Machine Translation Post-Editing (MTPE) from the Perspective of Translation Trainees: Implications for Translation Pedagogy

Abstract

This paper introduces data on translation trainees' perceptions of the MTPE process and implications on training in this field. This study aims to analyse trainees' performance of three MTPE tasks the English-Polish language pair and post-tasks interviews to determine the need to promote machine translation post-editing skills in educating translation students. Since very little information concerning MTPE training is available, this study may be found advantageous.

Keywords: MTPE training, translation pedagogy, translation technology, post-editing, machine translation.

1. Introduction

Although initial attempts at machine translation (MT) were taken already in the first half of the twentieth century, greater interest in this field may have been observed for just over a decade. Therefore, it is conceivable that data on the subject is still scarce. Nevertheless, intensive technological development is fuelling MT research and helping to fill the knowledge gap. The field, firstly distrusted by the translation community, is now attracting interest not only of academics, but also a growing number of private companies implementing MT systems to improve the flow of information within the company. Both studies conducted by the companies and researchers point to post-editing (PE) as an essential element of success in the translation industry and a bridge between machine solutions and skills that so far can only be demonstrated by humans. Hence, this paper has been motivated by the growing importance of post-editing and the technologically induced changing image of the translation industry and the translator's work. Furthermore, the literary background was another impetus for research into the perspective of MTPE trainees and possible future implications for translation pedagogy.

A definite precursor of awareness of education in the field is O'Brien (2002), who created a proposal for course content on teaching PE. Later, Belam (2003) presented a workshop on PE guidelines in a machine-assisted translation course. Another scholar, Kliffer (2008), has introduced PE teaching as a component of the MT programme for the pre-professional level. Further, Depraetere (2010) analysed a corpus of texts post-edited by ten translation trainees and concluded a distinct need to raise the students' awareness of typical MT errors. Other contributions to MTPE training have been made by Pym (2013). He presented a list of ten skills arranged in three categories: "learning to learn, learning to trust and mistrust data, and learning to revise with enhanced attention to detail" as an implication to technology adapted translation pedagogy. Flanagan & Christensen (2014) proposed training measures to address competency gaps that may cause difficulties in interpreting PE guidelines and introduced new post-editing guidelines. Doherty & Kenny's (2014) study was another step towards adapting translation technology in translation studies. They designed and evaluated an SMT curriculum for postgraduate students in translation studies at Dublin City University in 2012. The most recent and in line with the subject of this paper is the research of Guerberof Arenas & Moorkens (2019). They presented a course description of machine translation and post-editing together with an MT project management module. As can be seen from the above, the knowledge of MTPE training is limited, and students' perspective for education in this direction remains neglected. Furthermore, a common feature of the presented research findings is an attempt to adapt to the ever-changing conditions of translation technology without evaluating the results in an educational setting.

The influence of technological development on the translator's work and translation students' education has not escaped Polish researchers' attention. Świątek (2015) addressed the potential and limitation of statistical machine translation. Her conclusions suggested that a computer is not an opponent, but a tool in the translator's hands and that automation of the translation will develop positively. These outcomes were also confirmed by Witczak (2016), assuring that the automation of translation could not exist without a significant agent of the process — a translator. In the same year, Witczak conducted a study focusing on the attitude of translation students to the introduction of a post-editing component into a computer-assisted translation course. The data collected indicated that while MT of technical texts brought 'positive surprise', it was described as 'some disillusionment' in the journalistic texts. Nevertheless, Witczak emphasised the need to give translation education a direction consistent with technological development. These conclusions correspond with the studies by Nikishina (2018) and Tomaszkiewicz (2019), both of whom pointed to the lack of consistency and precise guidelines in the education of future translators. The latter additionally stressed the need for pedagogy in line with EMTs'

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assumptions. Among these, knowledge and the ability to use tools supporting the work of translators were introduced as one of the necessary competencies in this profession. Brożyna-Reczko (2020) also discussed digital tools in translation didactics, concluding that technological tools for verification, glossaries and corpora, which translation students can use to improve the translation process, facilitate the translator's work and deserve a place in education. The sources above indicate that the Polish translation community is unanimous in calling for research into standardising translation curricula in line with available technologies. As Jan Rybicki, Professor of English Studies at Jagiellonian University, underscored at the CALT conference (2021), programmes that not long ago distinguished between human-performed and machine-performed translations are now almost helpless in the light of the ongoing development of neural machine translation.

