the scene.	Управление тени отображается в сцене.
14	{1}Windows XP:{2} Click Start menu {3} Programs {4} Autodesk {5}<Product Name>{6} Reset Settings to Default.	{1}Windows XP: {2} выберите меню "Пуск" {3} "Программы" {4} Autodesk {5}<имя продукту> {6} "Восстановить параметры по умолчанию".
15	You can change any of these properties by clicking and changing its setting.	Можно изменить любое из этих свойств, щелкнув изменения его настройку.
16	In the Sheet Set Manager, Sheet List tab, click the sheets and subsets to include in the sheet selection.	В Диспетчере подшивок на вкладке "Список листов" выберите листы и группы листов, которые требуется включить в набор листов.
17	The current text style is displayed at the top of the drop-down list.	Текущий стиль текста шаблона отображается в верхней части списка.
18	If necessary, login to Facebook.	При необходимости выполните вход в Facebook.
19	Do one of the following to complete the offset:	Выполните одно из следующих действий для выполнения смещения:
20	In the Sheet Set Manager, Sheet List tab, open the sheet that you want to reassociate.	На вкладке "Список листов" Диспетчера подшивок откройте лист, который требуется прикрепить.

Link III.1.3. Remote training (EN-RU)
https://docs.google.com/spreadsheets/d/1u3w9EG5WCsmukmvHW6JJbolk8G-HDk85-rjTyer2N-M/edit?usp=sharing

Table III.2.1. Evaluation assignments (EN-ES, TS 1 and TS 2)

Segm. nr.	**Source segment**	**Target segments (Raw MT for evaluation)**
TS 1		
1	Click inside the closed shape or object and drag the cursor through the interior	Haga clic dentro de la forma cerrada o el objeto y arrastre el cursor en el interior del

	of the 3D solid object to create the hole.	objeto sólido 3D para crear el agujero.
2	If no colors are captured with the scan, grayscale colors are inferred based on the exiting algorithm.	Si no hay colores se capturan con la exploración, escala de grises, los colores se deducen según el algoritmo de salida.
3	AutoCAD 2007 and earlier releases did not support annotative objects.	AutoCAD 2007 y más pronto liberación no apoya objetos anotativos.
4	You can change the orientation of the geographic marker (geo marker) without changing its coordinates.	Puede modificar la orientación del marcador geográfico (GEO marcador) sin cambiar sus coordenadas.
5	In the Select SKP File dialog, navigate to and select a SketchUp file in a local or shared folder.	En el cuadro de diálogo Seleccionar archivo SKP, busque y seleccione un archivo de SketchUp en una unidad local o una carpeta compartida.
6	In the Design Feed panel, each comment is numbered in the order posted.	En el diseño del armario de alimentación, cada comentario se numeran en el orden.
7	If you are connected to the Internet, you can use an online mapping service to pick a geographical location from a map.	Si está conectado a Internet, puede utilizar una línea de servicio de cartografía para designar una ubicación geográfica en un mapa.
8	You can track the current location only if you have assigned a geographical location to the drawing file.	Puede realizar un seguimiento de la ubicación actual sólo si ha asignado una ubicación geográfica del archivo de dibujo.
9	Uses named plot style tables (STB) in the current drawing	Utiliza tablas de estilos de trazado guardados (STB) en el dibujo actual
10	If you move, the my current location indicator also moves.	Si mueve el indicador de Mi ubicación actual también se mueve.
TS 2		
1	Provides highlighted edges by darkening groups of points that are inferred to lie on the same plane.	Proporciona bordes resaltados de oscurecimiento de grupos de puntos que se deduce que se encuentren en el mismo plano.
2	The Feature Apps tab uses a filter to hide featured apps that you may already have installed.	La Cuenta de anexos de propiedades utiliza un filtro para ocultar los usos presentados, que ya puede haber definido.
3	The following photometric properties can be set with the Properties Inspector palette:	La propiedad fotométrica de mantener se puede establecer con la paleta del inspector de propiedades:
4	The following table lists the disciplines available for Revit in the Autodesk Building Design Suite.	La siguiente tabla enumera la lista de esquemas de pedidos disponibles para los diseños revit disponibles en la construcción de autodesk.
5	The system inserts a position marker on the current layer, at the coordinates corresponding to the imported location.	El sistema coloca la posición en el marcador en la capa actual, las coordenadas y las importaciones.
6	Controls whether the render is targeted at a render level or a certain amount of time.	Gestionado, si la cuota se paga en una cierta cantidad de pago o una cantidad de tiempo especificada.
7	Create realistic natural detail and painterly effects.	Crear detalles naturales realistas y efectos pictóricos.
8	Furthermore, this command works only if you have assigned a geographic location to your drawing.	Además, este comando sólo funciona si ha asignado una ubicación geográfica en un dibujo.
9	The map is available only when you are connected to the Internet.	El mapa sólo está disponible cuando se está conectado a Internet.

10	Create and edit UVs, normals, and color-per-vertex data.	Creación y edición de UV, normales y color por vértice.

Table III.2.2. EN-ES - post-editing assignments (TS 1 and TS 2)

Segm. nr.	Source segment	Raw MT (for post-editing)
TS 1		
1	Create a solid object by pressing or pulling a bounded area	Crear un objeto sólido pulsando en un área delimitada
2	Rendered images take longer to process, but the image quality is better.	Las imágenes modelizadas tardan más en procesarse, pero la calidad es superior.
3	For custom routines, the CTAB system variable can also be useful.	Para rutinas personalizadas, la variable de sistema CTAB también pueden ser útiles.
4	Displays the file tabs in the application.	Muestra las fichas en la aplicación.
5	In the Geographic Location dialog box, in the Search box, type the name of a landmark near your location and click Search.	En el cuadro de diálogo Ubicación geográfica, en el cuadro de búsqueda, escriba el nombre de una landmark cercana a su ubicación y haga clic en Buscar.
6	Inserts a position marker in model space, at the position corresponding to your current location.	Inserta un marcador de posición en el espacio modelo, en la posición correspondiente a su ubicación actual.
7	Specifies geographic location information for a drawing file.	Especifica la información de ubicación geográfica de un archivo de dibujo.
8	{1}Image tab {2}Clipping panel {3}Create Clipping Boundary{4}. {5}	{1}Ficha {2}grupo Delimitación {3}Crear contorno delimitador{4}. {5}
9	Click to specify slot width, or enter diameter or radius of the slot arcs.	Haga clic para especificar anchura de ranura o escriba el diámetro o el radio de los arcos de la ranura.
10	Click {1}Insert tab {2}Reference panel {3}> External References{4}.	Haga clic en la {1}ficha Insertar {2}grupo Referencia {3}> referencias externas{4}.
11	To work with the coordinate display on the status bar	Para modificar la visualización de las coordenadas en la barra de estado
12	The current drawing is associated with one or more standards (DWS) files.	El dibujo actual está asociado con uno o más archivos de normas (DWS).
13	Inserts a position marker at the position corresponding to your current location.	Inserta un marcador de posición en la posición correspondiente a su ubicación actual.
14	About Searching for Content by Name	Acerca de la búsqueda de contenido por nombre
15	Follow these steps to access more linetypes:	Siga estos pasos para acceder a varios tipos de línea:
16	After the drawing is uploaded to Autodesk 360, a URL is generated for the drawing.	Una vez que se haya cargando el dibujo en Autodesk 360, se generará una dirección URL para el mismo.
17	The 3D-Warehouse browser may have problems connecting to the internet.	El navegador 3D-Warehouse puede tener problemas para conectarse a Internet.
18	Tap the Ctrl key to switch to face extrusion, which presses or pulls the face	Pulse la tecla Ctrl para cambiar a la cara de extrusión, que presiona o tira sin que esto

	without affecting adjacent geometry.	afecte a las caras adyacentes de la geometría.
19	This paragraph must replace the preceding paragraph if the ECO for the warning is approved.	Este párrafo debe sustituir al párrafo anterior si la aprobación de ECO por la advertencia.
20	Click a closed object such as a circle and move the cursor to establish an extrusion direction.	Haga clic en un objeto cerrado, como un círculo y mueva el cursor para establecer una dirección de extrusión.
TS 2		
1	While the command is active, right-click to display additional options from a context menu.	Cuando el comando esté activo, haga clic con el botón derecho para mostrar más opciones en un menú contextual.
2	Right-click the layout, and click Page Setup Manager.	Haga clic con el botón derecho en la presentación y seleccione Administrador de configuraciones de página.
3	Switching between color schemes is not available in some AutoCAD-based products.	Cambiar entre los esquemas de color está disponible en determinados productos basados en AutoCAD.
4	Displays the map as a series of satellite images.	Muestra el mapa como una serie de imágenes de satélite.
5	The exact size of the text box is not critically important.	El tamaño exacto del cuadro de texto no es critically importante.
6	For quick access to the most common properties, use the Properties panel on the Home tab.	Para acceder rápidamente a la mayoría de las propiedades comunes, utilicen el panel Propiedades de la ficha Inicio.
7	On the Featured Apps tab, click an App button on the ribbon tab.	En la ficha Apps, haga clic en el botón App de la ficha cinta.
8	{1}Stylizes each point based on the intensity value of the point.	{1}Stylizes cada punto basado en el valor de intensidad del punto.
9	{1}Annotate tab{2}Dimensions panel {3}Update{4}. {5}	{1}ficha Anotar{2}grupo Cotas {3}Actualizar{4}. {5}
10	The Featured Apps tab displays an RSS feed of featured or suggested apps.	La pestaña apps Featured muestra un feed RSS de las aplicaciones ofrecidas o sugeridas.
11	Controls the shadows displayed in the scene.	Controla las sombras mostradas en la escena.
12	{1}Windows XP:{2} Click Start menu {3} Programs {4} Autodesk {5}<Product Name>{6} Reset Settings to Default.	{1}Windows XP:{2} haga clic en el menú Inicio {3} Programas {4} Autodesk {5}< nombre de producto >{6} Restablecer parámetros por defecto.
13	You can change any of these properties by clicking and changing its setting.	Se puede cambiar cualquiera de estas propiedades haciendo clic y cambiar su configuración.
14	Use this method to attach a point cloud file without using a dialog box interface.	Utilice este procedimiento para enlazar un archivo de nube de puntos sin mediante una interfaz de cuadro de diálogo.
15	In the Geographic Location dialog box, enter the values in the Latitude and Longitude boxes.	En el cuadro de diálogo Ubicación geográfica, escriba los valores en los cuadros latitud y longitud.
16	In the Sheet Set Manager, Sheet List tab, open the sheet that you want to reassociate.	En el Administrador de conjuntos de planos, ficha Lista de planos, abra el plano que desee reasociar.

