

# A Survey of Translation Learners' Uses and Perceptions of Neural Machine Translation\*

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**Abstract**—This paper reports a questionnaire-based survey that was designed to investigate how a group of Chinese translation learners used and perceived Neural Machine Translation (NMT), with a view to providing pedagogical implications for translation instruction which is being confronted with the AI-powered translation technology. 326 second- and third-year college students, who were translation learners as well as English majors from the same university in China participated in the survey. They reported high frequency of NMT use in their translation learning as well as English major learning. Instead of directly borrowing the NMT output, most of them post-edited it and/or used it as inspiration to accomplish their translation tasks. Although they evaluated NMT in a positive way and held an optimistic view toward the future of translation career, they expressed varying degrees of worry and anxiety toward their future employment and toward the use of NMT in the process of the translation learning. They clearly articulated the needs for NMT instruction in translation courses. Based on these findings, this paper proposes several ways to help reduce the learners' worry and anxiety in translation instruction.

**Index Terms**—Neural Machine Translation, translation teaching, translation technology, sustainability

## I. INTRODUCTION

### A. Background and Motivation

Neural Machine Translation (NMT) seems to symbolize the beginning of a new era for machine translation because of its allegedly largely improved translation quality. Google's NMT (GNMT), for example, is proved to have an improved translation quality which is close to human translation on some test sets, whose translation error rate is said to have dropped by approximately 60% on some popular language pairs compared with Google's early version of MT, the phrase-based statistical machine translation (SMT) (Wu et al., 2016). A lot of other empirical evidences also point to the fact that the translation quality of NMT is significantly higher than that of SMT (see, e.g. Bentivogli et al., 2016; Isabelle et al., 2017; Klubička et al., 2017; Koehn & Knowles, 2017).

As has been pointed out by Moorkens (2018, p. 375), "The rise of NMT has been accompanied by a good deal of media hyperbole about neural networks and machine learning, some of which has suggested that several professions, including translation, may be under threat." Similar observation has been made by some Chinese scholars like Ye (2017) and Qin (2018). Such threat posed by NMT was also sensed by translation/interpreting majors and foreign language majors. In September 2018, for example, a freshman just enrolled in the School of Foreign Languages of a famous Chinese university wrote at the very beginning of his new school life to the president of the university (Ifeng, 2018), saying that he would have no choice but to drop out of school if he were not offered a chance to change his current English Language program to some other program because he foresaw a future filled with gloom since, according to "many experts", MT would replace human translation in many occasions as long as its accuracy rate reached 93% or above.

It has long been observed that technological breakthrough will have great impact on learning and teaching. This is no exception for majors of translation/interpreting and of foreign languages, for whom AI-powered NMT can be both a blessing and a curse. Accordingly, translation teaching has to make changes, or develop sustainably, to adapt to this new era in which AI is playing a big role.

This study is designed to explore how NMT has impacted a group of Chinese college students majoring in English who are taking or have taken the course of translation (hence I refer to them as translation learners in this article) by examining their uses and perceptions of NMT, with a view to detecting their potential anxiety and needs concerning the new technology so that pedagogical implications can be offered for the sustainability of translation teaching in the era of AI.

### B. Previous Studies

A number of studies focusing on MT and the other forms of translation technology (TT), like CAT, are devoted to disclosing translators' uses and perceptions of, and needs for TT with diversified purposes.

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At the time of the advent of Web 2.0 technologies, professional translators had “vague awareness and insufficient understanding” of the new TTs and low frequency of using them probably due to their reluctant attitude towards employing new technologies (Joanna, 2011, p. 195). But just a few years later, this changed significantly probably due to the further development of the TTs and the translators’ raised awareness of them. A case in point is a large-scale survey of MT competencies on representatives from the translation and localization industry, professional translators, researchers and translation trainers conducted in or before 2015, which found “the growing uptake of MT and the perceived increase of its prevalence in future workflows” (Gaspari et al., 2015, p. 1).

In an even larger-scale survey on professional translators from 88 different countries (Zaretskaya et al., 2015), respondents showed high interest in TTs, with the majority of them regularly using translation memory (TM) systems, but with a much lower percentage using MT due to its low quality and the energy-consuming PE. Even so, “most translators (74%) think they could benefit from a high quality MT system” (Zaretskaya et al., 2015, p. 6), indicating that professional translators, though not using it frequently, do not view MT as a threat. However, different results were reported in a focus group study of institutional translators at the European Commission’s Directorate-General for Translation (Cadwell et al., 2016): MT was frequently used and was deemed as a useful tool. The mostly agreed reasons for the active adoption of MT included “for speed or productivity gains”, “because of the perceived good quality of the MT output”, “for inspiration, to kick-start the translation process, or for new ideas” and “to reduce typing or clicking” (Cadwell et al., 2016, p. 21).

