

# Student Performance in Machine Translation Training: Assessment and Exploration

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**Abstract**—The present research aims to conduct a process-oriented analysis to measure whether a group of graduate students enrolled in a translation course made steady progress in their performance of identifying machine translation (MT) errors and post-editing MT drafts of company web texts and news texts. A mixed methods approach consisting of quantitative and qualitative analyses was used. The findings show that there was a steady decline in the average number of MT errors that students could not spot or correctly identify in their three assignments. However, there was no significant improvement in student MTPE performance, with only a slight decrease in errors in the final MTPE assignment, which still remained worse than the first one. Finally, student responses in their reflection essays indicated that their reception of MT and MTPE had shifted from negative denial to positive acceptance. Overall, the findings of the present study reveal the need to extend the period of MTPE training for students. Incorporating MT training into the translation course has proven to be worthwhile for students, as it helps to dispel students' previous misconception about MT and MTPE.

**Index Terms**—MT, MTPE training, a mixed methods approach, assessment of student performance, student reception of MT

## I. INTRODUCTION

Over the past few decades, the technological revolution and evolution of machine translation (MT) systems have significantly improved the semantic and grammatical accuracy of MT output. As a result, the public has regained their faith in using MT for information acquisition. Not only professionals in the translation industry but individuals from diverse sectors recognize its effectiveness and use it in their work, studies and other areas. Many translation service providers and companies view MT use, along with post-editing, as an effective way to handle huge amounts of translation work within tight turnaround times and limited budgets. At the university level, the improved quality of MT output has motivated many students to incorporate it into their translation assignments. While some educators consider MT a cheating tool, others view it as a learning tool. However, MT post-editing (MTPE) has become a common practice within companies, and helps boost translation productivity when compared with human translation (Aranberri et al., 2014). Thus, the author of this study believes that university education in translation training should include MT and MTPE, so it can help students to adapt to changes in the translation industry, and prepare them for future professional work. By teaching MT, students can learn to use it smartly and productively.

O'Brien (2002) highlighted the benefits of training in MTPE and stated that it could give translators an advantage when seeking employment opportunities. Many companies in Europe and the United States, including Caterpillar, General Motors, the Pan American Health Organization, and the European Commission Translation Service, have integrated machine translation technology into their daily work and are looking to hire translation graduates who are proficient in post-editing (Allen, 2003; O'Brien, 2002). Somers (2003) recognized post-editing as a skill that needs to be honed. In their study of post-editing, Krings (2001) mentioned that an editor, Geoffrey S. Koby, informed them that "the translator must be trained in post-editing" (p. 12). Despite the importance of MTPE, many educators in Taiwan have not provided MT training, and many translators in Taiwan's localization companies or translation agencies do not use the method when handling their translation tasks. The previous negative impression of MT's poor quality may be one reason for their hesitation to implement MTPE. Some instructors fear that students may lose their translation skills and lower their language proficiency by working with poor MT outputs. However, significant advances in the quality of outputs produced by the NMT system could bring new impacts on student training in MT. The translation world is evolving, and the author has decided to incorporate MTPE into her translation class in Taiwan to write a new chapter in the context of translation teaching.

MTPE requires specialized training because it involves different skills than traditional translation. It is not always accurate to assume that a qualified translator will be a successful post-editor. According to Krings (2001), human cognitive processes related to source-text comprehension are different in translation and MT post-editing. Traditional translation is a less linear process and translators need much effort to interpret the messages of the source text from scratch. In contrast, reading MT outputs reduces their cognitive load, which increases the risk of being misled by MT errors. Therefore, students engaging in MTPE need to be more alert to hunt and correct errors. In traditional translation, trainee translators are taught to be accurate and pay attention to cultural and textual equivalence, while MTPE training

requires more caution due to the changing nature of recurring errors in MT outputs. Moreover, human translation aims for publication, whereas MTPE involves both light rendition, which allows for minor errors and unnatural style, and full rendition, which requires zero errors and natural flow of the edited text. Thus, specialized training is needed for MTPE.

Incorporating MTPE into translation courses raises questions about how well students can perform after receiving training. Can they cope with MT errors shortly after learning MTPE strategies? Do they steadily improve their post-editing skills over time? To answer these questions, the author implemented MTPE in her course and brought up three research questions (RQ) to guide her investigation:

- (1) Does students' ability to identify MT errors improve steadily over several weeks of MT training?
- (2) Does students' MTPE performance improve steadily over several weeks of MT training?
- (3) Does students' perception of MT and MTPE change after receiving the training?

To answer the first research question, the author (instructor) will calculate the number of MT errors that students failed to identify in their assignments over several weeks of MT training. To seek the answer to the second research question, the author will calculate the number of errors that students made in their post-edited MT texts over the same period. In addition, the author will evaluate student reflections in their written reports to determine if they have undergone a conceptual change towards MT and MTPE after receiving the training.

## II. THEORETICAL REVIEW

As this paper aims to probe student learning by examining their ability to identify MT errors and their performance in MTPE of news texts in a translation course, it is important to define and explain the concepts of MT errors, MTPE, and MTPE strategies in this section.