17	A similar situation occurs if you change the GIS coordinate system of the host drawing or referenced drawing.	Una situación similar se produce si cambia el sistema de coordenadas SIG del host o de dibujo del dibujo de referencia.
18	The TILEMODE system variable can have the same results as the MODEL and LAYOUT commands.	La variable de sistema TILEMODE puede tener los mismos resultados que el modelo y comandos de composición.
19	This permits text editing, program debugging, and interaction with AutoCAD and other applications.	Esto permite la edición de texto, el programa la depuración, y la interacción con AutoCAD y otras aplicaciones.
20	Uses color-dependent plot style tables (CTB) in the current drawing	Utiliza tablas de estilos de trazado dependientes de color (CTB) en el dibujo actual.

Link III.2.3. Remote training (EN-ES):

https://docs.google.com/spreadsheets/d/1Jwg4bGdYGwYwp_tzZ7NVKyBADiUv97M8d8yOfjZXeEI/edit?usp=sharing

Table III.3. Testing session instructions

Project brief	At this stage of the study you are asked to complete two tasks using a DQF tool: 1. an evaluation task (20 segments, 205 words); 2. a post-editing task (20 segments, 227 words). In your e-mail box, you will find two links to TAUS DQF tool, one for the evaluation task and the other one for the post-editing task. All segments are taken from Post-Editing Data corpus of Autodesk (multinational software corporation). While performing the assignments you may refer to any sources you consider useful for clarifying doubts about any issues with meaning, form and function of source and/or target TUs that might arise.
Project objectives	Task 1 – evaluation of PE The main objective of this assignment is to evaluate Adequacy and Fluency. Adequacy means the (scope of) meaning expressed in the target translation as compared to the source. The scale for Adequacy evaluation includes four choices: Everything – Most – Little – None. Fluency means the extent to which the translation is error-free and is perceived as natural/intuitive by a native speaker. The scale for Frequency evaluation includes four choices: Flawless – Good – Disfluent – Incomprehensible.

	Task 2 – performing PE The required level of output quality for this task is “publishable/human-like” quality. This means that your objective is to make sure the MTPE output is understandable, grammatically correct and conveys the original meaning.
PE guidelines	1. Accuracy (problems with source-to-target meaning transfer): cases of mistranslation, addition and/or omission, untranslated segments/words. 2. Language (problems with the target language): morphology (agreement in number/gender, POS, cases), verb forms (tense/mood/aspect, etc.), syntax (wrong word order of a sentence/phase), orthography (capitalization, spelling, hyphenation etc.), punctuation and “noise” (incorrect/missing/extra function words/symbols, e.g. prepositions or punctuation marks), etc.

Link III.4. Presentation: The Art of Post-Editing :
https://docs.google.com/presentation/d/1E1r_gaQGXCenuCS67qH9QibuauwIWWo__C9_sBwcrEk/edit#slide=id.p1

Link III.5.1. Testing session 1 - Questionnaire:

https://docs.google.com/forms/d/e/1FAIpQLScABgK_tqWsoJwd6uReyM2WyC7zKVNyc8VyXfX_tqoYQMqO7g/viewform

Link III.5.2. Testing session 2 - Questionnaire:
https://docs.google.com/forms/d/e/1FAIpQLSdbrD2cQ6rItVE2jgN8lA89kGTAHm2Tog9mDpTQXelm4naxyA/viewform

Appendix IV. PE Performance results

Table IV.1. Throughput values

Participant	TS 1	TS 2	TS 1	TS 2
	Group 1		Group 2	
G1_01	1439	1436	950	1594
G1_02	960	1206	1822	2422
G1_03	488	643	862	1629
G1_04	1173	1613	2177	2685
G1_05	1159	1755	689	1325
G1_06	812	2351	972	1619
G1_07	663	1334	1012	1359
G1_08	1311	2468	999	1638
G1_09	1522	2324	1456	1929
G1_10	896	1458	1276	1678
G1_11	1060	1672	779	1235
G1_12	364	2547	905	1623
G1_13	481	1203	1622	1890
G1_14	897	941	1232	1647
G1_15	869	1363	732	1144
G1_16	736	1365	2432	2962
G1_17	1045	976	1533	2673
G1_18	2210	2985	1282	1637
G1_19	1550	1632	897	1427
G1_20	1129	1531	1331	2411
G1_21	1120	1894	1324	2017
G1_22	826	1304	1076	2291
G1_23			1538	1741
G1_24			978	1623

Table IV.2. Output quality (Group 1)

Participant	TS1_un	TS2_un	TS1_fit	TS2_fit	TS1_ov	TS2_ov
G1_01	7	6	11	14	2	0
G1_02	7	4	10	14	3	2
G1_03	3	3	11	15	6	2
G1_04	5	4	13	15	2	1
G1_05	5	5	14	13	1	2
G1_06	5	5	13	11	2	4
G1_07	5	7	9	10	6	3
G1_08	7	6	12	12	1	2
G1_09	9	5	9	10	2	5
G1_10	7	3	9	12	4	5
G1_11	6	4	13	12	1	4
G1_12	5	3	12	14	3	3
G1_13	7	3	12	14	1	3
G1_14	6	5	14	15	0	0
G1_15	8	5	11	13	1	2
G1_16	9	3	10	12	1	5
G1_17	6	5	11	15	3	0
G1_18	3	2	15	15	2	3
G1_19	6	6	12	13	2	1
G1_20	8	8	8	10	4	2
G1_21	7	4	10	15	3	1
G1_22	1	10	15	10	4	0

Table IV.3. Output quality (Group 2)

Participant	TS1_un	TS2_un	TS1_fit	TS2_fit	TS1_ov	TS2_ov
G2_01	5	7	9	12	6	1
G2_02	5	1	11	14	4	5
G2_03	5	5	8	14	7	1
G2_04	7	6	13	10	0	4
G2_05	3	2	4	18	13	0
G2_06	1	8	7	10	12	2
G2_07	5	4	13	14	2	2

G2_08	8	5	4	14	8	1
G2_09	9	11	10	6	1	3
G2_10	9	7	9	10	2	3
G2_11	5	4	12	14	3	2
G2_12	5	9	13	8	2	3
G2_13	7	3	5	16	8	1
G2_14	6	7	4	7	10	6
G2_15	4	12	11	7	5	1
G2_16	7	0	13	11	0	9
G2_17	4	6	9	11	7	3
G2_18	5	8	14	12	1	0
G2_19	10	6	7	8	3	6
G2_20	6	10	9	9	5	1
G2_21	4	6	11	13	5	1
G2_22	11	3	8	16	1	1
G2_23	8	8	5	12	7	0
G2_24	7	5	9	11	4	4

Appendix V. Statistical inferences of WPH rates

Image V.I. Test of normality (WPH rate, Group 1)

```
      Pearson chi-square normality test

ıta:  WPH_TS.1
 = 2.1818, p-value = 0.7024


 normalityTest(~WPH_TS.2, test="pearson.test", data=Dataset)

      Pearson chi-square normality test

ıta:  WPH_TS.2
 = 7.2727, p-value = 0.1222
```

Image V.2. Contrast of hypotheses (WPH rate, Group 1)

```
        Paired t-test

data:  WPH_TS.1 and WPH_TS.2
t = -5.4754, df = 21, p-value = 0.000009843
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
      -Inf -414.2756
sample estimates:
mean of the differences
              -604.1364
```

Image V.3. Test of normality (WPH rate, Group 2)

```
        Pearson chi-square normality test

data:  WPH_TS.1
P = 6.6667, p-value = 0.2466


> normalityTest(~WPH_TS.2, test="pearson.test", data=Dataset)

        Pearson chi-square normality test

data:  WPH_TS.2
P = 18, p-value = 0.002946
```

Image V.4. Contrast of hypotheses (WPH rate, Group 2)

```
        Wilcoxon signed rank test with continuity correction

data:  WPH_TS.1 and WPH_TS.2
V = 0, p-value = 0.000009702
alternative hypothesis: true location shift is less than 0
```

Image V.5. Test of normality (WPH rate, Groups 1 and 2)

```
        Pearson chi-square normality test

data:  WPH1
P = 7.4783, p-value = 0.3808


> normalityTest(~WPH2, test="pearson.test", data=Dataset)

        Pearson chi-square normality test

data:  WPH2
P = 26.174, p-value = 0.0004689
```

Image V.6. Contrast of hypothesis (WPH rate, Groups 1 and 2)

```
        Wilcoxon signed rank test with continuity correction

data:  WPH1 and WPH2
V = 4, p-value = 0.000000002369
alternative hypothesis: true location shift is less than 0
```

Appendix VI. Statistical inferences of under-edited segments

Image VI.1. Test of normality (under-edited segments, Group 1)

```
        Pearson chi-square normality test

data:  TS.1_un
P = 7.9091, p-value = 0.09497

> normalityTest(~TS.2_un, test="pearson.test", data=Dataset)

        Pearson chi-square normality test

data:  TS.2_un
P = 8.5455, p-value = 0.07352
```

Image VI.2. Contrast of hypothesis (under-edited segments, Group 1)

```
        Paired t-test

data:  TS.1_un and TS.2_un
t = 1.8972, df = 21, p-value = 0.03582
alternative hypothesis: true difference in means is greater than 0
95 percent confidence interval:
 0.1099235       Inf
sample estimates:
mean of the differences
               1.181818
```

Image VI.3. Test of normality (under-edited segments, Group 2)

```
        Pearson chi-square normality test

data:  TS.1_un
P = 10, p-value = 0.07524

> normalityTest(~TS.2_un, test="pearson.test", data=Dataset)

        Pearson chi-square normality test

data:  TS.2_un
P = 5.3333, p-value = 0.3766
```

Image VI.4. Contrast of hypothesis (under-edited segments, Group 2)

```
        Paired t-test

data:  TS.1_un and TS.2_un
t = 0.1564, df = 23, p-value = 0.4385
alternative hypothesis: true difference in means is greater than 0
95 percent confidence interval:
 -1.244826       Inf
sample estimates:
mean of the differences
                  0.125
```