Therefore, the author of the paper attempted to investigate the demand for education in line with the contemporary translation market, namely machine translation post-editing, from the perspective of students of English Philology with Translation Studies at the Faculty of Philology of the University of Białystok. For this purpose, the studies were divided into two stages — the first one based on task completion, where participants received a set of 3 post-editing activities. The tasks concerned the English-Polish language pair. The follow-up phase of the study was an interview conducted with each participant individually. The study results aimed to determine the students' attitudes towards MTPE, the demand for the inclusion of a course on MTPE in their curricula and their awareness of MTPE tools. The research results were also to serve as a basis for the elaboration of a proposal for a unified post-editing machine translation course.

2. Methodology

The study aims, among others, to examine the opinions of translation students on teaching the MTPE process. In accordance with González Davies (2004:4) remark that 'new paths should be explored instead of keeping to one approach to translation or to its teaching,' the author hypothesized that there is a need to promote machine translation post-editing skills, and these abilities should be improved in the process of educating translation trainees. In particular, this study examines three main research questions analysed with the secondary level side questions:

1. What is the participants' (English Philology and Translation students) attitude towards MTPE?
    a. How do participants evaluate given tasks?
    b. What is the participants' view on the idea of including MTPE in an educational programme for future translators?
2. What are the implications for teaching the MTPE process?
    a. What kind of errors do participants make in given tasks?
    b. What problems do participants encounter during performance of tasks?
3. What is the state of the participants' knowledge about MTPE?
    a. What kind of translation digital tools are research participants' familiar with?

Procedure

Due to the outbreak of the global coronavirus pandemic, the whole study was carried out online using digital tools. The studies performed to obtain data for analysis were divided into two stages. The first one based on tasks completion. Participants received a set of 3 post-editing activities by e-mail. Each task was accompanied by written instructions, and tasks number two and three by attachments. On account of the level of complexity of the third assignment and the limited possibility of conducting the study to a remote working environment, an instructional video was attached to Task 3, recorded purposely to facilitate the task. The subjects were informed of the procedure and how they could contact the researcher in case of any inquires. After tasks completion, all nine subjects sent their answers back via e-mail. The follow-up phase of the study was an interview conducted with each participant individually via a platform designed for online meetings – Zoom.us. Proceeding the interviews subjects received an e-mail with a link to the meeting and available on YouTube instructional video explaining how to enter the Zoom. The subjects were informed in advance about the issues that was to be discussed during the interview. The data was recorded on a digital audio recorder provided by Zoom.us, transcribed using an online programme Gglot.com and then corrected manually by the researcher. The obtained audio files are between 4:44 and 10:07 minutes long. The participants signed an agreement to record and use the data collected with their help to carry out the research for the paper.

Techniques and tools

As mentioned above, the micro-level research procedure was divided into two phases. Each of them was based on a different methodology. Although both represent a qualitative approach, the first stage was process-oriented and consisted of a set of exercises that explored various competences. The tasks were constructed on particular

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activities conducted during MT Summit Workshop on Post-Editing Technology and Practice launched by O'Brien. Task 1 (Appendix 1) aimed to familiarize participants with different MT versions, draw their attention into diversity in MT and problems that can emerge during the post-editing process. The subjects were given three outputs of MT: Yandex Free, Google Translate and DeepL. They read three versions and then decided which one is, in their opinion, the best and why. The second assignment (Appendix 2) was designed to introduce the concept of pre-editing as well as the rules that should be applied in the process of pre-and post-editing - English Controlled Language rules (Appendix 3). The participants were provided with an original text in English. They chose from three to five most problematic sentences and tried to rewrite them using English Controlled Language rules. Then, they translated the rewritten versions of the sentences into Polish using the tool they chose in the previous assignment. The third task (Appendix 4) provided for combining skills learned from two previous exercises and introduced students to the CAT tool. It also intended to show students how to combine different tools in the post-editing process. The subjects first watched instructional video prepared for the purpose of this exercise. Then they were given a task to create a project on smartcat.ai. The students used the previously made glossary (Appendix 5) and implemented it into their projects. Finally, they translated the text (Appendix 6) in created projects on smartcat.ai platform. After tasks completion, subjects sent their answers back via e-mail.