### A. *MT Errors*

Despite the technological advancements of neural MT systems, errors are still present in the semantic, grammatical, syntactic, and pragmatic aspects of the automated translation produced. The type and number of errors vary depending on the MT systems and source texts. Shih's (2006) study of errors produced by statistical MT systems identified some recurring types of errors, including mistranslated homonyms and homographs, subject-specific lexical items, proper nouns, idioms, metaphors, and colloquial expressions. The study also found errors in syntactic and grammatical aspects, including mistranslated compound nouns and subjects, relative clauses, prepositional phrases, passive voices, articles, past participles, infinitive-led phrases, negative auxiliaries, and verb phrases. In contrast, Shih's (2001) study of errors in the news MT produced by neural Google Translate found decreasing error types, only divided into language-specific errors of inaccurate translation and pragmatic errors of "incorrect expressions or presentation that do not meet the real circumstance in which the target language is used" (p. 143).

Vilar et al. (2006) studied English-Spanish and En-Ch MTs produced by rule-based and statistical MT systems and found common errors such as missing words, incorrect word order, incorrect-meaning words, unknown words, and incorrect punctuation marks. Niño (2008) investigated some MT errors, including mistranslated proper nouns, different meanings, nonsense, wrong sense, false friends, collocation/idiom, words not interchangeable in context, and incorrect cultural equivalents. Kliffer (2008) examined MT errors in agreement, anaphora, article, literal, mistranslation, omission, preposition, punctuation, spelling, structure, tense, word choice, and word order. Luo (2014) analyzed En-Ch MT errors in noun phrases, verb phrases, prepositional phrases, infinitive phrases, and participle phrases. In the author's class, only linguistic and pragmatic errors extracted from her own study need to be detected by students.

### B. *MTPE: Definition and Strategies*

Post-editing is an essential aspect of using machine translation (MT) tools, as the raw MT output is not always 100% accurate semantically, syntactically, or pragmatically. Translation scholars have approached MTPE in different ways. Vasconcellos (1987) defined it as "adjusting the machine output so that it reflects the meaning of the original text as accurately as possible, with an emphasis on adjusting relatively predictable difficulties" (p. 41). Veale and Way (1997) defined MTPE as the correction of MT output by human translators. Allen (2003) described it as the task of editing, modifying, and correcting pre-translated text produced by an MT system. Martin-Mor et al. (2016) perceived MTPE as the task of editing and correcting raw MT output. In simple terms, MTPE involves checking and fixing errors in raw MT output.

Some research (Koehn, 2009; Ortiz-Martinez et al., 2016) viewed MTPE as a form of revision because they maintained that the time spent on PE was focused on pauses, such as omitting words and changing the word sequence, not typing on the keyboard. Thus, MTPE is associated with revision. Lommel (2018) declared that MTPE was paid at 60 to 65% of the full word rate, so MTPE was a form of revision, not translation. Due to the lower word rate for MTPE payment, post-editors should use as much of the raw MT output as possible if they are accepted.

To produce high-quality post-editing, editors need to follow MTPE guidelines and be well-versed in MTPE strategies. According to Loffler-Laurian (1994), fast MTPE involves quick correction of basic MT errors, while conventional MTPE requires more time and effort for elaborate correction or fine-tuning (as cited in Doherty & Gaspari, 2013; Shih, 2021). The primary objective of fast MTPE is to enable audiences to grasp the essence of the translation, while conventional MTPE aims to meet the standard of publication. Shofner (2021) argued that light MTPE should be sufficient for information

scanning or obtaining the gist of the text (TAUS, 2016). Conversely, full MTPE must be error-free and of human-translation quality (TAUS, 2016). In Depalma's (2013) report, the principles for light MTPE include the correction of mistranslations, lexical omissions, lexical additions, adherence to domain-specific terminology glossary, correct spelling, and terminological consistency (as cited in Shih, 2021). On the other hand, the principles for full MTPE include accurate cross-referencing, correct headers and footers, accurate grammar, semantics, punctuation, spelling, and a register-specific writing style (as cited in Shih, 2021).

According to Hu and Cadwell (2016), MTPE prioritizes factual accuracy, terminological consistency, correct grammar, correct semantics, rewriting of confusing sentences, and correction of other MT errors, such as machine-generated unnecessary or extra words. Full MTPE, on the other hand, emphasizes accurate messages, terminological consistency, appropriate terminology, correct grammar, semantics, punctuation, spelling, modification of incorrect syntactic structure, correct formatting and correction of other MT errors such as stylistic awkwardness (as cited in Shih, 2021). As the current MTPE guidelines tend to focus on translation within the same linguistic system, the author provided her students with her own MTPE guidelines. She instructed students to identify linguistic and pragmatic MT errors, and taught them the MTPE strategies used to amend the two types of errors. Students could choose from the given list of strategies to edit the MT draft. If students are unable to edit using the recommended strategies, their MTPE assignment is deemed flawed and unsuccessful.

### III. METHODOLOGY

#### A. Description of MTPE Training

A model of MTPE training was incorporated into an MA-level translation course that met students for three hours every week. MTPE training was a small part of the course and the author considered the training model a pilot study whose outcome could inform future modifications to the MT class. The course was attended by twelve first-year graduate students who majored in translation and interpretation, all of whom had no prior experience in MTPE. The training ran for five weeks.