Image VI.5. Test of normality (under-edited segments, Groups 1 and 2)

```
        Pearson chi-square normality test

data:  TS1_un
P = 33.565, p-value = 0.00002077


> normalityTest(~TS2_un, test="pearson.test", data=Dataset)

        Pearson chi-square normality test

data:  TS2_un
P = 16.609, p-value = 0.0201
```

Image VI.6. Contrast of hypothesis (under-edited segments, Groups 1 and 2)

```
        Wilcoxon signed rank test with continuity correction

data:  TS1_un and TS2_un
V = 500, p-value = 0.06222
alternative hypothesis: true location shift is greater than 0
```

Appendix VII. Statistical inferences of fit-for-purpose segments

Image VII.1. Test of normality (fit-for-purpose segments, Group 1)

```
        Pearson chi-square normality test

ata:   TS.1_fit
 = 4.0909, p-value = 0.3938


 normalityTest(~TS.2_fit, test="pearson.test", data=Dataset)

        Pearson chi-square normality test

ata:   TS.2_fit
 = 11.091, p-value = 0.02556
```

Image VII.2. Contrast of hypotheses (fit-for-purpose segments, Group 1)

```
        Wilcoxon signed rank test with continuity correction

data:  TS.1_fit and TS.2_fit
/ = 36, p-value = 0.005001
alternative hypothesis: true location shift is less than 0
```

Image VII.3. Test of normality (fit-for-purpose segments, Group 2)

```
        Pearson chi-square normality test

data:  TS1_ok
P = 10, p-value = 0.07524


> normalityTest(~TS2_ok, test="pearson.test", data=Dataset)

        Pearson chi-square normality test

data:  TS2_ok
P = 2.6667, p-value = 0.7512
```

Image VII.4. Contrast of hypotheses (fit-for-purpose segments, Group 2)

```
        Paired t-test

data:  TS1_ok and TS2_ok
t = -2.4629, df = 23, p-value = 0.01085
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
       -Inf -0.7476343
sample estimates:
mean of the differences
              -2.458333
```

Image VII.5. Test of normality (fit-for-purpose segments, Groups 1 and 2)

```
        Pearson chi-square normality test

data:  TS1_ok
P = 11.826, p-value = 0.1064


> normalityTest(~TS2_ok, test="pearson.test", data=Dataset)

        Pearson chi-square normality test

data:  TS2_ok
P = 21.391, p-value = 0.003232
```

Image VII.6. Contrast of hypothesis (fit-for-purpose segments, Groups 1 and 2)

```
        Wilcoxon signed rank test with continuity correction

data:  TS1_ok and TS2_ok
V = 212, p-value = 0.0007905
alternative hypothesis: true location shift is less than 0
```

Appendix VIII. Statistical inferences of over-edited segments

Image VIII.1. Test of normality (over-edited segments, Group 1)

```
        Pearson chi-square normality test

data:  TS.1_ov
P = 10.455, p-value = 0.03343


> normalityTest(~TS.2_ov, test="pearson.test", data=Dataset)

        Pearson chi-square normality test

data:  TS.2_ov
P = 6.6364, p-value = 0.1564
```

Image VIII.2. Contrast of hypotheses (over-edited segments, Group 1)

```
        Wilcoxon signed rank test with continuity correction

data:  TS.1_ov and TS.2_ov
V = 81.5, p-value = 0.4148
alternative hypothesis: true location shift is greater than 0
```

Image VIII.3. Test of normality (over-edited segments, Group 2)

```
        Pearson chi-square normality test

data:  TS.1_ov
P = 4.6667, p-value = 0.4579


> normalityTest(~TS.2_ov, test="pearson.test", data=Dataset)

        Pearson chi-square normality test

data:  TS.2_ov
P = 13.333, p-value = 0.02045
```

Image VIII.4. Contrast of hypotheses (over-edited segments, Group 2)

```
        Wilcoxon signed rank test with continuity correction

data:  TS.1_ov and TS.2_ov
V = 179.5, p-value = 0.01331
alternative hypothesis: true location shift is greater than 0
```

Image VIII.5. Test of normality (over-edited segments, Groups 1 and 2)

```
       Pearson chi-square normality test

ata:  TS1_ov
 = 27.478, p-value = 0.0002733


 normalityTest(~TS2_ov, test="pearson.test", data=Dataset)

       Pearson chi-square normality test

ata:  TS2_ov
 = 36.609, p-value = 0.000005563
```

Image VIII.6. Contrast of hypothesis (over-edited segments, Groups 1 and 2)

```
        Wilcoxon signed rank test with continuity correction

data:  TS1_ov and TS2_ov
V = 592.5, p-value = 0.01765
alternative hypothesis: true location shift is greater than 0
```

Appendix IX. Statistical correlations (TS 1)

Image IX.1. Spearman correlations of WPH rate vs. nr. of under-edited segments (TS 1)

```
 Spearman correlations:
       TS1_un   WPH1
TS1_un 1.0000 0.2264
WPH1   0.2264 1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS1_un WPH1
TS1_un        0.1303
WPH1   0.1303

 Adjusted p-values (Holm's method)
       TS1_un WPH1
TS1_un        0.1303
WPH1   0.1303
```

Image IX.2. Spearman correlations of WPH rate vs. nr. of fit-for-purpose segments (TS 1)

```
 Pearson correlations:
       TS1_ok   WPH1
TS1_ok 1.0000 0.1045
WPH1   0.1045 1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS1_ok WPH1
TS1_ok        0.4895
WPH1   0.4895

 Adjusted p-values (Holm's method)
       TS1_ok WPH1
TS1_ok        0.4895
WPH1   0.4895
```

Image IX.3. Spearman correlations of WPH rate vs. nr. of over-edited segments (TS 1)

```
 Spearman correlations:
        TS1_ov    WPH1
TS1_ov  1.0000 -0.1654
WPH1   -0.1654  1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS1_ov WPH1
TS1_ov        0.2721
WPH1   0.2721

 Adjusted p-values (Holm's method)
       TS1_ov WPH1
TS1_ov        0.2721
WPH1   0.2721
```

Image IX.4. Spearman correlations of fit-for-purpose vs. under-edited segments (TS 1)

```
 Spearman correlations:
        TS1_ok  TS1_un
TS1_ok  1.0000 -0.3473
TS1_un -0.3473  1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS1_ok TS1_un
TS1_ok        0.0181
TS1_un 0.0181

 Adjusted p-values (Holm's method)
       TS1_ok TS1_un
TS1_ok        0.0181
TS1_un 0.0181
```

Image IX.5. Spearman correlations of over-edited vs. under-edited segments (TS 1)

```
 Spearman correlations:
        TS1_ov  TS1_un
TS1_ov  1.0000 -0.3674
TS1_un -0.3674  1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS1_ov TS1_un
TS1_ov        0.012
TS1_un 0.012

 Adjusted p-values (Holm's method)
       TS1_ov TS1_un
TS1_ov        0.012
TS1_un 0.012
```

Image IX.6. Spearman correlations of fit-for-purpose vs. over-edited segments (TS 1)

```
 Spearman correlations:
        TS1_ok  TS1_ov
TS1_ok  1.0000 -0.6774
TS1_ov -0.6774  1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS1_ok TS1_ov
TS1_ok        <.0001
TS1_ov <.0001

 Adjusted p-values (Holm's method)
       TS1_ok TS1_ov
TS1_ok        <.0001
TS1_ov <.0001
```

Appendix X. Statistical correlations (TS 2)

Image X.1. Spearman correlations of WPH rate vs. nr. of under-edited segments (TS 2)

```
 Spearman correlations:
       TS2_un    WPH2
TS2_un  1.0000 -0.0502
WPH2   -0.0502  1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS2_un WPH2
TS2_un        0.7403
WPH2   0.7403

 Adjusted p-values (Holm's method)
       TS2_un WPH2
TS2_un        0.7403
WPH2   0.7403
```

Image X.2. Spearman correlations of WPH rate vs. nr. of fit-for-purpose segments (TS 2)

```
 Spearman correlations:
       TS2_ok    WPH2
TS2_ok  1.0000 -0.1853
WPH2   -0.1853  1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS2_ok WPH2
TS2_ok        0.2175
WPH2   0.2175

 Adjusted p-values (Holm's method)
       TS2_ok WPH2
TS2_ok        0.2175
WPH2   0.2175
```

Image X.3. Spearman correlations of WPH rate vs. nr. of over-edited segments (TS 2)

```
 Spearman correlations:
       TS2_ov   WPH2
TS2_ov 1.0000 0.3214
WPH2   0.3214 1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS2_ov WPH2
TS2_ov        0.0294
WPH2   0.0294

 Adjusted p-values (Holm's method)
       TS2_ov WPH2
TS2_ov        0.0294
WPH2   0.0294
```

Image X.4. Spearman correlations of fit-for-purpose vs. under-edited segments (TS 2)

```
 Spearman correlations:
        TS2_ok  TS2_un
TS2_ok  1.0000 -0.6521
TS2_un -0.6521  1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS2_ok TS2_un
TS2_ok        <.0001
TS2_un <.0001

 Adjusted p-values (Holm's method)
       TS2_ok TS2_un
TS2_ok        <.0001
TS2_un <.0001
```

Image X.5. Spearman correlations of over-edited vs. under-edited segments (TS 2)

```
 Spearman correlations:
        TS2_ov  TS2_un
TS2_ov  1.0000 -0.2354
TS2_un -0.2354  1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS2_ov TS2_un
TS2_ov        0.1152
TS2_un 0.1152

 Adjusted p-values (Holm's method)
       TS2_ov TS2_un
TS2_ov        0.1152
TS2_un 0.1152
```

Image X.6. Spearman correlations of fit-for-purpose vs. over-edited segments (TS 2)

```
 Spearman correlations:
        TS2_ok  TS2_ov
TS2_ok  1.0000 -0.4105
TS2_ov -0.4105  1.0000

 Number of observations: 46

 Pairwise two-sided p-values:
       TS2_ok TS2_ov
TS2_ok        0.0046
TS2_ov 0.0046

 Adjusted p-values (Holm's method)
       TS2_ok TS2_ov
TS2_ok        0.0046
TS2_ov 0.0046
```