Contrary to the first one, the second stage of research was based on a participant-oriented method – a semi-structured interview conducted in Polish to allow the research participants to express themselves freely. It consisted of a set of six open questions designed to correspond with the research questions stated in the paper. The interview questions were as follows:

1. Have you ever used machine translation tools like Goggle Translate? If so, which ones?
2. In the first task, you were asked to choose, in your opinion, the best machine translation and to justify your choice. Were you surprised that the versions of these translations can differ? Were you surprised by the quality of the translations?
3. In the second task, you were asked to translate selected problematic sentences into English using the English Controlled Language rules (ECL) and then translate chosen units employing a preferred tool. In your opinion, was the final version better due to this procedure (ECL rules) or was it not significantly different? Do you find practising these rules necessary? Would that be useful in your work as a translator?
4. In the third task, you were asked to translate an extract from an article using a CAT (computer-assisted translation) programme, in this case, available on the SmartCat.com platform. Have you ever employed such a programme? Which one? Did you find the programme helpful? In this exercise, you also used the prepared earlier glossary. Did you find the glossary helpful? Do you think it is worth preparing for translation and post-editing in this way?
5. What is your overall attitude towards the performed tasks? Do you think that you have learned something by completing them?
6. Would you like the post-editing exercises to be included in your educational programme at university?

The interview was conducted with each participant individually via Zoom.us.

Participants

For the purpose of the research procedure and data collection, nine students of the University in Białystok were recruited. The subjects were selected on the basis of their level of English proficiency, specialization and field of study. The participants were between 23 and 25 years old. All subjects received a Bachelor's degree in English Philology. They were during their first year of their Master's degree in English Philology with Translation Studies with a specialization in linguistics. At the time of the research procedure the participants completed the following classes:

- 15h of Assessment of Translation Equivalence in Translation,
- 30h of General Translation Practice,
- 30h of Journalistic Translation,
- 15h of Polish Language in Translation
- and one lecture:
- 30h of Introduction to the Theory of Translation.

It is necessary to mention that the research author and participants are acquainted and have been studying together in the same group. This fact will be regarded as one of the limitations to the study.

Limitations of the study

Limitations of the study may be classified as externally and internally derived. The latter refers to the characteristics of the research methodology used, i.e. semi-structured interview. An interviewer is not free from personal attribute and unintentional expectancy effect. This threat can impact participants' answers; however, as Saldanha and O'Brien (2014: 29-30) explained it, it is likely to occur under particular conditions:

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- when due to the ambiguity of the assignment or question, participants ask a researcher for advice on how to perform;
- when an interviewer affects respondents' answers by unconsciously revealing the type of results they expect.

Although threats above may relate to the research, especially since the author of the paper is personally acquainted with participants (as a co-student), it is vital to acknowledge that many commentators recognize this as an unavoidable consequence of the character of social research, which has to be dealt with through self-reflexivity (Saldanha, O'Brien 2014:29-30). Furthermore, the questions were designed in a way to limit the possibility of the author imposing her opinion. It is also worth noting that the less formal form of communication with participants may have encouraged them to ask questions if necessary. It is important given the exclusively internet-mediated form of contact during the various stages of the study.

Another (external) limitation was caused by the occurrence of coronavirus, which resulted in lockdown. Initially, the procedure was designed to be conducted in the form of a regular class. However, due to the outbreak of the pandemic and the associated restrictions, the nature of the research was changed. The contact with the participants of the study was narrowed to online tools such as emails, instant messaging, video and online meetings. It induced multiple issues:
- the participants were limited to online tools of contact in case of encountering concerns while solving the tasks;
- during interviews, there was a minor disruption due to a poor internet connection
- one of the participants could not use the Zoom platform.

All mentioned above threats were overcome and the research data was collected.

3. Data analysis

In the process of data analysis of qualitative research, an inductive approach was implemented with research tasks and questions acting as a prism through which to view the information and choose relevant items. Both the first and second phase of the study were to be examined accordingly to the following stages:
- Code units were selected from the acquired data.
- Units were encoded by their content.
- Units were grouped into categories accordingly to the stages of research.
- The themes were identified.
- The representative extracts of the transcribed interviews were selected in order to exemplify the categories and themes.

Mentioned above procedure describes 'thematic' analysis, which according to Matthews and Ross (2010:373), describes as "[a] process of working with raw data to identify and interpret key ideas or themes".