The MT/PE training was provided to achieve four objectives: three for the student development of MTPE skills and one for student MTPE concept acquisition or/and adjustment. The three MTPE skills that students needed to develop include (1) the ability to identify common types of MT errors, (2) the ability to choose the right MTPE strategies to fix MT errors, and (3) the ability to self-monitor and improve their MTPE performance. Additionally, students were expected to develop a positive attitude towards MT and MTPE, and maintain a clear and accurate perception of MTPE. To achieve the objectives, the training included theoretical information input on three online MT tools, MT errors, the definition and function of MTPE, and MTPE strategies in the first week as well as regular hands-on practice from the second to the fifth week.

In their assignments, students were asked to identify MT errors and amend them. The instructor graded student assignments and provided feedback. During class, the instructor corrected any errors in student identification and demonstrated appropriate MTPE techniques. All student assignments were shared in class for peer learning. At the end of the five weeks, students were asked to write a short reflective essay. The three major tasks performed inside and outside the class are shown as follows.

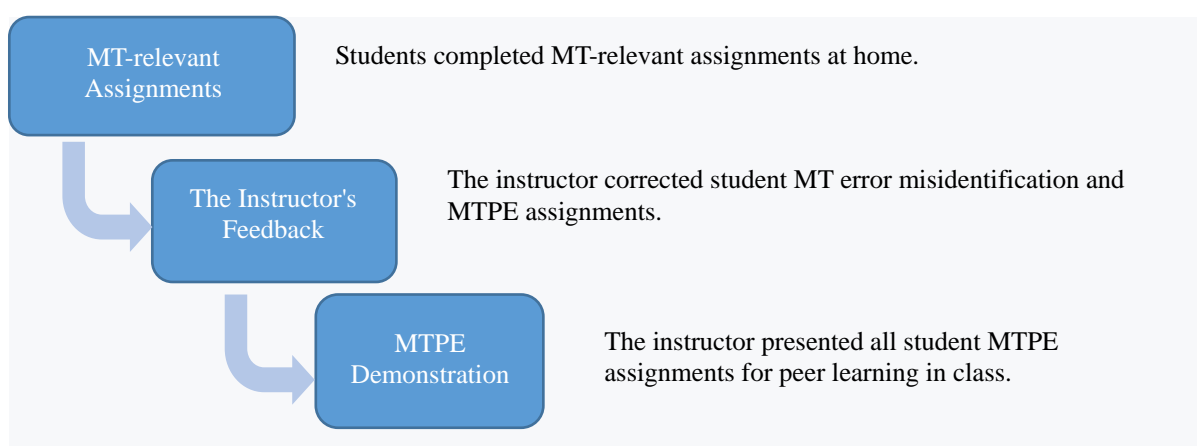


Figure 1. The Major Tasks Performed Inside and Outside the Class

The graduate students taking the course were aged between 24 and 27, and had a high level of English proficiency, so they were considered suitable candidates for MT training.

#### B. Methods

A mixed-methods approach was used to conduct the present research. The quantitative analysis involves calculating the number of misidentified MT errors and mis-corrected MT errors during the period of implementing MT training.

The purpose was to observe if there was a significant decrease in the number of the above two types of errors in student assignments the student performance in their three assignments was assessed and used in the process-based analysis.

Additionally, a qualitative analysis was conducted through reflective essays written by the students. Three questions for students to answer include: (1) What's your experience of learning to identify MT errors? (2) What's your experience of learning to fix MT errors using some MTPE strategies? (3) How do you change your perception of MT and MTPE after receiving the training?

### C. Assignments for Analysis

The prerequisite for successful MTPE is that the raw MT output must have a good enough quality. It has been observed that there are fewer errors in the MT drafts of informative texts as compared to expressive and operative texts. This is because informative texts are content-based and aim to communicate messages clearly, according to Reiss' (2000) text typology theory. In a different manner, expressive texts, such as literary works, are form-oriented and aim to express the author's creative style and format, while operative texts, such as advertisements and speeches, aim to create emotional appeal to audiences. When the latter two types of texts are processed by MT systems, they cannot produce automated translations with a good enough quality, and require more effort of MTPE than human translation from scratch. Therefore, the instructor chose the MT output of informative texts for student practice of MTPE.

The four texts collected for the pilot study are clips extracted from company web texts and journalistic texts on the web. They are of the similar length and students do not need special background knowledge to understand the textual content. The errors in the MT outputs encompass the linguistic and pragmatic errors that need to be fixed through MTPE. By amending the errors through MTPE, the edited texts read with natural flow, semantic accuracy and pragmatic appropriateness.

### D. Criteria for Analysis

Two sets of criteria are utilized to evaluate the performance of students in MTPE. The first set consists of a series of MT errors that students are required to identify and indicate in their assignments. Linguistic errors comprise of incorrect words, incorrect specialized terms, and incorrect word order. On the other hand, pragmatic errors include unlocalized specialized terms, redundant or repeated words, inconsistent terminology, segments that do not comply with the linguistic conventions of the target language, and incomplete linguistic expressions. Table 1 shows the two types of MT errors that students need to scrutinize and indicate in their assignments.