More recently, a survey of the translators from the French language department of the European Commission (Rossi & Chevrot, 2019, p. 184) showed “good MT acceptance and frequent use, as well as patent variation and polarisation on the assessment of future prospects.” It further disclosed that the major factors impacting on professional (non-)acceptance of MT are “perceptions of control, subjective norm and image, as well as insecurity (fear of MT)” (Rossi & Chevrot, 2019, p. 177). Cadwell et al. (2018, p. 301) presented somewhat different factors influencing translators’ use and non-use of MT: text type, language pair, quality and trust.

From what is described here, we may argue that translators’ attitude towards TT has changed from being reluctant to being positive, that TT have gained more and more popularity among translators, and that quality is one of the major factors discouraging translators from frequently using MT. The focal points of the major studies concerned involve users’ (in most cases translators’) actual use of TT, perception of the quality of MT, TT’s impacts (or consequences) on users and on the translation process, users’ prediction of TT’s future development and influence on the translation profession, and users’ needs, requirements and expectations concerning TT.

In almost all the studies, it is professional translators who are selected as the participants, whose feedback is good for the improvement of TT since they are the immediate users and/or clients of TT developers, and is also beneficial to the other professionals in the translation industry to help them overcome fear of technology, if any, or any other unintended consequences brought about by TT. Professional translators’ feedback is also helpful in offering hints and suggestions for translator training. But that helpfulness is quite limited since translation professionals are not translation learners so that translation instructors do not know exactly how their direct interactants use and perceive TT, thus not knowing their fear (or non-fear) of TT and needs for TT instruction. Although there are a few studies that did address translation learners’ uses and perceptions of MT, they were not designed for detecting the possible concerns and needs of translation learners. Man et al. (2020), for example, surveyed a group of postgraduates majoring in Translation and Interpreting in China to reveal TT adoption among them, and found a positive correlation between knowledge of TT and its frequency of use. Another study (Liu et al., 2022) conducted among students (both undergraduates and postgraduates) majoring in translation and translation instructors in Hong Kong universities, with the purpose of disclosing how useful MT was in translation competence acquisition, found that “MT is particularly helpful in gaining lexical knowledge and knowledge to ensure translation efficiency, but not in bicultural knowledge” (Liu et al., 2022, p. 1). Both studies had purposes and motives different from this current study.

In this era when we are being “invaded” by robots, learners may soon get lost if the technology issue is not properly handled, and this is particularly true for translation learners, who might think their future job will be completely replaced by robots. Therefore, it is urgent for us to find out how they, as learners, not professionals, practice with and think of TT, especially NMT which seems to be a most threatening technology, so that pedagogical implications can be obtained to maintain the sustainability of translation teaching.

### C. Aims

This study will report a questionnaire-based survey targeted at a group of Chinese translation learners who are being trained or have been trained to do translation between English and Chinese, with the aims of:

- (1) providing a clear picture of translation learners’ uses of NMT, and
- (2) clarifying their perceptions of NMT, including their evaluation of its current performance and quality, prediction of its impacts on future career, perception of its impacts on current translation learning and needs for NMT instruction in translation courses, based on which the pedagogical implications for the sustainability of translation teaching in the new era will be discussed.

## II. METHODOLOGY

### A. Design

The questionnaire developed for this survey contains 30 items which are grouped into six sections: (1) uses of NMT, (2) evaluation of NMT, (3) prediction of NMT's impacts on future career, (4) perception of NMT's impacts on current translation learning, (5) needs for NMT instruction in translation courses, and (6) participants' bio-data. All the items, except one inquiring about the age in the bio-data section, are close-ended questions. Of all the closed-ended items, those in Section 1 and Section 6 are multiple choice questions, while those in all the other sections are five-point Likert-scale statements. The questionnaire was presented in Chinese instead of English to avoid possible misunderstanding since the participants were all native Chinese speakers.

Items in the sections other than the bio-data were designed out of two (groups of) sources in addition to the researcher's own brain work. First, a structured interview designed to provide inspiration and help determine the questions and their options to appear in the questionnaire. 21 translation learners participated in the interview. Second, previous studies, concerning uses, perceptions, evaluation and/or prediction of MT, which provided not only inspiration but also evidence to supplement and refine the items in the questionnaire. Table 1 outlines all the major studies that have informed the design of the items in each section of the questionnaire.