The preliminary stage of research– task completion is to be studied in terms of the difficulties that may have occurred in the process of performing the activities, errors appearing in individual stages of post-editing, the level of understanding of the instructions and the effectiveness of the assignments. While all of the aspects mentioned above will be reviewed in each task, the last one measuring the effectiveness of the activities will be most visible in the third exercise, which aimed to use the skills acquired in the previous tasks. Furthermore, the difficulty and level of understanding of the instructions will be evident from the analysis of the questions asked by the participants through online communication. To sum up, this part of the research provides data for implications for MTPE pedagogy and forms the foundation of MTPE course.

The second stage of the study conducted with the application of a semi-structured interview will be analysed to offer answers to the two remaining research questions. The examination will be provided in the order presented in section Techniques and tools. Inquiries number one, two and four of the interview will attempt to answer the third research question providing insight on participants experience with digital translation tools and their general state of knowledge on MTPE. Consequently, question number five is to determine participants' attitude towards post-editing. Interrogatives number two, three and four evaluate provided exercises. Finally, the participants' view on the idea of including MTPE in the educational programme for future translators might be revealed by analysing answers to the last interview question.

Tasks evaluation

The first study phase concerns the evaluation of research assignments. As already described, Task 1 aimed to familiarise participants with different MT versions, highlight diversity in MT and the problems that can emerge during the post-editing process.

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	S1	S2	S3	S4	S5	S6	S7	S8	S9
Stylistics	1	1							
Readability	1	1		1		1	1		
Consistency/accuracy			1				1		
Grammar							1	1	
Errors		1			1	1			1
Vocabulary				1					

Table 1 Answers from Task 1.

All nine participants completed the task correctly. Each participant provided an explanation of their choice. Of the nine subjects, two pointed out statistical correctness, five participants emphasized that the text they preferred is easy to read and understand, one person remarked that the text selected was consistent and also one that it was precise. Grammar correctness was noted twice. Of nine participants, four commented on errors in the texts. Only one person emphasized vocabulary as an essential factor in evaluating the quality of translations. The data provide a preliminary suggestion that such a translation evaluation form could be useful in that kind of activity or as a part of introductory exercises. Instead of a form, the instruction could include a set of translation quality indicators to be noted.

The second assignment (Task 2) was designed to introduce the concept of pre-editing as well as rules that should be applied in the process of pre-and post-editing.
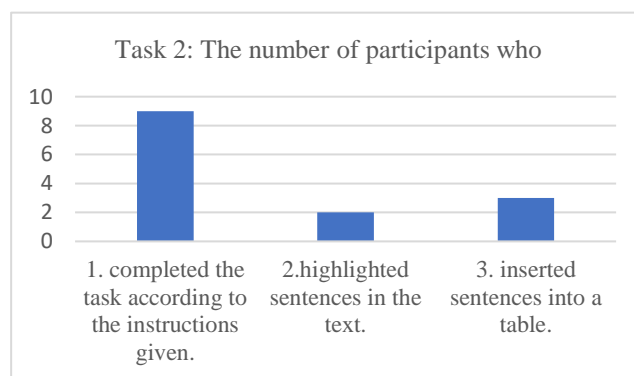

Figure 1 The evaluation of Task 2.

Although all participants completed the task as instructed, it is worth noting that five of them implemented additional elements to the exercise. Two subjects highlighted sentences selected for correction in the text, and three inserted these units into a table. Concluding, Task 2 lacked space in the table for a pre-edited version.

The assignment number three provided for combining skills learned from two previous exercises and introduced students to a CAT tool. It also intended to show students how to combine different tools in the post-editing process. The findings depict a repeated occurrence of one type of language error - inflectional – in two units

(17)   firma SpaceX wystrzelił [orig: SpaceX launched]
(18)   partię swoich satelity [orig: the first batch of its Starlink]

This error emerged in the responses of 7 out of 9 participants. Two participants (S4 and S9) performed this assignment flawlessly and as directed. The fact that they had asked questions about this task's procedure may help determine why such errors occurred in the rest of the cases. The enquires were as follows:

(1)   S4: [So in general we don't show any creativity and we do exactly what we see on the video, yes?]
(2)   S9: [Can I split sentences if I want to?]