TABLE 1  
MT ERRORS

| Linguistic MT Errors   | Examples   |
|--|--|
| Use of incorrect specialized terms   | ST: The <u>Electrical network</u> is classified as hazardous.<br>MT: 電氣網絡歸類為危險品。   |
| Use of incorrect word order  | ST: "We've seen nationalism distorted into nativism, forgotten the dynamism that immigration has always brought to America," Mr. Bush said.<br>MT: "我們已經看到民族主義被扭曲為本土主義，忘記了移民一直給美國帶來的活力" 布什先生說。 |
| Use of words with incorrect meanings   | ST: Take <u>Drive</u> even further<br>MT: 更進一步駕駛   |
| Pragmatic MT Errors  | Examples   |
| No use of well-established terms for target audiences                              | ST: Rice Cooker, Drive, Videos<br>MT: 電飯鍋\雲端硬碟\視頻(for China's audiences)   |
| No terminological consistency  | ST: Drive...drive...drive<br>MT: Drive...雲端硬碟...驅動器  |
| No use of segments/clauses that meet the linguistic conventions of target language | ST: Elite benefits reach new heights.<br>MT: 獲得的精英福利達到了新的高度。   |
| No explication of implicit meanings  | ST: From weddings to meetings to family reunions.<br>MT: 從婚禮到會議再到家庭聚會。   |

Students can understand what problems cause current NMT systems to produce mistranslation when identifying MT errors. Students are expected to easily detect MT errors through practice. On the other hand, student MTPE performance is evaluated, so the author/instructor can understand student difficulties in the process of MTPE. The author also wants to discover if students can improve their MTPE in the end. The errors shown in student MTPE assignments are to be calculated, including (1) no change of the incorrect word order, (2) no editing or incorrect editing of the words without correct meanings, (3) no change of passive voice into active voice, (4) no revision of proper nouns and terminology, (5) no correction of incorrect punctuation, (6) no explication of pronouns (e.g., they, he), (7) no explication of implicit meanings and (8) no revision of words/segments that do not meet the linguistic conventions in Taiwan. Examples are shown below.

Students are expected to be able to identify MT errors and understand the problems that cause current NMT systems to produce mistranslations. Through practice, they should be able to easily detect MT errors. However, their MTPE

performance will also be evaluated to help the instructor understand any difficulties students may encounter during the process of MTPE. The author/instructor also wants to find out whether students can improve their MTPE skills through the training. The errors identified in student MTPE assignments will be tallied, including: (1) failure to correct word order errors, (2) no editing or incorrect editing of words with incorrect meanings, (3) failure to change passive voice to active voice, (4) failure to revise proper nouns and specialized terminology, (5) failure to correct punctuation errors, (6) failure to clarify pronouns, (7) failure to explain implicit meanings, and (8) failure to revise words/segments that do not conform to linguistic conventions in Taiwan. Examples of these errors are provided below.

TABLE 2  
MTPE ERRORS

| Linguistic MTPE Errors   |   |
|--|---|
| (1) No change of the incorrect word order  | ST: It's that time of year again, <u>folks</u> . It's time for the War on Christmas.<br>MT: 又到了每年的这个时候, <u>伙计们</u> 。<br>PE: 又到了每年的這個時候了, <u>夥伴們</u> 。<br>Feedback: <u>夥伴們</u> should be put at the beginning of the translation sentence  |
| (2) No or incorrect editing of the words without correct meaning                         | ST: Mr. Gibson said the book had <u>taken on a life</u> of its own over the years — and that it had never dwelled on the political implications of “Happy Holidays”.<br>MT: 吉布森先生说, 多年来, 这本书已经有了自己的 <u>生命</u> 。并说它从未纠缠于“节日快乐”的政治含义。<br>PE: 吉布森先生說, 多年來這本書有了自己的 <u>定義(影響力)</u> 。他從未討論“節日快樂”的政治含意。<br>Feedback: <u>定義</u> should be corrected as <u>影響力</u> |
| Pragmatic MTPE Errors  |   |
| (3) No change of passive voice into active voice   | ST: That culture war issue <u>ignited</u> and we won.<br>MT: 那个文化战争问题被点燃了, 我们赢了。<br>PE: 那個文化戰爭問題被点燃了, 我們贏了。<br>Feedback: <u>被点燃了</u> should be corrected as <u>又点燃了</u>   |
| (4) No revision of incorrect proper nouns  | ST: Fox News<br>MT: 福克斯新聞<br>PE: 福克斯 ( 福斯 ) 新聞<br>Feedback: 福克斯新聞 should be corrected as 福斯新聞   |
| (5) No correction of incorrect punctuation   | ST: “We’ve seen nationalism....” Mr. Bush said.<br>MT: “我們看到民族主義....”小布希說。<br>Feedback: “..... ” should be replaced with 「..... 」   |
| (6) No explication of pronouns (e.g., they, he)  | ST: When Bill made it an issue, <u>it</u> went mega.<br>MT: 當比爾把它變成一個問題時, <u>它</u> 就變得巨大了。<br>PE: 因為當比爾引發聖誕節這個話題時, <u>它(這本書)</u> 就成了大話題。<br>Feedback: <u>它</u> should be corrected as <u>這本書</u>  |
| (7) No explication of implicit meanings (e.g., the country, this country)                | ST: So perhaps there is hope for peace on earth, <u>or at least cable television</u> .<br>MT: 因此, 也許地球上的和平是有希望的, <u>或者至少是有線電視</u><br>PE: 因此, 也許地球上的和平是有希望的, <u>至少存在有線電視(可以看到)</u> 。<br>Feedback: <u>至少存在有線電視</u> should be corrected as <u>至少在有線電視可以看到</u>  |
| (8) No revision of words/segments that do not meet the linguistic conventions in Taiwan. | ST: <u>Elite benefits</u> reach new heights.<br>MT: 獲得的 <u>精英福利</u> 達到了新的高度。<br>PE: 獲得的 <u>精英福利</u> 達到了新的高度。<br>Feedback: Revise <u>精英福利</u> into <u>尊榮福利</u> 。   |

If the rates of misclassifying and failing to amend MT errors in student assignments gradually decrease, it would demonstrate that the MTPE training had a positive impact on students' abilities.