TABLE 1  
PREVIOUS STUDIES INFORMING THE DESIGN OF THE QUESTIONS IN THE QUESTIONNAIRE

Sections of the questionnaire	Previous studies
1 uses of NMT	Zaretskaya et al. (2015), Rossi and Chevrot (2019)
2 evaluation of NMT	Gaspari et al. (2015), Zaretskaya et al. (2015), Daems (2017), Rossi and Chevrot (2019)
3 prediction of NMT's impacts on future career	Zaretskaya et al. (2015), Wang (2017), Ye (2017), Wang et al. (2018), Zhu (2018)
4 perception of NMT's impacts on current translation learning	López-Bonilla and López-Bonilla (2012)
5 needs for NMT instruction in translation courses	Pym (2013), Feng and Zhang (2015), Daems (2017), Wang et al. (2018)

The draft of the questionnaire (Version 1) was sent for evaluation to four colleagues who had been teaching and researching translation for a number of years. They were requested to evaluate the questionnaire by answering the questions provided by the researcher. Their feedback was carefully considered and analyzed before part of it was adopted to revise the questionnaire, whose 50 items were reduced to 41 in the new version (Version 2).

Version 2 of the questionnaire was then administered to 45 translation learners as a pretest. They were requested not only to answer the questions but also to note down any comments and suggestions concerning the design of the questionnaire. The data of the pretest was analyzed and the students' feedback considered, based on which the questionnaire was revised again (hence Version 3, the final version, was formulated), with the number of items being further reduced to 30.

### B. Participants

The final version of the questionnaire was launched through an online survey tool ([www.wjx.cn](http://www.wjx.cn)) at the end of April 2019 and remained open for ten days. All the second and third-year undergraduate English majors in the School of Foreign Languages of a university in Southwest China were invited to participate in the survey. The total number of students invited was 336, with 166 second-year students and 170 third-year students. 326 responses were received (with a response rate of 97.02%), of which 292 were valid. The reliability of the questionnaire was verified (Cronbach's  $\alpha = 0.785$ , Cronbach's  $\alpha$  Based on Standardized Items = 0.831).

The second-year students had taken a compulsory translation course named *Translation Theory and Practice* for 1.5 semester (48 class hours), and were being trained in this course at the time of the survey, while the third-year students had finished 3 semesters' formal translation training (96 class hours) with the same course. Table 2 presents the full information of the participants.

TABLE 2  
PARTICIPANTS' DEMOGRAPHIC INFORMATION

Grades	Number of valid responses	Age (Mean)	Sex		Formal training in translation	Formal English major training
			M	F		
Second-year	148	20.00	34	114	48 class hours	1.5 years
Third-year	144	20.79	32	112	96 class hours	2.5 years
Total	292		66	226		

English major is offered in almost all major universities in China, in which the offering of translation courses is officially required (English Section of the National Steering Committee for the Instruction of Foreign Language Programs in Institutions of Higher Learning, 2000; Steering Committee of Ministry of Education for the Instruction in Institutions of Higher Learning, 2018). This means that all those enrolled in English major in China are (potential) translation learners. So the sampling of this study can be representative of this group of learners in China, or possibly of those in other parts of the world where majors of languages are offered in which formal translation training is required.

### III. RESULTS

#### A. Uses of NMT

The first section of the questionnaire contained 4 questions, with a focus on the participants' uses of NMT in the learning of translation and other major-related courses. Question 1 investigated the perceived frequency of NMT use, the responses to which show that a vast majority of the participants (73.29%) have often used NMT, while just 4 of them (1.37%) have never used it. The rest of them (25.34%) stated that they had used it sometimes.

Questions 2-4 were designed only for those who had ever used NMT (288 out of 292 overall participants), inquiring about the types of NMT systems most frequently used, the purposes of using NMT in English major learning and the ways to deal with NMT output in completion of translation tasks. A vast majority of the participants (83.68%) chose smartphone translation APP powered by NMT (or NMT APP for short) as the most frequently used type of NMT systems (Question 2), and very small proportions of them chose the other three options (Figure 1).