Having been instructed that after creating a project on the SmartCat.com platform, the output text should be edited as much as they felt appropriate, the participants performed the task autonomously and correctly. Simultaneously, the rest of the participants who lacked this information were limited to following the video instruction and did not apply post-editing. These findings confirm that corrections to the instructions should be applied and that Task 3 should be split into separate activities to ensure that they are more precise and understandable.

Interview analysis

The final stage of the analysis discusses the results of the interview carried after all participants had completed the three MTPE tasks. The first interview question was to evaluate the level of interviewees" familiarity with MT tools.

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	Number of participants familiar with enumerated machine translation tools
Google Translate	9
DeepL	4
SmartCat	1
PONS	1

Table 2. Summary of answers to the first interview question.

All nine subjects used Google Translate before, four of which declared that they did not employ other tools. Three participants were accustomed to DeepL. One person pointed out SmartCat.com and also one PONS text translation. The findings revealed that although all participants were accustomed to MT tools, their state of knowledge on the subject was not extensive.

The next question that was asked during the interview related to the subjects' reaction to MT outputs differentiation, also in terms of quality.

Interview Question 2		S1	S2	S3	S4	S5	S6	S7	S8	S9
Were you surprised that the versions of these translations can differ?	Yes					1	1			
	No	1	1	1	1			1	1	1
Were you surprised by the quality of the translations?	Yes	1		1	1	1	1			1
	No		1					1	1	

Table 3. Summary of answers to the second interview question.

Seven out of nine participants declared that they were not surprised that machine translations performed with various tools were different. Two of the subjects also wrote a paper on machine translation and used this argument to explain their lack of surprise. Two students expressed a reaction of surprise. First, Google Translate turned out to be of a higher standard than expected, and second, it was an interesting phenomenon. Considering the quality of MT, the situation was as follows. Six out of nine subjects claimed to be surprised by the quality of the translations, three of them – positively. One found the differences in the translations amusing. Two expressed disappointment of the level of quality in one of the outputs. Three interviewees were not surprised by the quality of the translations. The majority of participants were aware of the variety in MT outputs. Still, more than half of the group admitted that the quality of the translations was, to some degree, unexpected. These responses revealed that although the participants were aware of the existence of the different MT tools, they still showed little knowledge of the quality of the results of these tools.

The third interview question was based on the participants' experience after completion of Task 2 and was designed to establish their attitude towards the concept of pre-editing.

Interview Question 3		S1	S2	S3	S4	S5	S6	S7	S8	S9
In your opinion, was the final version better due to this procedure (ECL rules) or was it not significantly different?	It was better	1	1	1	1	1		1	1	
	It was not significantly different									
	Other						1			1
Do you find practising these rules necessary? Would that be useful in your work as a translator?	Yes	1	1	1	1	1	1	1	1	
	No									
	Other									1

Table 4 Summary of answers to the third interview question.

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Asked about the usefulness of employing pre-editing tools in the MTPE process, 7 out of 9 interviewees reported that, to some extent, the final version was improved through the process. Two subjects emphasized the significance of Muegge's (2002) first CLOUT rule that sentences should be no longer than 25 words. One participant stated that she relied on her already acquired knowledge during the task, regardless of the attached guideline. The last subject pointed out that pre-editing improved lower quality fragments but that post-editing should also be used eventually. The second part of the third question provided similar findings. Eight subjects agreed that the application of ECL rules, which represent the pre-editing phase of the MT process, is assumed to support translator's work. One participant stated that following the ECL rules may support developing translation skills. Two subjects emphasized the necessity of simplifying sentences in the MTPE process. One interviewee noted that the rules do not exhaust the topic of pre-editing because they do not cover the issue of metaphors or other phraseological compounds in the text. Finally, one of the participants did not answer the question directly but pointed out an interesting correlation between the principles stated in Belczyk's book *Poradnik Tłumacza* [Translator's Guide], which, inter alia, discusses translation rules and the principles mentioned by Muegge (2002). Although the vast majority of the survey participants confirmed the validity of implementing the pre-editing phase in the MTPE process, their comments indicated that ECL rules could be enriched, such as rules covering idioms, metaphors and phrasal verbs.

The aim of the next question was to evaluate whether participants were familiar with CAT programme and tools associated with that software and their attitude towards CAT after completing Task 3.