#### IV. FINDINGS AND DISCUSSION

The author piloted the present study to investigate student performance in the identification of MT errors and the post-editing of English into Chinese MT output produced by DeepL. The results are used to answer the three research questions raised in section one.

##### A. Student Performance in MT Error Identification

In response to RQ1 on the progress of student identification of MT errors during the training process, the statistical results showed that the average number of MT errors that students failed to identify or incorrectly identified in their first assignment was 18. In the second assignment, there was a slight drop to an average of 14 errors, and in the final assignment, the average number further decreased to 10. This trend indicates that the training was effective in helping students improve their ability to identify MT errors, as evidenced by the decreasing number of errors over time.

In the first assignment, the highest number of MT errors that students had failed to identify was pragmatic MT errors, with an average number of 9.5. For example, students failed to spot the errors when "President Trump" was rendered as 「特朗普總統」 [lit: President Trump] and articles were directly rendered as 「一位」 [lit: a] and 「一次」 [lit: one time] that were redundant in Chinese translation. Passive voice was also not detected in the Chinese MT output, which should be changed into active voice. Additionally, students incorrectly marked pragmatic errors as linguistic errors, with an average number of 7.8, ranking second highest. For example, "In separate and unrelated appearances," and "casual cruelty" were translated as 「在單獨的、不相關的露面」 [lit: individual and irrelevant appearance] and 「隨意殘忍」 [lit: casual cruelty], respectively, in the MT output. While these translations do not convey a wrong message, native Chinese speakers would not present the message in that way. Clearer transmission of the message would require modification of the translations as 「在個別與政治不相關的場合露面」 [lit: appeared on separate and politically unrelated occasions] and 「不以為意的殘酷心態」 [lit: a callous attitude of cruelty] by adding words. Table 3 presents the statistical results of MT errors that students failed to identify or incorrectly identified in their first assignment.

TABLE 3  
THE ERRORS OF MIS-IDENTIFICATION OF MT ERRORS IN STUDENT ASSIGNMENT 1

|        | Pair 1 | Pair 2 | Pair 3 | Pair 4 | Pair 5 | Pair 6 | Average |
|--------|--------|--------|--------|--------|--------|--------|---------|
| Type 1 | 13     | 13     | 7      | 7      | 7      | 10     | 9.5     |
| Type 2 | 3      | 2      | 2      | 3      | 1      | 2      | 2.5     |
| Type 3 | 3      | 4      | 10     | 10     | 13     | 7      | 7.8     |
| Type 4 | 0      | 0      | 0      | 0      | 1      | 0      | 0.16    |
| Total  | 19     | 19     | 19     | 20     | 22     | 19     | 18      |

Note: 1=missing identification of pragmatic errors; 2= missing identification of linguistic errors; 3=mis-identification of pragmatic errors as linguistic errors; 4=mis-identification of linguistic errors as pragmatic errors.

In the second assignment, the highest number of errors that students failed to identify was still pragmatic MT errors, with an average number of 10.5, slightly higher than the first assignment (9.5). This could be attributed to the instructor's unclear and confusing guidance, which advised students to do light post-editing, not elaborate editing after the first assignment. As a result, in the second assignment, some students tried to avoid editing when they thought the MT output was good enough and the meaning was clear, resulting in the tolerance of some errors that should be marked but were skipped. For example, when the proper noun "it" was rendered as 「它」 [lit: it] in the MT output, the translation did not comply with Chinese linguistic conventions, but many students overlooked this pragmatic error.

It is interesting to note that the second most frequent type of error in both the first and second assignments was the same, but the average number of misidentifications decreased from 7.8 to 2.5 in the second assignment. For instance, some students classified the translation of "histrionic yuletide debate"-- 「激動人心的辯論」 [lit: exciting debate] as a linguistic error, while the MT output only used an inappropriate expression without conveying an incorrect meaning. Therefore, it should be identified as a pragmatic error. Table 4 provides statistical results on the misidentification of MT errors by students in the second assignment.