Appendix XI. Questionnaire results

Table XI.1. Attitude to MTPE (Groups 1 and 2)

"1" – very negative, "2" – negative, "3" – positive, "4" – very positive

Participant	TS1	TS2	TS1	TS2
	Group 1		Group 2	
G1_01	3	3	2	4
G1_02	3	3	3	3
G1_03	3	3	3	4
G1_04	3	3	3	3
G1_05	3	3	3	3
G1_06	4	2	3	4
G1_07	3	3	3	3
G1_08	3	3	3	3
G1_09	3	3	3	3
G1_10	3	2	3	3
G1_11	3	3	3	4
G1_12	3	3	3	3
G1_13	3	3	3	4
G1_14	3	3	3	3
G1_15	2	2	3	3
G1_16	2	2	2	3
G1_17	3	2	3	3
G1_18	3	4	3	3
G1_19	3	2	3	4
G1_20	2	3	3	4
G1_21	3	3	3	3
G1_22	3	3	3	2
G1_23			3	4
G1_24			3	3

Table XI.2. Attitude to quality standards in PE (Groups 1 and 2)

"1" – I strongly disagree, "2" – I disagree, "3" – I agree, "4" – I fully agree

Participant	TS1	TS2	TS1	TS2
	Group 1		Group 2	
G1_01	2	2	2	1
G1_02	1	2	2	3
G1_03	1	1	3	2
G1_04	2	2	3	3
G1_05	1	1	2	3
G1_06	1	1	3	2
G1_07	2	3	3	2
G1_08	4	3	3	2
G1_09	2	2	3	3
G1_10	2	3	3	3
G1_11	1	4	2	2
G1_12	3	3	1	2
G1_13	3	3	2	2
G1_14	2	1	2	3
G1_15	3	3	2	2
G1_16	2	2	2	2
G1_17	2	3	3	3
G1_18	3	3	2	3
G1_19	1	1	4	3
G1_20	2	3	3	3
G1_21	2	2	2	3
G1_22	2	3	3	2
G1_23			2	3
G1_24			3	3

Table XI.3. Attitude towards PE as a profession (Groups 1 and 2)

"1" – no I won't, "2" – maybe, but I won't be looking forward to it, "3" – yes I will, "4" – yes, and I will be looking forward to it

Participant	**TS1**	**TS2**	**TS1**	**TS2**
	Group 1		**Group 2**	
G1_01	1	2	2	3
G1_02	2	2	2	
G1_03	2	2	2	3
G1_04	2	2	2	2
G1_05	2	3	2	2
G1_06	3	2	3	3
G1_07	2	2	2	1
G1_08	2	2	2	3
G1_09	2	2	3	2
G1_10	2	3	1	3
G1_11	3	2	3	4
G1_12	3	3	2	2
G1_13	3	3	3	4
G1_14	2	2	2	3
G1_15	2	2	3	2
G1_16	2	1	2	2
G1_17	2	1	3	3
G1_18	4	4	3	2
G1_19	2	2	3	2
G1_20	1	2	2	3
G1_21	2	2	2	2
G1_22	3	3	4	3
G1_23			2	2
G1_24			2	3

Table XI.4. Satisfaction with performance of a PE task (Groups 1 and 2)

"1" – I am very dissatisfied, "2" – I am rather dissatisfied, "3" – I'm rather satisfied, "4" – I'm very satisfied

Participant	TS1	TS2	TS1	TS2
	Group 1		Group 2	
G1_01	1	2	2	1
G1_02	2	3	3	3
G1_03	2	3	2	2
G1_04	3	3	3	2
G1_05	2	2	3	2
G1_06	3	2	2	3
G1_07	3	3	2	1
G1_08	3	2	3	3
G1_09	3	2	2	2
G1_10	3	3	3	3
G1_11	2	3	3	3
G1_12	2	2	2	2
G1_13	2	2	4	3
G1_14	3	3	2	2
G1_15	4	3	3	2
G1_16	2	2	3	3
G1_17	3	2	2	2
G1_18	3	4	3	3
G1_19	2	2	2	2
G1_20	3	3	2	2
G1_21	2	3	4	3
G1_22	3	3	2	2
G1_23			3	2
G1_24			3	3

Table XI.5. Self-evaluation of PE competence (Groups 1 and 2)

“1” – deficient, “2” – average, “3” – sufficient, “4” – excellent

Participant	TS1	TS2	TS1	TS2
	Group 1		Group 2	
G1_01	1	2	2	2
G1_02	2	3	3	3
G1_03	2	3	2	2
G1_04	3	3	2	3
G1_05	2	2	3	3
G1_06	1	2	3	2
G1_07	3	3	2	2
G1_08	2	2	3	3
G1_09	3	3	2	2
G1_10	3	3	2	3
G1_11	3	3	3	3
G1_12	2	2	2	2
G1_13	2	2	3	3
G1_14	3	3	2	2
G1_15	3	3	2	2
G1_16	2	2	2	3
G1_17	2	2	2	2
G1_18	3	3	3	3
G1_19	2	2	2	3
G1_20	2	2	2	2
G1_21	2	2	3	3
G1_22	2	3	2	2
G1_23			2	2
G1_24			3	3

Appendix XII. Associative correlations (TS 1)

Image XII.1. Associative correlation of attitude to MT vs. PE quality standards (Group 1, TS 1)

```
Frequency table:
             PE.quality1
MTPE.attitude1 very negative negative positive very positive
     average               0        1        0             0
     good                  2        8        3             1
     excellent             4        2        1             0

        Pearson's Chi-squared test

data:  .Table
X-squared = 5.6071, df = 6, p-value = 0.4686
```

Image XII.2. Associative correlation of PE quality standards vs. PE as a job (Group 1, TS 1)

```
requency table:
              PE.qualityvery.negative
E.profession1  negative positive very negative very positive
 negative             8        1             4             1
 positive             1        2             2             0
 very negative        2        0             0             0
 very positive        0        1             0             0

        Pearson's Chi-squared test

ata:  .Table
-squared = 10.531, df = 9, p-value = 0.3092
```

Image XII.3. Associative correlation of PE as a job vs. attitude to MT (Group 1, TS 1)

```
Frequency table:
               PE.profession1
MTPE.attitude1  negative positive very negative very positive
  negative             0        1             0             0
  positive            12        1             0             1
  very positive        2        3             2             0

        Pearson's Chi-squared test

data:  .Table
X-squared = 13.29, df = 6, p-value = 0.03866
```

Image XII.4. Associative correlation of self-satisfaction vs. estimation of PE competence (Group 1, TS 1)

```
Frequency table:
               PE.task.satisfaction1
PE.competence1  negative positive very negative very positive
  negative             7        5             0             1
  positive             2        5             0             0
  very negative        0        1             1             0

        Pearson's Chi-squared test

data:  .Table
X-squared = 13.292, df = 6, p-value = 0.03863
```

Image XII.5. Associative correlation of Attitude to MT vs. PE quality standards (Group 2, TS 1)

```
Frequency table:
              PE.quality1
MTPE.attitude1 bad excellent good neutral
       good      1         1   11       9
       neutral   0         0    0       2

        Pearson's Chi-squared test

data:  .Table
X-squared = 2.5785, df = 3, p-value = 0.4613
```

Image XII.6. Associative correlation of PE quality standards vs. PE as a job (Group 2, TS 1)

```
Frequency table:
               PE.quality1
PE.profession1 bad excellent good neutral
     bad         1         0    1       1
     excellent   0         0    1       0
     good        0         1    2       5
     neutral     0         0    7       5

        Pearson's Chi-squared test

data:  .Table
X-squared = 12, df = 9, p-value = 0.2133
```

Image XII.7. Associative correlation of PE as a job vs. attitude to MT (Group 2, TS 1)

```
Frequency table:
                PE.profession1
MTPE.attitude1 bad excellent good neutral
       good      3         1    7      11
       neutral   0         0    1       1

        Pearson's Chi-squared test

data:  .Table
X-squared = 0.54545, df = 3, p-value = 0.9088
```

Image XII.8. Associative correlation of self-satisfaction vs. estimation of PE competence (Group 2, TS 1)

```
Frequency table:
           Self_satisf
Self_compet excellent good neutral
    good            1    9       1
    neutral         0    2       9

        Pearson's Chi-squared test

data:  .Table
X-squared = 11.855, df = 2, p-value = 0.002666
```

Image XII.9. Associative correlation of attitude to MT vs. PE quality standards (Groups 1 and 2, TS 1)

```
Frequency table:
              PE.quality1
MTPE.attitude1 bad excellent good neutral
     excellent   1         0    0       0
     good        6         2   14      18
     neutral     0         0    1       4

        Pearson's Chi-squared test

data:  .Table
X-squared = 8.053, df = 6, p-value = 0.2342
```

Image XII.10. Associative correlation of PE quality standards vs. PE as a job
(Groups 1 and 2, TS 1)

```
Frequency table:
           PE.profession1
PE.quality1 bad excellent good neutral
  bad         1         0    2       4
  excellent   0         0    1       1
  good        1         2    4       8
  neutral     3         0    6      13

        Pearson's Chi-squared test

data:  .Table
X-squared = 5.2486, df = 9, p-value = 0.8121
```

Image XII.11. Associative correlation of PE as a job vs. attitude to MT
(Groups 1 and 2, TS 1)

```
Frequency table:
              PE.profession1
MTPE.attitude1 bad excellent good neutral
     excellent   0         0    1       0
     good        4         2   11      23
     neutral     1         0    1       3

        Pearson's Chi-squared test

data:  .Table
X-squared = 3.3527, df = 6, p-value = 0.7635
```

Image XII.12. Associative correlation of self-satisfaction vs. estimation of PE competence
(Groups I and II, TS 1)

```
Frequency table:
            Self_compet1
Self_satisf1 bad good neutral
   bad         2    0       0
   excellent   0    2       0
   good        2   14       8
   neutral     0    2      16

        Pearson's Chi-squared test

data:  .Table
X-squared = 37.836, df = 6, p-value = 0.000001209
```

Appendix XIII. Associative correlations (TS 2)