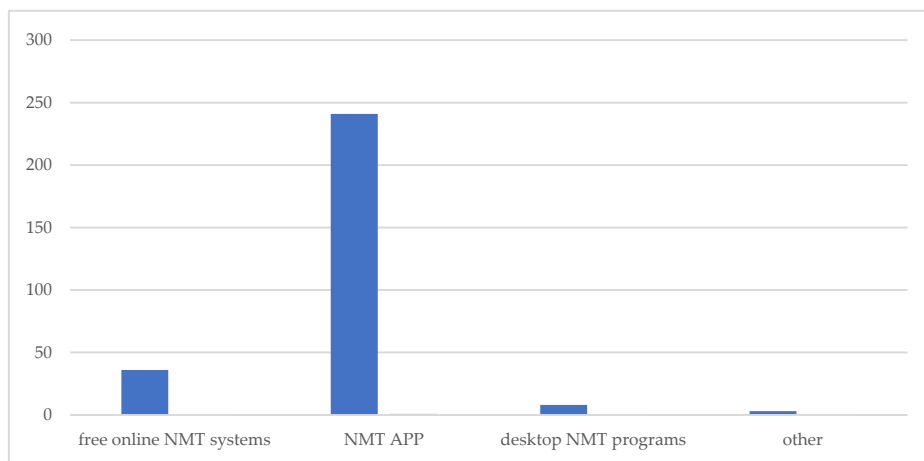


Figure 1. Most Frequently Used NMT Types

Question 3 asked about the purposes of using NMT in English major learning. Participants could choose more than one of its six options. Their choices showed that the vast majority of them had multiple purposes: 87.15% of them chose at least two options and half of them chose at least three. Figure 2 shows the two most favored purposes were comprehending the meaning of new English words (90.97%) and helping improve translation (77.43%), with 39 more people choosing the former. There were also a lot of participants who would use NMT to help English writing, reading and speaking by referring to the English translation of the Chinese expressions.

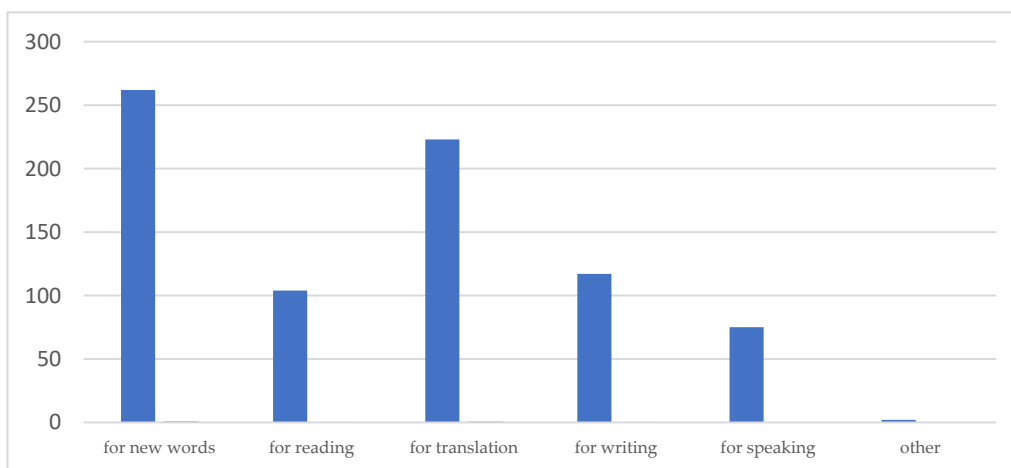


Figure 2. Purposes of Using NMT

Question 4 zoomed in on translation, investigating the ways the participants used to deal with NMT output in completion of translation tasks. It contained five options, from which participants could also choose more than one. A large number of them (42.36%) chose only one option, nearly half of them (48.61%) chose two options, and just a minority of them chose 3 or more options. Figure 3 reveals that the largest number of them (86.46%) would revise the output -- technically speaking, post-edit it -- before using it. Besides, 62.15% of them would get inspiration from the output to help them do the translation on their own. Just a tiny proportion of them would directly copy and use the output as their own translation, and even fewer of them would abandon the output on the ground that it had poor quality.