TABLE 4  
THE ERRORS OF MIS-IDENTIFICATION OF MT ERRORS IN STUDENT ASSIGNMENT 2

|        | Pair 1 | Pair 2 | Pair 3 | Pair 4 | Pair 5 | Pair 6 | Average |
|--------|--------|--------|--------|--------|--------|--------|---------|
| Type 1 | 13     | 13     | 10     | 6      | 9      | 12     | 10.5    |
| Type 2 | 3      | 1      | 2      | 0      | 2      | 2      | 1.6     |
| Type 3 | 3      | 4      | 0      | 2      | 2      | 2      | 2.5     |
| Type 4 | 0      | 0      | 0      | 0      | 0      | 0      | 0       |
| Total  | 19     | 18     | 12     | 8      | 13     | 16     | 14.3    |

In the final assignment, the highest number of errors that students failed to identify was linguistic errors, including incorrect word order and words with incorrect meanings. For example, some students did not mark words like "outspoken", "supplicants", "convincing", "more and more X", and "less and less Christ" as linguistic errors when they were mistranslated as 「直言不諱」 [lit: straightforward], 「請求者」 [lit: people who make a request], 「令人信服」 [lit: convincing], 「越來越多的 X」 [lit: more and more X] and 「越來越少的基督」 [lit: less and less Christ]. The correct translation should be 「能言善道」 [lit: eloquent], 「祈福者」 [lit: supplicants], 「令人信以為真」 [lit: making people believe it to be true], 「越來越多人使用 X'mas」 [lit: more and more people use X'mas] and 「越來越少人使用代表基督的 Christmas」 [lit: less and less people use Christmas to represent Christ]. However, the average number of pragmatic errors that students failed to identify in the third assignment dropped to 3.6. Table 5 shows statistical results of student MT errors misidentification in the final assignment.

TABLE 5  
THE ERRORS OF MIS-IDENTIFICATION OF MT ERRORS IN STUDENT ASSIGNMENT 3

|        | Pair 1 | Pair 2 | Pair 3 | Pair 4 | Pair 5 | Pair 6 | Average |
|--------|--------|--------|--------|--------|--------|--------|---------|
| Type 1 | 5      | 5      | 5      | 2      | 3      | 2      | 3.6     |
| Type 2 | 7      | 3      | 4      | 4      | 5      | 7      | 5       |
| Type 3 | 1      | 3      | 0      | 3      | 1      | 0      | 1.3     |
| Type 4 | 0      | 0      | 0      | 0      | 1      | 0      | 0.1     |
| Total  | 13     | 11     | 9      | 9      | 10     | 9      | 10.1    |

The technological advances in MT have greatly improved the quality of MT output, making it more difficult for students to detect MT errors. As Yamada (2019) has put it, the neural MT output is more fluent and closer to human translation, which makes it harder for students to correct errors. However, the pilot study showed that students made fewer errors in identifying MT errors in the final assignment. This suggests that with training, students can develop the ability to distinguish between pragmatic and linguistic MT errors, which increases the instructor's confidence in providing MT training.

### B. Student Performance in MTPE

The initial average number of errors that students made in their first PE assignment was 11.8, which slightly increased to 12.6 in the second assignment. In the final assignment, the average number of errors decreased to 12.1, but the improvement was not significant. When considering the type of errors, the average number of linguistic errors that students failed to correct in the first assignment was 4.3, whereas the average number of pragmatic errors was 9.1. In the second assignment, the average number of linguistic errors that were not addressed was 3.5, while the average number of pragmatic errors remained the same at 9.1. Finally, in the third assignment, the average number of linguistic errors that were not amended increased to 5.6, while the average number of pragmatic errors decreased to 6.5. Figure 2 displays the variation in linguistic and pragmatic MT errors that students failed to correct in their MTPE assignments.