Image XIII.1. Associative correlation of attitude to MT vs. PE quality standards (Group 1, TS 2)

```
Frequency table:
              PE.quality2
MTPE.attitude2 bad excellent good neutral
     excellent   0         0    1       0
     good        3         1    6       5
     neutral     2         0    3       1

        Pearson's Chi-squared test

data:  .Table
X-squared = 2.5422, df = 6, p-value = 0.8637
```

Image XIII.2. Associative correlation of PE quality standards vs. PE as a job (Group 1, TS 2)

```
Frequency table:
              PE.quality2
PE.profession2 bad excellent good neutral
     bad         0         0    1       1
     excellent   0         0    1       0
     good        1         0    3       0
     neutral     4         1    5       5

        Pearson's Chi-squared test

data:  .Table
X-squared = 5.1211, df = 9, p-value = 0.8236
```

Image XIII.3. Associative correlation of PE as a job vs. attitude to MT (Group 1, TS 2)

```
Frequency table:
              PE.profession2
MTPE.attitude2 bad excellent good neutral
     excellent   0         1    0       0
     good        0         0    3      12
     neutral     2         0    1       3

        Pearson's Chi-squared test

data:  .Table
X-squared = 27.83, df = 6, p-value = 0.0001011
```

Image XIII.4. Associative correlation of self-satisfaction vs. estimation of PE competence (Group 1, TS 2)

```
Frequency table:
                  Evaluation.of.PE.competence
Self.satisfaction bad good neutral
        bad         1    0       0
        excellent   0    1       0
        good        1    8       4
        neutral     0    1       8

        Pearson's Chi-squared test

data:  .Table
X-squared = 20.089, df = 6, p-value = 0.00267
```

Image XIII.5. Associative correlation of attitude to MT vs. PE quality standards (Group 2, TS 2)

```
Frequency table:
              PE.quality2
MTPE.attitude2 bad good neutral
     excellent   1    3       4
     good        0   10       5
     neutral     0    0       1

        Pearson's Chi-squared test

data:  .Table
X-squared = 4.5846, df = 4, p-value = 0.3326
```

Image XIII.6. Associative correlation of attitude PE quality standards vs. PE as a job (Group 2, TS 2)

```
Frequency table:
              PE.quality2
PE.profession2 bad good neutral
     bad         0    0       1
     excellent   0    0       2
     good        1    3       4
     neutral     0   10       3

        Pearson's Chi-squared test

data:  .Table
X-squared = 8.9396, df = 6, p-value = 0.177
```

Image XIII.7. Associative correlation of PE as a job vs. attitude to MT
(Group 2, TS 2)

```
Frequency table:
              PE.profession2
MTPE.attitude2 bad excellent good neutral
     excellent   0         2    4       2
     good        1         0    3      11
     neutral     0         0    1       0

        Pearson's Chi-squared test

data:  .Table
X-squared = 10.215, df = 6, p-value = 0.1159
```

Image XIII.8. Associative correlation of self-satisfaction vs. estimation of PE competence
(Group 2, TS 2)

```
Frequency table:
                 Evaluation.of.PE.competence
Self.satisfaction good neutral
        excellent    2       0
        good         9       2
        neutral      1      10

        Pearson's Chi-squared test

data:  .Table
X-squared = 13.818, df = 2, p-value = 0.0009987
```

Image XIII.9. Associative correlation of attitude to MT vs. PE quality standards
(Groups 1 and 2, TS 2)

```
Frequency table:
              PE.quality2
MTPE.attitude2 bad excellent good neutral
     excellent   1         0    4       4
     good        3         1   16      10
     neutral     2         0    3       2

        Pearson's Chi-squared test

data:  .Table
X-squared = 2.5971, df = 6, p-value = 0.8574
```

Image XII.10. Associative correlation of PE quality standards vs. PE as a job (Groups 1 and 2, TS 2)

```
Frequency table:
                PE.profession2
PE.quality2 bad excellent good neutral
  bad         0         0    2       4
  excellent   0         0    0       1
  good        1         1    6      15
  neutral     2         2    4       8

        Pearson's Chi-squared test

data:  .Table
X-squared = 4.0556, df = 9, p-value = 0.9077
```

Image XIII.11. Associative correlation of PE as a job vs. attitude to MT (Groups 1 and 2, TS 2)

```
Frequency table:
                PE.profession2
MTPE.attitude2 bad excellent good neutral
     excellent   0         3    4       2
     good        1         0    6      23
     neutral     2         0    2       3

        Pearson's Chi-squared test

data:  .Table
X-squared = 24.023, df = 6, p-value = 0.0005172
```

Image XII.12. Associative correlation of self-satisfaction vs. estimation of PE competence (Groups 1 and 2, TS 2)

```
Frequency table:
            Self_compet2
Self_satisf2 good neutral
   excellent    3       0
   good        18       4
   neutral      2      19

        Pearson's Chi-squared test

data:  .Table
X-squared = 25.671, df = 2, p-value = 0.000002664
```

Appendix XIV. Clusters: attitude towards MT vs. PE performance

Table XIV.1. Cluster A (unchanged positive attitude to MTPE) performance values

Subject	TS1_un	TS1_ok	TS1_ov	TS2_un	TS2_ok	TS2_ov	WPH1	WPH2
G1_01	7	11	2	6	14	0	1439	1436
G1_02	7	10	3	4	14	2	960	1206
G1_03	3	11	6	3	15	2	488	643
G1_04	5	13	2	4	15	1	1173	1613
G1_05	5	14	1	5	13	2	1159	1755
G1_07	5	9	6	7	10	3	663	1334
G1_08	7	12	1	6	12	2	1311	2468
G1_09	9	9	2	5	10	5	1522	2324
G1_11	6	13	1	4	12	4	1060	1672
G1_12	5	12	3	3	14	3	364	2547
G1_13	7	12	1	3	14	3	481	1203
G1_14	6	14	0	5	15	0	897	941
G1_21	7	10	3	4	15	1	1120	1894
G1_22	1	15	4	10	10	0	826	1304
G2_02	5	11	4	1	14	5	1822	2422
G2_04	7	13	0	6	10	4	2177	2685
G2_05	3	4	13	2	18	0	689	1325
G2_07	5	13	2	4	14	2	1012	1359
G2_08	8	4	8	5	14	1	999	1638
G2_09	9	10	1	11	6	3	1456	1929
G2_10	9	9	2	7	10	3	1276	1678
G2_12	5	13	2	9	8	3	905	1623
G2_14	6	4	10	7	7	6	1232	1647
G2_15	4	11	5	12	7	1	732	1144
G2_17	4	9	7	6	11	3	1533	2673
G2_18	5	14	1	8	12	0	1282	1637
G2_21	4	11	5	6	13	1	1324	2017
G2_24	7	9	4	5	11	4	978	1623
G1_18	3	15	2	2	15	3	2210	2985
G2_03	5	8	7	5	14	1	862	1629

G2_06	1	7	12	8	19	2	972	1619
G2_11	5	12	3	4	14	2	779	1235
G2_13	7	5	8	3	16	1	1622	1890
G2_19	10	7	3	6	8	6	897	1427
G2_20	6	9	5	10	9	1	1331	2411
G2_23	8	5	7	8	12	0	1538	1741

Table XIV.2. Cluster B (worsened attitude to MTPE) performance values

Subject	**TS1_un**	**TS1_ok**	**TS1_ov**	**TS2_un**	**TS2_ok**	**TS2_ov**	**WPH1**	**WPH2**
G1_06	5	13	2	5	11	4	812	2351
G1_10	7	9	4	3	12	5	896	1458
G1_17	6	11	3	5	15	0	1045	976
G1_19	6	12	2	6	13	1	1550	1632
G2_22	11	8	1	3	16	1	1076	2291

Table XIV.3. Cluster C (improved attitude to MTPE) performance values

Subject	**TS1_un**	**TS1_ok**	**TS1_ov**	**TS2_un**	**TS2_ok**	**TS2_ov**	**WPH1**	**WPH2**
G1_20	8	8	4	8	10	2	1129	1531
G2_16	7	13	0	0	11	9	2432	2962
G2_01	5	9	6	7	12	1	950	1594

Table XIV.4. Cluster D (unchanged negative attitude to MTPE) performance values

Subject	**TS1_un**	**TS1_ok**	**TS1_ov**	**TS2_un**	**TS2_ok**	**TS2_ov**	**WPH1**	**WPH2**
G1_15	8	11	1	5	13	2	869	1363
G1_16	9	10	1	3	14	5	736	1365