Interview Question 4		S1	S2	S3	S4	S5	S6	S7	S8	S9
Have you ever employed such a programme? Which one?	Yes									1
	No	1	1	1	1	1	1	1	1	
Did you find the programme helpful?	Yes	1		1	1	1	1	1	1	1
	No									
	Other		1							
Did you find the glossary helpful? Do you think it is worth preparing for translation and post-editing in this way?	Yes	1	1	1	1	1	1	1	1	1
	No									

Table 5 Summary of answers to the fourth interview question.

Only one participant had used this type of software (SmartCat) before the study. It is worth mentioning that the person who previously used this programme wrote his master's thesis on machine translation. For the rest of the group, it was their first encounter with a CAT tool. Two participants commented that CAT software seemed complicated in use. One subject said that the programme was not as difficult as it appeared at first. Moreover, S1 added that he had learnt something by completing the assignment. The second part of the same question showed almost unanimity in the survey participants' opinions on the advantage of CAT tools in translator's work. Apart from one person, who called the use of the software a 'challenge', all the rest agreed on its usefulness. Finally, respondents were asked about their attitudes towards implementing the MTPE pre-editing tool, namely, the glossary. All participants were in favour of this means. Furthermore, two trainees expressed approval for the glossary, confirming their opinion on the usefulness of CAT programmes. Three of nine subjects underlined that it may be helpful when dealing with a professional, specialist or problematic vocabulary. One person described the glossary as an improvement to the result of the work. Another participant described it as making the translator's work easier. Two interviewees stressed that receiving a glossary from a client is very important as it ensures that a translator sticks to the required vocabulary. Finally, one person remarked that the glossary helps with maintaining terminological consistency in the source text.

The fifth question from the research interview measured the participants' overall attitude towards the performed tasks. It also evaluated whether they considered the experience beneficial in acquiring new skills necessary for their work as translators.

Participants' attitude to and comments on the tasks performed		Number of participants
Beneficial experience		9
	• familiarising themselves with CAT software	7
in terms of:	• acquiring new skills	1
	• improving skills	1
Challenging experience		1

Experience that showed the importance of the translator's role in the MTPE process		1

Table 6 Summary of answers to the fifth interview question

All nine participants in the study agreed that the performance of the project tasks was beneficial in various ways. Some of them appreciated acquiring or improving translation skills. Others emphasized learning CAT software as a positive experience. Still, one person found it challenging, suggesting that this kind of activity is even more appropriate for translator trainees.

The final research interview question addressed the participants' position on including post-editing training in university educational programme.

Interview Question 6		Number of participants
Would you like the post-editing exercises to be included in your educational programme at university?	Yes	9
Other comments:	• it would help in career as a translator	5
	• it would be interesting	3
	• it would be an adaptation to today's technologically developed approach to translation	3
	• it would improve and simplify the translator's work	2
	• it is odd that there is no class concerning CAT tool	1

Table 7 Summary of answers to the sixth interview question

Not only would the research participants like to have MTPE training, but they also enumerated the advantages of such exercises. They suggested it would support, simplify and improve their future work as translators. Furthermore, they referred to introducing such activities as a positive adaptation in an educational system and accurate to today's technologically developed approach to translation. Finally, they described MTPE training as enjoyable, which implies that they would be actively engaged in learning new skills.

4. Conclusions and discussion

This study attempted to employ existing findings from the field of MTPE to research tasks with a view of investigating the translation trainees' perspective. Further, it intended to derive the implications for translation pedagogy. Based on the current state of the art, the author hypothesized that there is a need to promote machine translation post-editing skills, and these abilities should be improved in the process of educating translation trainees. To this end, the research analysis was divided into three stages: the review of the participants' questions concerning assignments, tasks evaluation and the analysis of the interview. The subjects of the study were nine first-year students of a Master's degree in English Philology with Translation Studies with a specialization in linguistics between 23 and 25 years old. In the process of data analysis of qualitative research, an inductive approach was implemented with research tasks and questions acting as a prism through which to view the information and choose relevant items.