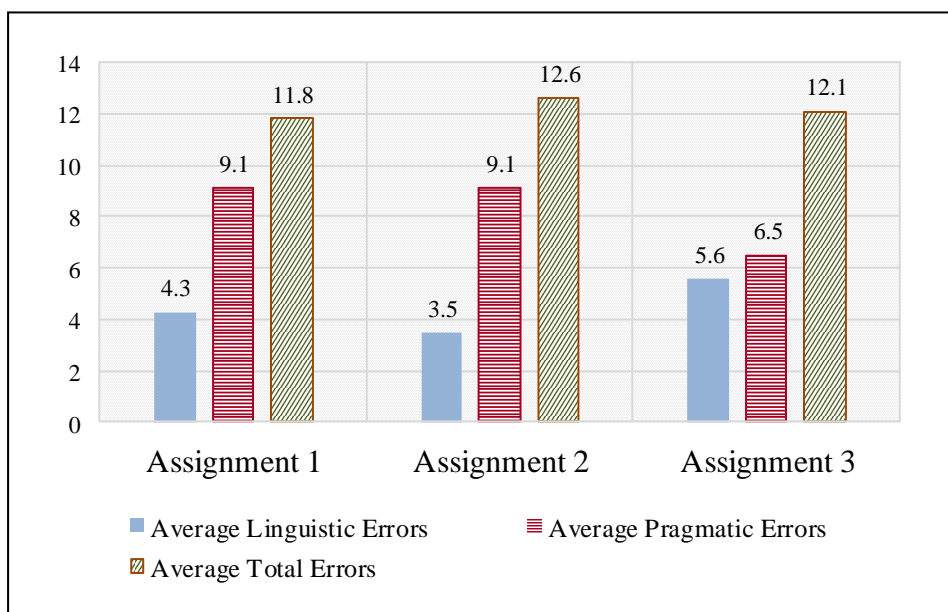


Figure 2. Statistical Results of Errors in Student Three MTPE Assignments

The lowest average number of errors in students' first MTPE assignment could be attributed to the fact that some of them lacked experience in MTPE and thus retranslated the entire sentence instead of editing the MT draft, resulting in fewer errors. However, this approach is time-consuming and not recommended as the correct way of MTPE. In the second assignment, some students were influenced by the instructor's advice to directly amend errors on the MT draft, rather than starting from scratch with human translation. Due to their lack of MTPE experience, students left some MT errors uncorrected, leading to a high number of errors in their output. In the final assignment, although students were more familiar with MTPE, they encountered challenging sentences that they could not fully understand, resulting in incorrect amendments to MT errors. The lack of a significant improvement in MTPE performance suggests that four weeks of hands-on experience with MTPE may not be sufficient for students. More time is needed for students to develop their MTPE skills and use appropriate strategies to amend MT errors effectively.

As mentioned above, many students in the first MTPE assignment did not have a clear concept of MTPE, so they tended to use manual translation to re-translate the source text, not engaging in MTPE. As a result, the average number of errors in Types 3, 5, and 6 was low since students changed the word order, used correct punctuation and pronouns. However, students did not add words to clarify the implicit meanings of expressions, resulting in a high average number

of MTPE errors in Type 7 (3.5). For example, in the MT draft, expressions such as 「他的兩位前任」 [lit: two of his predecessors], 「自己的身份」 [lit: our own identity], 「遠方」 [lit: distant places] and 「基本理想」 [lit: basic ideal] were not clearly rendered in the MT draft, but students did not fix them. To address this, the mistranslations should be amended by supplementing additional information, for example, 「小布希與歐巴馬兩位前任總統」 [lit: the two former presidents, Bush and Obama], 「美國人自己的民主身份」 [lit: the democratic identity of the American people], 「遠方其他國家」 [lit: other countries far away] and 「基本的民主理想」 [lit: basic democratic ideals]. Table 6 shows statistical results of errors in student MTPE assignment 1.

TABLE 6  
ERRORS IN STUDENT MTPE ASSIGNMENT 1

|        | Pair 1 | Pair 2 | Pair 3 | Pair 4 | Pair 5 | Pair 6 | Average |
|--------|--------|--------|--------|--------|--------|--------|---------|
| Type 1 | 4      | 4      | 0      | 1      | 1      | 0      | 1.6     |
| Type 2 | 8      | 3      | 0      | 4      | 1      | 0      | 2.6     |
| Type 3 | 1      | 1      | 0      | 0      | 2      | 0      | 0.6     |
| Type 4 | 3      | 2      | 0      | 1      | 5      | 0      | 1.8     |
| Type 5 | 0      | 2      | 0      | 0      | 1      | 0      | 0.5     |
| Type 6 | 1      | 1      | 0      | 1      | 0      | 1      | 0.6     |
| Type 7 | 3      | 3      | 4      | 4      | 5      | 2      | 3.5     |
| Type 8 | 4      | 0      | 1      | 2      | 2      | 3      | 2       |
| Total  | 24     | 16     | 5      | 13     | 17     | 6      | 11.8    |

Note: Type 1=No change of incorrect word order, Type 2=No correction or mis-correction of incorrect words, Type 3=No change from passive into active voice, Type 4=No revision of proper nouns, Type 5=No revision of inappropriate punctuation, Type 6=No explication of pronouns, Type 7=No explication of implicit meanings of words, Type 8=No revision of words/segments that do not meet the linguistic conventions in Taiwan.

In the second MTPE assignment, the average number of errors in student failure to edit words/segments that do not meet Chinese linguistic conventions (5.3) was higher than in the first assignment (2). One possible reason for this was that students tried their best to retain the MT draft without revision and overlooked some expressions that did not conform to the way Chinese is spoken Taiwan. For instance, 「福克斯新聞」 [lit: Fox News] 「競選路線」 [lit: campaign-trail] 「政治的聲明」 [lit: political statements] in the MT draft were non-standard expressions used in Taiwan, but students did not revise them. These should be edited as 「福斯新聞」 [lit: Fx News], 「競選活動期間」 [lit: campaign period] and 「政治宣傳」 [lit: political propaganda] respectively. In addition, the average number of MTPE errors without changing the language order (2.3) was higher in the second assignment than the first (1.6). Perhaps the MT draft sounded fluent, so students did not revise it. Another reason could be that the second assignment had more phrases that needed a change in the word order than the first assignment. Table 7 shows the statistical results of MTPE errors in the second assignment.

TABLE 7  
ERRORS IN STUDENT MTPE ASSIGNMENT 2

|        | Pair 1 | Pair 2 | Pair 3 | Pair 4 | Pair 5 | Pair 6 | Average |
|--------|--------|--------|--------|--------|--------|--------|---------|
| Type 1 | 2      | 2      | 3      | 0      | 3      | 3      | 2.3     |
| Type 2 | 1      | 0      | 2      | 3      | 2      | 0      | 1.3     |
| Type 3 | 0      | 0      | 1      | 0      | 0      | 0      | 0.2     |
| Type 4 | 0      | 0      | 1      | 0      | 1      | 0      | 0.3     |
| Type 5 | 0      | 0      | 0      | 0      | 2      | 0      | 0.3     |
| Type 6 | 3      | 0      | 1      | 0      | 2      | 0      | 1       |
| Type 7 | 2      | 2      | 2      | 2      | 2      | 2      | 2       |
| Type 8 | 8      | 3      | 5      | 3      | 8      | 5      | 5.3     |
| Total  | 16     | 7      | 15     | 8      | 20     | 10     | 12.6    |