Appendix XV. (N/S)MT engines output

Image XV.1. Similarity index

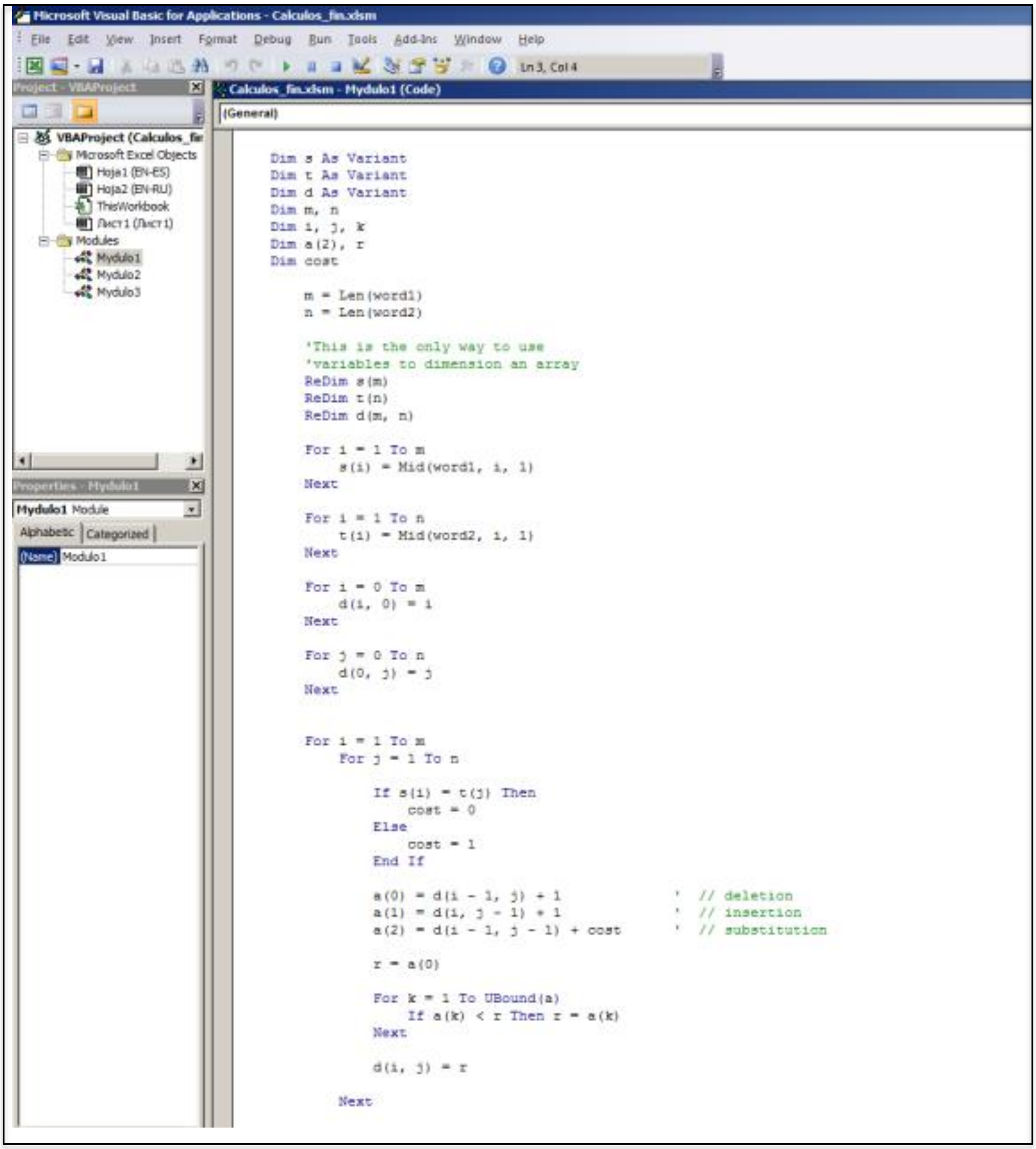
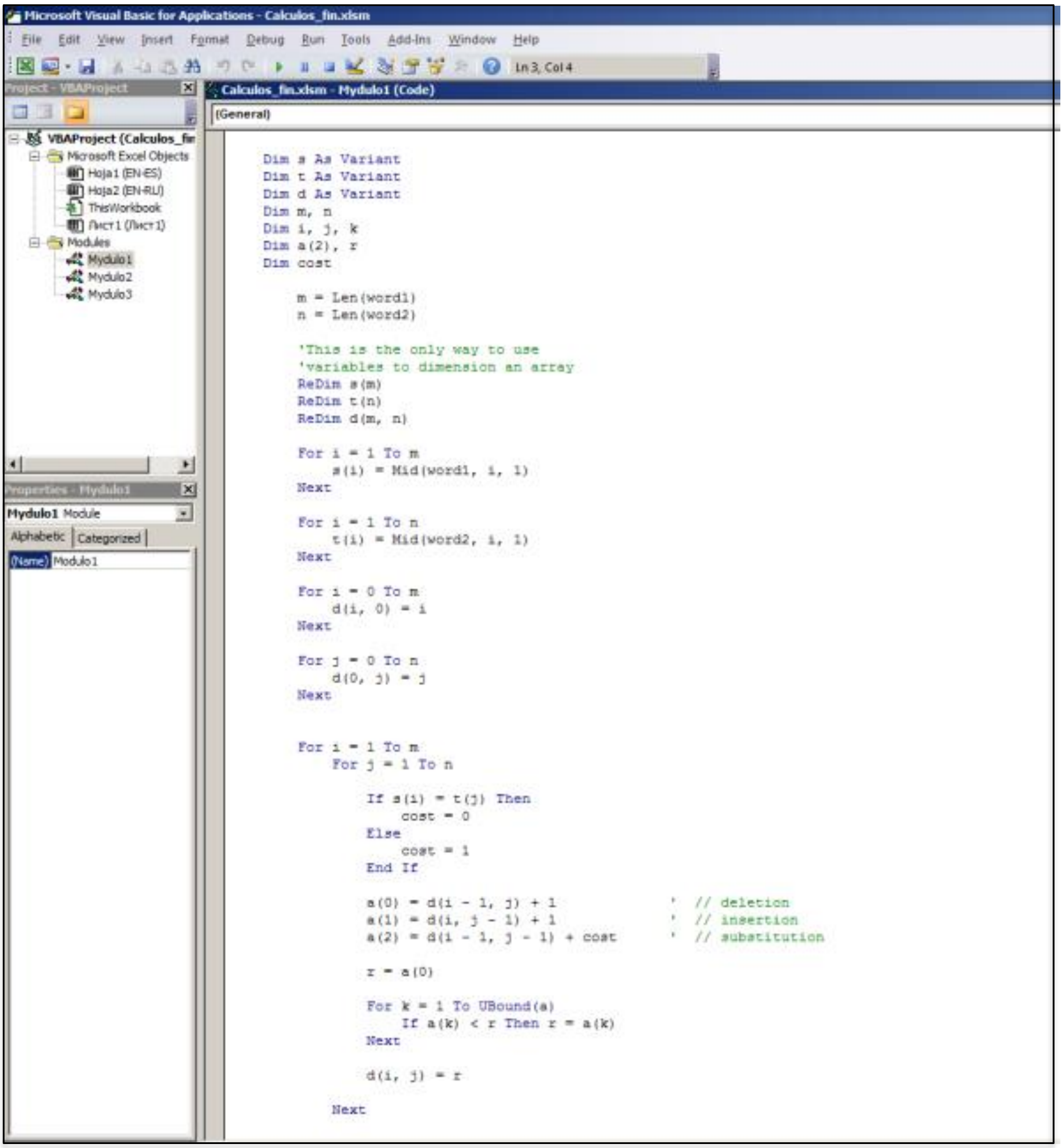


Image XV.2. Levenshtein distance




```
Dim s As Variant
Dim t As Variant
Dim d As Variant
Dim m, n
Dim i, j, k
Dim a(2), r
Dim cost

    m = Len(word1)
    n = Len(word2)

    'This is the only way to use
    'variables to dimension an array
    ReDim s(m)
    ReDim t(n)
    ReDim d(m, n)

    For i = 1 To m
        s(i) = Mid(word1, i, 1)
    Next

    For i = 1 To n
        t(i) = Mid(word2, i, 1)
    Next

    For i = 0 To m
        d(i, 0) = i
    Next

    For j = 0 To n
        d(0, j) = j
    Next


    For i = 1 To m
        For j = 1 To n

            If s(i) = t(j) Then
                cost = 0
            Else
                cost = 1
            End If

            a(0) = d(i - 1, j) + 1              '  // deletion
            a(1) = d(i, j - 1) + 1              '  // insertion
            a(2) = d(i - 1, j - 1) + cost       '  // substitution

            r = a(0)

            For k = 1 To UBound(a)
                If a(k) < r Then r = a(k)
            Next

            d(i, j) = r

        Next
```

Table XV.3 ((N/S)MT strings) EN-ES

	Input	Raw MT output (DeepL)	Raw MT output (Yandex)
TS 1			
1	Create a solid object by pressing or pulling a bounded area	Crear un objeto sólido presionando o tirando de un área delimitada	Para crear un objeto sólido presionando o tirando de un área limitada
2	Rendered images take longer to process, but the image quality is better.	Las imágenes renderizadas tardan más en procesarse, pero la calidad de la imagen es mejor.	Las imágenes renderizadas tomar más tiempo para procesar, pero la calidad de imagen es mejor.

3	For custom routines, the CTAB system variable can also be useful.	Para rutinas personalizadas, la variable de sistema CTAB también puede ser útil.	Para rutinas personalizadas, el CTAB variable de sistema también puede ser útil.
4	Displays the file tabs in the application.	Muestra las fichas de archivo de la aplicación.	Muestra el archivo de fichas en la aplicación.
5	In the Geographic Location dialog box, in the Search box, type the name of a landmark near your location and click Search.	En el cuadro de diálogo Ubicación geográfica, en el cuadro Buscar, escriba el nombre de un punto de referencia cercano a su ubicación y haga clic en Buscar.	En la Ubicación Geográfica cuadro de diálogo, en el cuadro de Búsqueda, escriba el nombre de un punto de referencia cerca de su ubicación y haga clic en Buscar.
6	Inserts a position marker in model space, at the position corresponding to your current location.	Inserta un marcador de posición en el espacio del modelo, en la posición correspondiente a su posición actual.	Inserta un marcador de posición en el espacio del modelo, en la posición correspondiente a su ubicación actual.
7	Specifies geographic location information for a drawing file.	Especifica la información de la ubicación geográfica de un archivo de dibujo.	Especifica la ubicación geográfica de la información de un archivo de dibujo.
8	{1}Image tab {2}Clipping panel {3}Create Clipping Boundary{4}. {5}	1}Ficha Imagen {2}Panel de recorte {3}Crear límite de recorte{4}. {5}	{1}la Imagen de ficha {2}Recorte del panel {3}Crear Recorte Límite de{4}. {5}
9	Click to specify slot width, or enter diameter or radius of the slot arcs.	Haga clic para especificar el ancho de la ranura o introduzca el diámetro o el radio de los arcos de la ranura.	Haga clic para especificar la ranura de ancho, o introduzca el diámetro o el radio de la ranura de arcos.
10	Click {1}Insert tab {2}Reference panel {3}> External References{4}.	Haga clic en {1}Pestaña Insertar {2}Panel de referencia {3}> Referencias externas{4}.	Haga clic en {1}ficha Insertar {2}panel de Referencia {3}> Referencias Externas{4}.
11	To work with the coordinate display on the status bar	Para trabajar con la visualización de coordenadas en la barra de estado	Para trabajar con la pantalla de coordenadas en la barra de estado
12	The current drawing is associated with one or more standards (DWS) files.	El dibujo actual está asociado a uno o más archivos de estándares (DWS).	El dibujo actual se asocia con uno o más estándares (DWS) archivos.
13	Inserts a position marker at the position corresponding to your current location.	Inserta un marcador de posición en la posición correspondiente a su posición actual.	Inserta un marcador de posición en la posición correspondiente a su ubicación actual.
14	About Searching for Content by Name	Acerca de la búsqueda de contenido por nombre	Acerca de la Búsqueda de Contenido por Nombre
15	Follow these steps to access more linetypes:	Siga estos pasos para acceder a más tipos de línea:	Siga estos pasos para acceder a más tipos de línea:
16	After the drawing is uploaded to Autodesk 360, a URL is generated for the drawing.	Después de cargar el dibujo en Autodesk 360, se genera una URL para el dibujo.	Después de que el dibujo es subido a Autodesk 360, una URL que se genera para el dibujo.
17	The 3D-Warehouse browser may have problems connecting to the	El navegador 3D-Warehouse puede tener problemas para conectarse a Internet.	El 3D-Almacén navegador puede tener problemas para conectarse a internet.