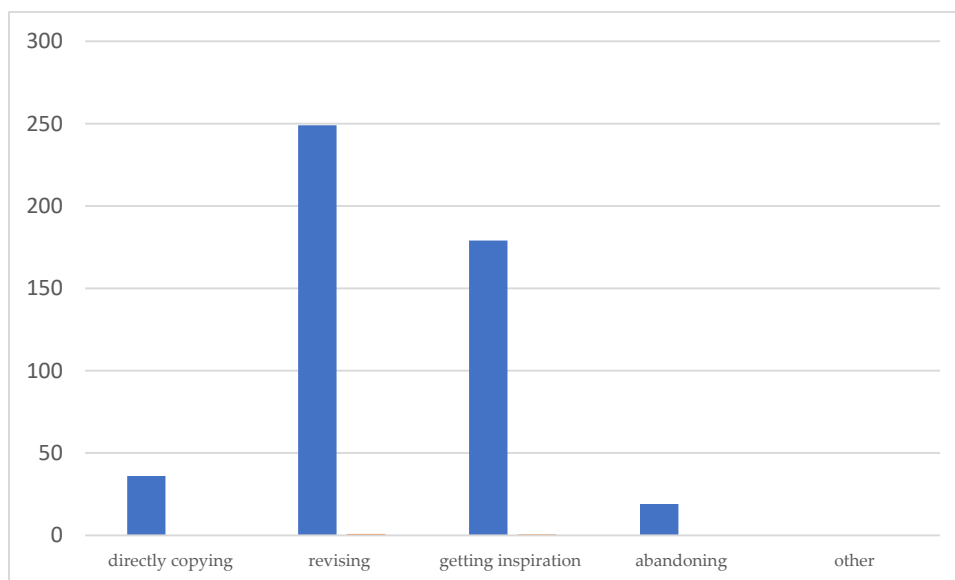


Figure 3. Ways to Deal With NMT Output

### B. Evaluation of NMT

Section 2 of the questionnaire invited the participants to evaluate NMT in terms of its helpfulness for human translation and the quality of its output. Table 3 shows that the vast majority of them agreed that NMT could help improve the efficiency of their translation (Item 5), and more than half of them agreed that it could also help improve their translation quality, but there were still one third of them not sure about this (Item 6). When asked to compare the quality of NMT output and human translation, half of the participants were not sure whether NMT had defeated them or not, with just a minority of them agreeing or disagreeing that NMT had surpassed them in terms of quality (Item 7). Although not many people agreed that NMT output has readability, and nearly half of them had no idea of this (Item 8), most of them thought that it could basically fulfill the purpose of information transferring (Item 9).

TABLE 3  
EVALUATION OF NMT

Item	Likert 1/2* (%)	Likert 3* (%)	Likert 4/5* (%)	M	SD
5. My translation efficiency can be improved with the aid of NMT.	1.02	15.75	83.22	3.95	0.59
6. My translation quality can be improved with the aid of NMT.	9.59	33.56	56.85	3.54	0.76
7. The quality of NMT output surpasses my own translation quality.	28.08	52.40	19.52	2.91	0.77
8. NMT output has readability.	21.58	48.29	30.14	3.06	0.77
9. NMT output can basically fulfill the purpose of information transferring.	5.48	17.81	76.71	3.73	0.59

\* Likert 1/2 = strongly disagree / disagree; Likert 3 = neither agree nor disagree; Likert 4/5 = agree / strongly agree

### C. Prediction of NMT's Impacts on Future Career

Participants' prediction of NMT's impacts on future career (in both translation and non-translation fields -- Some English majors in Chinese universities will choose to get employed in the trade of translation upon graduation, while others will take a job in the other English language-related trades. So the items in this section focused both on the translation and non-translation fields.) was investigated through the 5 items in Section 3 (See Table 4 for the results). Most of them did not agree that NMT will completely replace human translators in the future (Item 10). They almost unanimously agreed that professional translators must be able to skillfully use NMT in the future (Item 11). Their opinions were divided concerning professional translators' future task (Item 12) and English majors' future employment (Item 13): nearly half of them thought PE would be professional translators' main task, but the rest of them either did not think so or were not sure (Item 12); similarly, nearly half of them saw a gloomy future as far as employment was concerned due to the impacts of NMT, only a small proportion of them felt optimistic in this regard, and one third of them were not sure about it (Item 13). Finally, most of them agreed that professional translators who have a translation competence lower than NMT will get unemployed (Item 14).

TABLE 4  
PREDICTION OF NMT'S IMPACTS ON FUTURE CAREER

Item	Likert 1/2 (%)	Likert 3 (%)	Likert 4/5 (%)	M	SD
10. NMT will completely replace human translators in the future.	76.03	17.47	6.50	2.03	0.87
11. Professional translators must be able to skillfully use NMT in the future.	3.42	9.59	86.99	4.06	0.69
12. Professional translators' main task in the future will be revising and editing the NMT output.	24.66	27.4	47.95	3.27	0.93
13. English majors will have difficulty in getting employed in the future because of the impacts of NMT.	23.63	33.56	42.81	3.22	0.93
14. Professional translators who have a translation competence lower than NMT will get unemployed.	10.96	20.55	68.49	3.67	0.86

#### D. Perceptions of NMT's Impacts on Current Translation Learning

Section 4 of the questionnaire was designed to disclose the anxiety (or non-anxiety) the participants held toward NMT by examining their perceptions of NMT's impacts on their current translation learning. The results (Table 5) reveal that most of them did not think translation learning meaningless despite the fast evolution of MT technology (Item 15). The largest number of them did not feel disoriented about translation learning either (Item 16), though there were also a lot of them feeling the contrary or being noncommittal. Besides, more than half of them would not be hesitant to use NMT in translation practice (Item 17). But all this does not mean that they were free of anxiety: The majority of them worried about the negative effects of NMT on the improvement of their translation competence (Item 18), diligence (Item 19) and sense of accomplishment (Item 21). Nearly half (and the largest number) of them also reported the feeling of being guilty (Item 20) and uneasy (Item 22).