The primary focus of the study was to assess the attitudes of translation trainees towards MTPE. The answers collected to the fifth and sixth interview questions indicate that participants view training in post-editing machine translation as positive. In Question 5, all nine participants acknowledged that they benefited in various ways from completing the tasks. As advantages, they enumerated acquiring or improving translation skills and learning CAT software. Yet, one person found it challenging, which may indicate a knowledge gap that should be filled. Question 6 provides information on participants' views on the inclusion of MTPE in the training programme for future translators. Not only would the research participants like to have MTPE training, but they also supported their opinion, suggesting that it would ease, simplify and improve their future work as translators. Furthermore, they referred to introducing such activities as a positive adaptation in an educational system and accurate to today's

technologically developed approach to translation. Finally, they described MTPE training as enjoyable, which implies that they would actively learn new skills. Question 3 measured participants' approach to the concept of pre-editing using English Controlled Language rules (ECL). Most trainees (7 out of 9) reported that, to some extent, the final version was improved through post-editing and, in consequence, agreed that the application of ECL rules is assumed to support the translator's work. Similarly, answers to Question 4 showed almost unanimity in the survey participants' opinions on the advantage of computer-assisted and terminology management tools in the translator's work.

Implications for teaching the MTPE process were another concern of the study. In particular, attention was brought to the errors that the study participants made in the tasks. Two of the three tasks were completed flawlessly by all participants. Only the third task revealed one type of language error - inflectional - made by seven of the nine participants. It is worth noting that the two participants who did not make this error (they performed the task correctly) asked for additional information and received the answer that the machine translation output should be post-edited. Therefore, it can be concluded that the third task should be supplemented with precise information about the need to post-edit the output from the task. The fact that Task 3 was complex may have also contributed to this error. Most of the participants (8 out of 9) were exposed to CAT software and terminology management for the first time. In summary, the results indicate that changes should be made to both the instruction and the structure of Task 3, preferably breaking it into separate tasks. In addition to errors, the study also examined problems encountered by the participants during the performance of the tasks. Analysis of Task 2 explicated that participants (five out of nine) implemented additional elements to the exercise. Two subjects highlighted sentences selected for correction in the text, and three inserted these units into a table. These findings revealed that Task 2 lacked space in the table for a pre-edited version. Therefore, one might be tempted to conclude that tasks should be designed carefully considering each stage of the student's work, and even more so when it comes to a process as complex as the post-editing of machine translations. Other implications to translation pedagogy may be acquired from the participants' comments during the interviews. In Question 3, one interviewee noted that the ECL rules do not exhaust the topic of pre-editing because they do not cover the issue of metaphors or other phraseological compounds in the text. This comment leads to the conclusion that ECL rules could be enriched with the mentioned above points.

The final issue discussed in the study is the participants' knowledge of MTPE. The first interview question estimated that although all participants are accustomed to MT tools, their state of knowledge on the subject is not extended. Even though each participant declared familiarity with Google Translate, as many as four of them did not use any other tools and three only used DeepL. Other tools mentioned one time were SmartCat and PONS. Question 2 revealed that most participants (7 out of 9) were aware of the variety in MT outputs. Still, more than half of the group admitted that the quality of the translations was, to some degree, unexpected. These responses unveiled that although the participants anticipated the differentiation of MT outputs provided from various MT tools, they showed little knowledge of the quality of the results of these instruments. The analysis of the answers to Question 4 confirmed the inadequate expertise of translation support tools of translation trainees. Out of the 9, only one person, who wrote a dissertation on machine translation himself, was familiar with CAT software.

These conclusions point to the need to include a machine translation post-editing course in the educational programme of future translators. They also indicate that translation support tools, such as computer-assisted and terminology management tools and guidelines, including ECL, should be introduced in the process of developing MTPE skills. Nevertheless, it is worth highlighting that the components included in the course and the state of knowledge about them are constantly evolving, and therefore both the guidelines and the general approach to teaching in this field should remain open to change.

<div align="center">***</div>

The results addressing the main research problem yielded some interesting findings. First, they tentatively support the claim that the participants positively evaluate machine translation post-editing, perceiving benefits such as acquiring or improving translation skills and learning CAT software. Second, they reveal the correlation between Zhechev's (2014) and Silva's (2014) findings that the effort to implement and adapt machine translation in the translation process induces positive results on many levels and students' perspective that the skills gained from the MTPE tasks are an opportunity to facilitate, simplify and improve their future work as translators. Finally, they emphasise the correlation between MTPE and a positive adaptation in an educational system, accurate to today's technologically developed approach to translation mentioned by Brożyna-Reczko (2020) and Witczak (2016).