	internet.		
18	Tap the Ctrl key to switch to face extrusion, which presses or pulls the face without affecting adjacent geometry.	Toque la tecla Ctrl para cambiar a la extrusión de cara, que presiona o tira de la cara sin afectar a la geometría adyacente.	Presiona la tecla Ctrl para cambiar a la cara de extrusión, que empuja o tira de la cara sin afectar adyacentes de la geometría.
19	This paragraph must replace the preceding paragraph if the ECO for the warning is approved.	Este párrafo debe sustituir al párrafo anterior si se aprueba el OCE para la advertencia.	Este párrafo debe reemplazar el párrafo anterior, si el ECO de la advertencia es aprobado.
20	Click a closed object such as a circle and move the cursor to establish an extrusion direction.	Haga clic en un objeto cerrado, como un círculo, y mueva el cursor para establecer una dirección de extrusión.	Haga clic en un objeto cerrado como un círculo y mueva el cursor para establecer una dirección de extrusión.
TS 2			
1	While the command is active, right-click to display additional options from a context menu.	Mientras el comando está activo, haga clic con el botón secundario para mostrar opciones adicionales desde un menú contextual.	Mientras que el comando está activo, haga clic en mostrar opciones adicionales en el menú contextual.
2	Right-click the layout, and click Page Setup Manager.	Haga clic con el botón secundario en la presentación y haga clic en Administrador de configuración de página.	Haga clic en el diseño y haga clic en la Página de Configuración de Administrador.
3	Switching between color schemes is not available in some AutoCAD-based products.	Algunos productos basados en AutoCAD no permiten cambiar entre combinaciones de colores.	La conmutación entre los esquemas de color no está disponible en algunos de AutoCAD basada en los productos.
4	Displays the map as a series of satellite images.	Muestra el mapa como una serie de imágenes de satélite.	Muestra el mapa como una serie de imágenes de satélite.
5	The exact size of the text box is not critically important.	El tamaño exacto del cuadro de texto no es de importancia crítica.	El tamaño exacto de la caja de texto no es muy importante.
6	For quick access to the most common properties, use the Properties panel on the Home tab.	Para acceder rápidamente a las propiedades más comunes, utilice el panel Propiedades en la ficha Inicio.	Para el acceso rápido a las propiedades más comunes, utilice el panel Propiedades, en la pestaña Inicio.
7	On the Featured Apps tab, click an App button on the ribbon tab.	En la ficha Apps destacadas, haga clic en un botón App de la ficha de la cinta.	En las Aplicaciones Destacadas de la ficha, haga clic un botón de la Aplicación en la ficha de la cinta.
8	{1}Stylizes each point based on the intensity value of the point.	Estila cada punto basado en el valor de intensidad del punto.	{1}Stylizes cada punto de base en el valor de la intensidad del punto.
9	{1}Annotate tab{2}Dimensions panel {3}Update{4}. {5}	1}Pestaña Anotar{2}Panel de dimensiones {3}Actualizar{4}. {5}	{1}ficha anotación{2}Dimensiones del panel {3}Update{4}. {5}
10	The Featured Apps tab displays an RSS feed of featured or suggested apps.	La pestaña Aplicaciones destacadas muestra un canal RSS de aplicaciones destacadas o sugeridas.	Las Aplicaciones Destacadas de la ficha muestra un feed RSS de destacados o sugerido aplicaciones.

11	Controls the shadows displayed in the scene.	Controla las sombras que se muestran en la escena.	Los controles de las sombras aparece en la escena.
12	{1}Windows XP:{2} Click Start menu {3} Programs {4} Autodesk {5}<Product Name>{6} Reset Settings to Default.	{1}Windows XP:{2} Haga clic en el menú Inicio {3}. Programas {4} Autodesk {5}<Nombre del producto>{6}. Restablecer los ajustes a los valores predeterminados.	{1}Windows XP:{2} haga Clic en menú Inicio {3} Programas {4} Autodesk {5}<Nombre de Producto>{6} Restablecer la Configuración a los valores Predeterminados.
13	You can change any of these properties by clicking and changing its setting.	Puede cambiar cualquiera de estas propiedades haciendo clic y cambiando su configuración.	Usted puede cambiar cualquiera de estas propiedades, haga clic y cambiar su configuración.
14	Use this method to attach a point cloud file without using a dialog box interface.	Utilice este método para adjuntar un archivo de nube de puntos sin utilizar una interfaz de cuadro de diálogo.	Utilice este método para fijar un punto de archivos en la nube sin necesidad de utilizar un cuadro de diálogo de la interfaz.
15	In the Geographic Location dialog box, enter the values in the Latitude and Longitude boxes.	En el cuadro de diálogo Ubicación geográfica, introduzca los valores en los cuadros Latitud y Longitud.	En la Ubicación Geográfica cuadro de diálogo, introduzca los valores de la Latitud y la Longitud de las cajas.
16	In the Sheet Set Manager, Sheet List tab, open the sheet that you want to reassociate.	En la ficha Lista de hojas del Administrador de conjuntos de hojas, abra la hoja que desea reasociar.	En la ficha Administrador de Conjunto, la Hoja de la ficha Lista, abra la hoja de trabajo que desea volver a asociar.
17	A similar situation occurs if you change the GIS coordinate system of the host drawing or referenced drawing.	Una situación similar ocurre si cambia el sistema de coordenadas GIS del dibujo del host o del dibujo referenciado.	Una situación similar se produce si cambia el sistema de información geográfica sistema de coordenadas de la acogida de dibujo o dibujo que se hace referencia.
18	The TILEMODE system variable can have the same results as the MODEL and LAYOUT commands.	La variable de sistema TILEMODE puede tener los mismos resultados que los comandos MODELO y LAYOUT.	El TILEMODE variable de sistema puede tener los mismos resultados que el MODELO y el DISEÑO de los comandos.
19	This permits text editing, program debugging, and interaction with AutoCAD and other applications.	Esto permite la edición de texto, la depuración de programas y la interacción con AutoCAD y otras aplicaciones.	Esto permite la edición de texto, programa de depuración, y la interacción con AutoCAD y otras aplicaciones.
20	Uses color-dependent plot style tables (CTB) in the current drawing	Utiliza tablas de estilo de trazado en función del color (CTB) en el dibujo actual	Utiliza el color dependiente de tablas de estilo de trazado (CTB) en el dibujo actual

Table XV.4. (N/S)MT strings vs. referent strings

Similarity (between Autodesk raw output and DeepL/Yandex raw output)

LD_1: Levenshtein distance between the PE output and the raw MT output by Autodesk

LD_2: Levenshtein distance between the PE output and the raw MT output by Deepl/Yandex

	Deepl			**Yandex**		
	Similarity	**LD_1**	**LD_2**	**Similarity**	**LD_1**	**LD_2**
TS 1						
1	0,76	10	7	0,70	10	15
2	0,79	4	16	0,70	4	29
3	0,96	9	6	0,90	9	17
4	0,74	20	17	0,76	20	22
5	0,86	21	20	0,76	21	47
6	0,93	0	10	0,96	0	5
7	0,96	0	3	0,77	0	27
8	0,61	7	34	0,62	7	43
9	0,86	12	15	0,73	12	33
10	0,85	5	22	0,92	5	16
11	0,85	11	4	0,71	11	14
12	0,89	3	8	0,70	3	30
13	0,95	0	5	1,00	0	0
14	1,00	0	0	1,00	0	3
15	0,93	5	0	0,93	5	0
16	0,68	1	33	0,55	1	56
17	1,00	0	0	0,83	0	20
18	0,67	0	60	0,79	0	36
19	0,86	13	6	0,70	13	34
20	0,99	1	0	0,99	1	2
TS 2						
1	0,75	0	32	0,67	0	47
2	0,85	0	20	0,53	0	61
3	0,35	33	73	0,64	33	59
4	1,00	0	0	1,00	0	0
5	0,81	10	13	0,80	10	6

6	0,86	2	20	0,75	2	39
7	0,76	23	17	0,23	23	53
8	0,88	26	26	0,89	26	27
9	0,62	2	25	0,55	2	32
10	0,46	0	32	0,52	0	54
11	0,80	0	12	0,70	0	18
12	0,78	9	39	0,79	9	47
13	0,96	10	10	0,92	10	20
14	0,83	9	18	0,94	9	70
15	0,92	2	8	0,61	2	68
16	0,67	0	55	0,66	0	50
17	0,82	15	24	0,66	15	66
18	0,78	36	17	0,74	36	56
19	0,88	19	1	0,95	19	19
20	0,88	2	11	0,72	2	35

Table XV.5. (N/S)MT strings (EN-RU)

	Source	**Raw MT output (Google Translate)**	**Raw MT output (Yandex)**
TS 1			
1	To Work With Pressing or Pulling Bounded Areas	Работать с нажатием или вытягиванием ограниченных областей	Работать с отжимать или вытягивать ограниченные области
2	Create a Solid Object by Pressing or Pulling a Bounded Area	Создание твердого объекта путем нажатия или выталкивания ограниченной области	Создание твердого объекта путем нажатия или вытягивания ограниченной области
3	Rendered images take longer to process, but the image quality is better.	Полученные изображения занимают больше времени для обработки, но качество изображения лучше.	Обработанные изображения занимает больше времени, но качество изображения лучше.
4	For custom routines, the CTAB system variable can also be useful.	Для пользовательских подпрограмм также может быть полезна системная переменная CTAB.	Для пользовательских подпрограмм также может быть полезна системная переменная CTAB.
5	Displays the file tabs in the application.	Отображает вкладки файлов в приложении.	Отображает вкладки файлов в приложении.
6	In the Geographic Location dialog box, in the Search box, type the name of a landmark near your location and click Search.	В диалоговом окне «Географическое местоположение» в поле «Поиск» введите имя ориентира рядом с вашим местоположением и нажмите	В диалоговом окне Географическое Местоположение В поле поиска введите имя ориентира рядом с вашим местоположением и нажмите