TABLE 5  
PERCEPTIONS OF NMT'S IMPACTS ON CURRENT TRANSLATION LEARNING

Item	Likert 1/2 (%)	Likert 3 (%)	Likert 4/5 (%)	M	SD
15. The fast evolution of MT technology makes me feel that translation learning is meaningless.	75.68	16.78	7.53	2.17	0.80
16. The fast evolution of MT technology disorients me in my translation learning, not knowing which direction to work in.	39.39	34.25	26.37	2.85	0.89
17. I hesitate about whether to use NMT or not in translation practice.	56.85	20.89	22.26	2.58	0.95
18. I'm worried that NMT is not conducive to the improvement of my translation competence.	25.34	17.12	57.54	3.36	0.95
19. I'm worried that NMT will make me lazy.	13.36	10.27	76.37	3.72	0.84
20. I feel guilty about using NMT to complete translation assignments.	31.16	20.21	48.63	3.16	1.03
21. Using NMT to complete translation assignments makes me feel unfulfilled.	28.77	13.70	57.53	3.32	1.02
22. I would be uneasy if I didn't use NMT to do my translation tasks.	34.93	22.26	42.80	3.09	0.97

#### E. Needs for NMT Instruction in Translation Courses

Section 5 of the questionnaire investigated the participants' needs for NMT instruction in translation courses. The results (Table 6) show that the vast majority of them found it necessary that translation instructors help them learn how to properly use NMT (Item 24), how to post-edit its output (Item 25), how to make use of it to improve their translation competence (Item 26) and how to actively respond to the challenges posed by it (Item 27). But just half of them showed the needs of knowing whether NMT should be used in the process of translation learning (Item 23), with another half either not agreeing or not being sure.

TABLE 6  
NEEDS FOR NMT INSTRUCTION IN TRANSLATION COURSES

Item	Likert 1/2 (%)	Likert 3 (%)	Likert 4/5 (%)	M	SD
23. The translation instructor should explicitly tell me whether NMT should be used in the process of translation learning.	28.08	22.6	49.31	3.25	1.02
24. The translation instructor should explicitly tell me how to properly use NMT in the process of translation learning.	2.19	11.99	80.82	3.88	0.79
25. I should be taught in the translation course how to revise the NMT output.	8.56	13.01	78.42	3.83	0.81
26. I should be taught in the translation course how to use NMT to improve my translation competence.	6.16	6.16	87.67	3.96	0.73
27. I should be taught in the translation course how to actively respond to the challenges brought about by NMT.	4.11	8.56	87.33	3.98	0.68

## IV. DISCUSSION

### A. *Uses of NMT*

One of the aims of this study is to show how the participants have used NMT in their major learning, including translation learning. The results show that, (1) they have used it frequently and for multiple purposes, with appreciating new English words and aiding human translation being the two most favored ones, (2) they have used the NMT output by post-editing it or for inspiration in order to accomplish their translation tasks, and (3) their most favored NMT type is translation APP instead of online systems or desktop programs.

Popular use of NMT among translation learners contrasts with the findings made just four or five years ago by Gaspari et al. (2015) with professionals and academics in the translation field, of whom only 21% had used MT, but it is consistent with the more recent findings made by Rossi and Chevrot (2019) who disclosed a high rate of MT adoption among institutional translators, and Liu et al. (2022) who reported that all translation learners used MT to accomplish their translation tasks. It may be argued that in the era of NMT where the quality of MT is largely improved, translation learners, as well as translation professionals, put more trust in the technology.

The participants' frequent use of translation APP instead of the other NMT forms is somewhat surprising in that a translator would most probably use online NMT systems or desktop NMT programs (as is evidenced by Gaspari et al., 2015 who reports that the vast majority of the participants who were using MT chose online MT systems) because one would generally choose to do translation on a computer instead of on a smartphone to improve the efficiency. But a glimpse of their purposes of using NMT will decipher this puzzle: as English majors, not only translation learners, they used NMT to do a lot of things in addition to translation, including word comprehension, reading comprehension, writing, and speaking. A smartphone APP, rather than the other forms of NMT, would enable them to fulfill those purposes at any time and place convenient for them. Therefore, a distinction may be made between translation learners and professionals: The former use NMT as a learning tool as well as a translation tool, while the latter may use it more as a translation tool than as a learning tool.

The participants' disposal of NMT output is consistent with Gaspari et al. (2015)'s, and Zaretskaya et al. (2015)'s findings that the majority of those who used MT always post-edited its output, and with Rossi and Chevrot (2019)'s and Cadwell et al. (2016)'s findings that many translators used MT output for inspiration. This indicates that translation learners, like what translation professionals were doing, used the NMT output in a positive way: They chose to post-edit it or get inspiration from it, instead of directly copying it or simply discarding it. This is echoed by Liu et al. (2022, p. 9) who reported that a large number of translation learners "had never used the raw machine-translated texts without modifications".