Another research problem tackled in this study concerned the implications for teaching the MTPE process, focusing on possible errors made by the trainees. The general picture emerging from this part of the analysis is that when confronted with performing a translation using a CAT tool, MT and a glossary, trainees may forget to post-edit TT and thus make apparent errors. Another reason for the appearance of inflectional error may be an insufficiently specified instruction. However, such an explanation is not consistent with the conclusions of Čulo,

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Gutermuth, Hansen-Schirra and Nitzke (2014), who assumed that the output of MT itself provokes errors. An additional reason is given by O'Brien (2002) and Depraetere (2010). They suggested that the critical solution to these problems is to train novice translators in post-editing and raise awareness of typical MT errors. Unfortunately, at present, it is not possible to identify one main factor contributing to such errors.

There are also two interesting side findings. First implies that practitioners intuitively aid their performance by adapting enhancements to the exercise structure. This situation occurred in the case of the inclusion of an additional column for a selected sentence from the ST in Task 2. Such practice may indicate the experience of confronting complex sentences in translation contexts. Future research will have to clarify whether the provided explanation is accurate. The second concerned the ECL rules. The results suggest that ECL does not exhaust the topic of pre-editing because they do not cover metaphors or other phraseological compounds in the text. This finding leads to the conclusion that ECL rules could be enriched with the above-mentioned points. Further research in this area is advised.

The results relating to the last issue addressed by the study – the participants' knowledge of MTPE - provided some surprising findings. They show that trainees do not use most of the translation support tools currently available, with most of them reporting experience solely with Google Translate. The situation may imply that after graduation, the trainees would not be prepared for their work as translators according to the assumptions of EMT, which list knowledge and the ability to use tools supporting the work of translators as one of the necessary competencies in this profession.

However, it is worth emphasising that these findings are not generalisable beyond the participants interviewed. In Poland, out of 13 institutions providing BA and MA studies, eight include CAT in their curricula, of which four introduce MT and two MTPE. Thus, students' experience (from institutions with at least CAT in their curricula) with MTPE and the tools in question is likely to be different. Although it can be assumed that the results of this study would provide similar outcomes at universities offering a translation specialisation without including an MTPE course (or CAT or MT), in order to be able to draw further conclusions and translate the results of this work to a broader scope, the study should be replicated. Additionally, it is also worth noting that as the research's main hypothesis is the need for integrating MTPE education into the university teaching system, where MTPE courses are already taught, such a study would not be justified.

Overall, this study confirms the validity of integrating MTPE into the educational programme for future translators. More broadly, this means adapting teaching to the pace of technological development. In order to provide the best possible education aligned with the needs of the translation market, while at the same time increasing the employability of translation graduates in the future, an MTPE course should be included. This summary is in line with the conclusions of Świątek (2015), who suggested that the computer is not an adversary, but a tool in the translator's hands and that translation automation will develop positively. Based on Jan Rybicki's (May 2021) words , the difference between human and machine translation is less and less conspicuous in light of the progressive development of neural machine translation. The changes that are taking place in the field of translation can no longer be ignored. On the contrary, such ignorance may lead to the opposite effect –translators will be less and less qualified, and the level of their work will decline.

Given the need expressed by Nikishina (2018) and Tomaszkiewicz (2019) for consistency and precise guidelines in the education of future translators, the research findings led the author to attempt to design an MTPE course. The set of 15 lessons of 1.5 hours each is considered to be an impulse to introduce this component in the university curriculum. The course is structured to include an introduction, the three stages of the MTPE process, time for exercises to consolidate and test the knowledge and skills acquired, as well as a discussion on the future of post-editing and students' evaluation of course. The tasks are arranged in such a way that trainees systematically learn and improve the MTPE process. Upon completing the course, the participants should be equipped with basic knowledge of the discussed field and skills that will enable them to work independently in processing machine translations within various fields. The author encourages the researchers to investigate whether the above assumptions are achievable and to suggest further adjustments.

The above MTPE course proposal includes using tools such as light and full post-editing guidelines and ECL rules. However, these measures do not differentiate and address the needs of the fields from which the texts originate. In other words, a different approach would be needed for literary, academic or journalistic texts and another for texts from the field of law or medicine. Therefore, the next step to improve the MTPE course and enrich the state of knowledge of working with machine translations should be to adapt (or construct) separate guidelines and rules for varied disciplines. Again, a suitably adapted tool could be a valuable contribution to the development of MTPE.

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