In the final MTPE assignment, there was fewer errors in Type 3 (passive to active), Type 5 (correction of incorrect punctuation), and Type 8 (modification of phrases that do not conform to Chinese usage). In particular, Type 8 showed a significant improvement, decreasing from 5.3 in the second assignment to 2.1 in the final one, indicating that students were more attentive to correcting awkward and non-standard expressions. For example, they revised 「克勞斯先生」 [lit: Mr. Claus] and 「郵政編碼」 [lit: postal code] in the MT draft to 「聖誕老人」 [lit: Santa Claus] and 「郵遞區號」 [lit: zip code]. In contrast, Type 1 (correcting the incorrect word order) and Type 2 (no correction of words with incorrect meanings) showed a regression compared to the second assignment, with more instances that required adjustments to the sentence structure that students failed to notice. Table 8 shows the statistical results of MTPE errors in the final assignment.



TABLE 8  
ERRORS IN STUDENT MTPE ASSIGNMENT 3

|        | Pair 1 | Pair 2 | Pair 3 | Pair 4 | Pair 5 | Pair 6 | Average |
|--------|--------|--------|--------|--------|--------|--------|---------|
| Type 1 | 4      | 4      | 1      | 4      | 3      | 3      | 3.1     |
| Type 2 | 3      | 3      | 5      | 2      | 2      | 0      | 2.5     |
| Type 3 | 0      | 0      | 0      | 0      | 0      | 0      | 0       |
| Type 4 | 3      | 3      | 1      | 0      | 2      | 0      | 1.3     |
| Type 5 | 0      | 1      | 0      | 0      | 0      | 0      | 0.2     |
| Type 6 | 0      | 0      | 0      | 0      | 0      | 0      | 0       |
| Type 7 | 4      | 2      | 2      | 2      | 3      | 3      | 2.6     |
| Type 8 | 3      | 2      | 2      | 1      | 4      | 1      | 2.1     |
| Total  | 17     | 15     | 11     | 9      | 14     | 7      | 12.1    |

It is true that the types of MTPE errors made by students can vary depending on the content of the assignment. However, if students have a high level of skill in MTPE, they should be able to handle different types of errors effectively. The results of this study suggest that students made more errors in Types 1, 2, and 8 across all three assignments, indicating that these areas may require more attention and training from the instructor. By providing targeted instruction and practice in these areas, students may be better equipped to improve their MTPE skills and produce more accurate translation.

### C. Student Reception of MT Errors and PE

The results of RQ3 indicated that students' understanding of ME errors and MTPE improved after the MT training. The reflections of students can be analyzed in the following three categories.

#### (a). The Learning Process of Identifying MT Errors

The majority of students reported that they were better able to identify different types of MT errors after receiving MTPE training. However, they also acknowledged that they needed more practice to become quicker and more efficient at identifying these errors.

#### (b). The Learning Process of Using MTPE Strategies to Correct MT Errors

Many students claimed that they previously believed that retranslating the entire MT draft was the only way to improve its quality. They had limited expectations and only aimed to understand the overall meaning of the draft. However, after the MTPE training, they learned various strategies to identify and correct different types of MT errors. They realized that it was not necessary to start the translation from scratch, and they could make significant improvements by editing the MT draft using appropriate methods.

#### (c). Differences in Student Concept of MTPE

Many students reported that before the MT/PE training, they held negative views about the usefulness of MTPE. They believed that online MT tools were only good for word look-up and information scanning, and that MT drafts were highly erroneous. Consequently, they saw MTPE as a time-consuming and energy-draining task. However, after they had practiced editing MT drafts of company web texts and news texts, they came to appreciate the benefits of MTPE. They realized that using correct MTPE methods could save them a lot of time and enhance their translation efficiency and productivity. As a result, they began to view MTPE more positively.

## V. CONCLUSION

This study aimed to investigate the performance of graduate students in identifying MT errors and conducting MTPE on company web texts and news texts. A process-based analysis was conducted to determine whether the students made a steady progress in their abilities during the translation course. The study employed a mixed-methods approach, comprising both quantitative and qualitative analyses. The quantitative analysis focused on student learning outcomes, while the qualitative analysis explored changes in student perception of MT and MTPE.

The results of the study showed a steady improvement in the students' ability to identify MT errors, with the average number of errors they could not spot or incorrectly identify decreasing from 18 in the first assignment to 14 in the second and 10 in the final assignment. This indicates that the MT error training had a positive impact. However, the students' performance in MTPE did not show significant improvement, with only a slight decrease in errors in the final assignment, which was still worse than the first one. This can be attributed to the students' lack of sufficient MTPE experience and the need for more practice to develop effective strategies for identifying and correcting MT errors. The students' reflections in their essays revealed a shift in their perception of MT and MTPE, from pessimistic opposition to optimistic acceptance. The study emphasizes the need to extend the period of MTPE training in translation courses and to incorporate MT training to help students learn MTPE skills and overcome their misconceptions about MT and MTPE.

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