### B. *Perceptions of NMT*

The participants' perceptions of NMT were examined in this study from four perspectives, namely, evaluation of the technology, prediction on its future influence, impacts on current translation learning and needs for NMT instruction.

**Evaluation.** Generally speaking, the participants thought of NMT as a useful tool to help improve their translation efficiency and quality; on the other hand, they did not think that or were not sure whether NMT produced a high quality output (when compared with their own translation and in terms of the readability), a finding somewhat similar to Liu et al. (2022) where the lowest number of the participants would think MT could produce accurate target texts. However, what seemed to be contradictory in this study was that the participants found NMT able to convey information somewhat successfully. Maybe they deemed that NMT had yet to meet the strict criteria of translation by producing a faithful and fluent target text, but it was good enough to produce a text that could basically get the source text's idea across to its audience. If we also take into consideration the high frequency of NMT use among the participants and the high percentage of them post-editing the NMT output (Figure 3), we may arrive at the conclusion that the participants found the NMT output generally usable. Earlier studies like Gaspari et al. (2015) and Zaretskaya et al. (2015) show that most translation professionals regarded MT output quality as being poor, but more recent studies like Cadwell et al. (2016) and Rossi and Chevrot (2019) show an increased acceptance of MT by translation professionals for its improved quality. Cadwell et al. (2016, p. 21), for example, reports that among the top 3 reasons why the participants used MT was "the perceived good quality of the MT output". This means that both translation professionals and translation learners in this new era did not reject MT on the ground of poor quality.

What is noteworthy is the large proportion of the participants who did not know for sure about the quality of the NMT output (Items 7 and 8, Table 3). This was in contrast to translation professionals, most of whom would not sit on the fence -- they either thought it to be high or deemed it to be low (as is evidenced in Cadwell et al., 2016; Rossi & Chevrot, 2019). One of the possible reasons underlying this contrast is that the former, due to their comparatively low proficiency in both languages (SL and TL), had difficulty in assessing the quality of translation.

**Prediction.** The results of the survey show that most of the participants were optimistic about the future of translation professionals: They did not think NMT will completely replace human translation in the future. But they did think that a good command of the technology was a must for professional translators, and that they must develop a translation competence higher than the machine in order to stay on their job. In other words, human can not be defeated by machines, but he or she must be "stronger" than them and be able to make them work for him or her. The translation learners held a view toward the destiny of translation professionals that is similar to scholars (who are also translation

instructors) like Ye (2017), who holds that machine translation can not possibly replace human translation in that they are two completely different activities and the former can not accomplish translation tasks whose ST is fuzzy and difficult to make sense, and Zhu (2018), who argues that “the panic that human beings are to be replaced by machines [in translation]... is self-evident fallacy” (Zhu, 2018, p. 109).

However, the participants' view of PE was somewhat different from that of the scholars: A large number of them seemed not to have realized or agree with the important role PE will play in the future translation career (see Table 4). By contrast, some researchers see the importance of PE and predict its mainstream use in the future translation industry. Wang (2017), for example, argues that MT + PE is and will be the mainstream work mode for the translation professionals. Feng and Zhang (2015) claim that MT and PE represent the future of translation career. In addition, some other researchers have gone beyond the stage of argumentation for the significance and justification of PE; instead, they have begun to work on the effective ways of doing and/or improving PE (e.g. Daems et al., 2017a; Daems et al., 2017b; Arenas & Moorkens, 2019; Tezcan et al., 2019; etc.). This is probably because of the already-existent PE practice that is prevalent in language service industry. According to a survey conducted in 2018 by the European Language Industry Association and the other five organizations, PE was a popular operational practice for language service companies in and out of Europe, 37% of which indicated that they wanted to increase this practice and an additional 17% indicated that they were starting this practice (ELIA et al., 2019). The discrepancy between the translation learners and researchers in the understanding of PE's status in the future translation career may be attributed to the latter's ignorance of the current and future development of the translation industry, which, in turn, is possibly due to their translation instructors' failure to inform them about it.

As far as the future employment was concerned, the participants, who were translation learners as well as English majors, were not as optimistic as when they predicted the destiny of translation professionals -- the largest number of them foresaw difficulties in getting employed because of the impacts of NMT, and one third of them expressed uncertainty about the difficulties (Table 4). This may be indicative to some degree that many of them, like the freshman mentioned in Section I, were worried, if not threatened, by the fast evolution of the translation technology as far as their future employment was concerned. Similar worry, or “fear”, is detected with translation professionals by Rossi and Chevrot (2019) who report that fear of MT, among others, has an impact on the participants' adoption of MT.