		«Поиск».	кнопку Поиск.
7	The 3D Warehouse browser may have problems connecting to the internet, if your network uses a proxy server that requires authentication.	У браузера 3D Warehouse могут возникнуть проблемы с подключением к Интернету, если ваша сеть использует прокси-сервер, для которого требуется аутентификация.	Браузер 3D Warehouse может иметь проблемы с подключением к интернету, если в сети используется прокси-сервер, требующий проверки подлинности.
8	Click Open to import the file as a block.	Щелкните "Открыть", чтобы импортировать файл в виде блока.	Щелкните "Открыть", чтобы импортировать файл в виде блока.
9	Closes the Point Cloud Manager palette.	Закрывает палитру диспетчера точек.	Закрывает палитру Диспетчер облаков точек.
10	Specifies geographic location information for a drawing file.	Задает информацию о географическом местоположении для файла чертежа.	Указывает сведения о географическом местоположении для файла чертежа.
11	{1}Image tab {2}Clipping panel {3}Create Clipping Boundary{4}. {5}	{1} Вкладка «Изображение» {2} Панель обрезки {3} Создать граничную границу {4}. {5}	{1}вкладка "образ" {2}отсечения группы {3}создать Обтравочную границу{4}. {5}
12	Multi-functional grip options are not available.	Многофункциональные функции захвата недоступны.	Многофункциональные варианты сжатия не доступны.
13	On the Command line, you can search for named objects such as blocks, hatches, layers, or styles, and then initiate an appropriate action by selecting them.	В командной строке вы можете искать именованные объекты, такие как блоки, штриховки, слои или стили, а затем инициировать соответствующее действие, выбирая их.	В командной строке можно выполнить поиск именованных объектов, таких как блоки, штриховки, слои или стили, а затем запустить соответствующее действие, выбрав их.
14	Click {1}Insert tab {2}Reference panel {3}> External References{4}.	Нажмите {1} Вставить вкладку {2} Панель ссылок {3}> Внешние ссылки {4}.	Нажмите {1}вкладку "Вставка" {2}панель "ссылка" {3}> внешние ссылки{4}.
15	To Work with the Coordinate Display on the Status Bar	Работа с дисплеем координат на панели состояния	Для работы с отображением координат в строке состояния
16	The current drawing is associated with one or more standards (DWS) files.	Текущий рисунок связан с одним или несколькими стандартными (DWS) файлами.	Текущий чертеж связан с одним или несколькими файлами стандартов (DWS).
17	Inserts a position marker at the position corresponding to your current location.	Вставляет маркер положения в положение, соответствующее вашему текущему местоположению.	Вставляет маркер позиции в позицию, соответствующую текущему местоположению.
18	As much as possible, layer names are kept the same.	Как можно больше, имена слоев сохраняются одинаковыми.	Насколько это возможно, имена слоев остаются неизменными.
19	Follow these steps to access more linetypes:	Выполните следующие действия для доступа к другим типам линий:	Чтобы получить доступ к другим типам линий, выполните следующие действия:

20	After the drawing is uploaded to Autodesk 360, a URL is generated for the drawing.	После того, как чертеж загружен в Autodesk 360, для чертежа создается URL-адрес.	После загрузки чертежа в Autodesk 360 создается URL-Адрес для чертежа.
TS 2			
1	While the command is active, right-click to display additional options from a context menu.	Пока команда активна, щелкните правой кнопкой мыши, чтобы отобразить дополнительные параметры из контекстного меню.	Пока команда активна, щелкните правой кнопкой мыши, чтобы отобразить дополнительные параметры из контекстного меню.
2	Right-click the layout, and click Page Setup Manager.	Щелкните правой кнопкой мыши макет и выберите «Диспетчер настройки страницы».	Щелкните правой кнопкой мыши макет и выберите пункт Диспетчер установки Страниц.
3	Switching between color schemes is not available in some AutoCAD-based products.	Переключение между цветовыми схемами недоступно в некоторых продуктах на базе AutoCAD.	Переключение между цветовыми схемами недоступно в некоторых продуктах на основе AutoCAD.
4	Displays the map as a series of satellite images.	Отображает карту как серию спутниковых изображений.	Отображает карту в виде серии спутниковых изображений.
5	The exact size of the text box is not critically important.	Точный размер текстового поля не является критическим.	Точный размер текстового поля не является критически важным.
6	For quick access to the most common properties, use the Properties panel on the Home tab.	Для быстрого доступа к наиболее распространенным свойствам используйте панель «Свойства» на вкладке «Главная».	Для быстрого доступа к наиболее распространенным свойствам используйте панель "свойства" на вкладке "Главная".
7	On the Featured Apps tab, click an App button on the ribbon tab.	На вкладке «Рекомендуемые приложения» нажмите кнопку «Приложение» на вкладке «Лента».	На вкладке Избранные приложения нажмите кнопку приложения на вкладке ленты.
8	Enter the time in seconds or fractions of a second.	Введите время в секундах или доли секунды.	Введите время в секундах или долях секунды.
9	In the Geographic Location dialog box, enter the values in the Latitude and Longitude boxes.	В диалоговом окне «Географическое местоположение» введите значения в полях «Широта и долгота».	В диалоговом окне Географическое положение введите значения в полях широта и Долгота.
10	Stylizes each point based on the intensity value of the point.	Стилизирует каждую точку в зависимости от значения интенсивности точки.	Стилизует каждую точку на основе значения интенсивности точки.
11	{1}Annotate tab{2}Dimensions panel {3}Update{4}. {5}	{1} Вкладка «Аннотировать» {2} Панель «Параметры» {3} Обновить {4}. {5}	{1}вкладка "Примечания" {2}панель "измерения" {3}обновление{4}. {5}
12	The Featured Apps tab displays an RSS feed of featured or suggested apps.	На вкладке «Рекомендуемые приложения» отображается RSS-канал избранных или предлагаемых приложений.	На вкладке Рекомендуемые приложения отображается RSS-канал рекомендуемых или рекомендуемых приложений.

13	Controls the shadows displayed in the scene.	Управляет тенями, отображаемыми в сцене.	Управляет тенями, отображаемыми в сцене.
14	{1}Windows XP:{2} Click Start menu {3} Programs {4} Autodesk {5}<Product Name>{6} Reset Settings to Default.	{1} Windows XP: {2} Нажмите «Пуск» {3} Программы {4} Autodesk {5} <Название продукта> {6} Сброс настроек по умолчанию.	{1}Windows XP: {2} Выберите меню Пуск {3} программы {4} Autodesk {5}<имя продукта>{6} сбросить настройки по умолчанию.
15	You can change any of these properties by clicking and changing its setting.	Вы можете изменить любое из этих свойств, щелкнув и изменив его настройку.	Вы можете изменить любое из этих свойств, щелкнув и изменив его настройки.
16	In the Sheet Set Manager, Sheet List tab, click the sheets and subsets to include in the sheet selection.	На вкладке «Список листов» на вкладке «Список листов» щелкните листы и подмножества, которые нужно включить в выбор листа.	На вкладке Диспетчер Подшивок, список листов выберите листы и подмножества для включения в выбор листа.
17	The current text style is displayed at the top of the drop-down list.	Текущий стиль текста отображается в верхней части раскрывающегося списка.	Текущий стиль текста отображается в верхней части раскрывающегося списка.
18	If necessary, login to Facebook.	При необходимости войдите в Facebook.	При необходимости войдите в Facebook.
19	Do one of the following to complete the offset:	Для завершения смещения выполните одно из следующих действий:	Для завершения смещения выполните одно из следующих действий:
20	In the Sheet Set Manager, Sheet List tab, open the sheet that you want to reassociate.	На вкладке «Список листов» на вкладке «Список листов» откройте лист, который вы хотите повторно связать.	В диспетчере подшивок на вкладке "список листов", откройте лист, который требуется связать.

Table XV.6. (N/S)MT strings vs. referent strings

Similarity (between Autodesk raw output and Google Translate/Yandex raw output)

LD_1: Levenshtein distance between the PE output and the raw MT output by Autodesk

LD_2: Levenshtein distance between the PE output and the raw MT output by Google Translate/Yandex

	Google Translate			**Yandex**		
	Similarity	**LD_1**	**LD_2**	**Similarity**	**LD_1**	**LD_2**
TS 1						
1	0,93	0	5	0,79	58	55
2	0,86	2	11	0,96	77	76
3	0,60	1	43	0,78	92	80

4	0,51	52	56	1,00	84	84
5	0,72	8	6	1,00	39	39
6	0,78	1	40	0,94	135	137
7	0,54	9	101	0,72	157	141
8	1,00	0	0	1,00	58	58
9	0,76	0	12	0,83	35	42
10	0,90	0	9	0,83	68	69
11	0,73	0	27	0,66	83	77
12	0,64	2	26	0,75	47	48
13	0,75	4	55	0,85	159	161
14	0,73	0	30	0,82	71	71
15	0,67	2	17	0,63	47	54
16	0,76	0	27	0,76	74	71
17	0,77	15	30	0,77	87	76
18	0,48	0	34	0,61	54	57
19	0,67	12	16	0,40	62	73
20	0,79	12	17	0,65	80	70
TS 2						
1	0,58	0	66	1,00	115	115
2	0,71	3	29	0,86	77	81
3	0,94	3	5	0,94	86	88
4	0,57	2	27	0,87	51	54
5	0,43	31	35	0,89	54	61
6	0,84	0	19	0,95	110	111
7	0,80	2	17	0,80	85	75
8	0,85	7	2	0,95	42	43
9	0,88	0	14	0,90	94	85
10	0,68	0	33	0,80	71	63
11	0,73	1	20	0,65	71	67
12	0,77	1	27	0,85	99	102
13	0,77	11	0	1,00	40	40
14	0,73	0	44	0,86	118	118
15	0,88	5	17	0,97	74	75
16	0,61	0	51	0,61	122	103
17	0,78	24	1	0,00	73	73

18	0,80	0	9	1,00	37	37
19	0,61	6	47	1,00	61	61
20	0,60	9	48	0,57	104	91