**Impacts.** Effects of the technology use on students' anxiety have long been a focus of attention (e.g. Jiao & Onwuegbuzie, 2004; López-Bonilla & López-Bonilla, 2012; Memmedova & Selahattin, 2018), but the effects of MT on translation learners' anxiety have received little attention. The current study detected NMT-induced anxiety in the translation learners, in addition to other negative impacts of NMT on their translation learning. More or less, they expressed the feeling of being disoriented about translation learning, being hesitant about whether to use NMT or not, feeling guilty about using NMT to complete translation assignments, being unfulfilled if NMT was used and being uneasy if NMT was not used. They also expressed the worry of NMT's negative impacts on the improvement of their translation competence and the degree of diligence in translation learning. They shared some forms of the anxiety with translation professionals who reportedly expressed the fear of MT making them become lazy and “reducing their opportunities to learn and develop their skills” (Cadwell et al., 2016, p. 23).

**Needs.** The participants almost unanimously voiced their needs of being taught in the translation course about how to use NMT, how to post-edit its output, how to use NMT to improve translation competence and how to cope with the challenges brought about by NMT. Besides, half of them also articulated the need of being informed of whether or not they should use NMT in translation learning. All these reflect to some degree the translation learners' struggle, puzzle and anxiety over NMT use and its unintended consequences to translation learning and future career, echoing their responses to the items in the previous two sections.

## V. CONCLUSIONS AND PEDAGOGICAL IMPLICATIONS

The translation learners -- who were also English majors -- in this study reported high frequency of NMT use in their translation learning as well as major learning, who used it for multiple purposes: comprehending new English words, aiding human translation, and helping English writing, reading and speaking. These purposes prompted them to choose NMT APP among any other NMT types, which was taken as both a convenient translation tool and an English learning tool. In translation practice, instead of directly borrowing or simply abandoning the NMT output, most of them post-edited it and/or used it as inspiration to accomplish their translation tasks.

Although the translation learners did not think that or did not know whether NMT produced a high quality output, they evaluated the technology in a positive way: it was a useful tool to help improve their translation efficiency and quality, and its output was generally usable. They also held an optimistic view toward the future of translation career, but recognized that a translation professional must be equipped with a good command of the technology and a translation competence higher than the machine in order to ‘defeat’ the machine. That being said, they expressed a seemingly contradictory attitude towards their future employment as an English major: they were worried to some degree. They did not have a full recognition of the importance of PE in the future translation career either. When it comes to the NMT's impacts on their current translation learning, they expressed varying degrees of anxiety: feeling disoriented, hesitant, guilty, unfulfilled, and uneasy. They were also worried about NMT's negative impacts on their translation competence and their diligence in translation learning. They clearly articulated needs for translation

instruction in the proper ways of using NMT, post-editing, improving translation competence with the aid of NMT and dealing with the challenges brought about by NMT.

The above findings confront the translation instructors with at least one major task: to help reduce the worry and anxiety felt by the translation learners toward NMT. The translation learners' worry of their future career can be partially diminished by guiding them toward a correct understanding of NMT since fear of MT is probably caused by little knowledge of it, as has been observed by Rossi and Chevrot (2019), and of its future impacts on translation industry. Expert opinions concerning the future fate of HT (e.g., Ye, 2017; Qin, 2018; Zhu, 2018; etc.) may be cited to help them regain confidence. For instance, they can be informed of the 'battlefields' lost, preserved and gained in human being's 'engagement' with machine: Machine may take away translation tasks that are simple and unimportant, and require a low level of readability, but human has always been and will proceed to be the master in such fields as literary translation and the only trusted force when a high-quality TT is required; besides, machine will provide new 'battlefields', i.e., new job opportunities for human -- PE (Qin, 2018), for example.

The translation learners' anxiety toward NMT's impacts on their current translation learning may be effectively reduced by instructing them whether, when and how to use NMT. First of all, they need to be informed of the occasions on which NMT can or cannot be used. For example, at the initial stage of translation instruction when the learners have little knowledge about translation and low level of translation competence (see PACTE, 2018 for the specific components of translation competence), they may be discouraged from using NMT to accomplish any translation tasks since it may hinder their acquisition of the knowledge and competence -- machine may do their job that is particularly designed to empower themselves to 'defeat' machine. But at a later stage when their translation competence is fully developed, in other words, when they are empowered with abilities to 'reign' the machine, they can not only be encouraged, but also trained to use NMT. The decision of whether to discourage or encourage NMT use can also function on a task-specific basis, i.e., with some tasks designed to develop the learners' sub-competence of TT use, where use of NMT is encouraged, and some other tasks designed to develop the other sub-competences, where use of NMT is discouraged. Following the decision of whether and when to use NMT, the translation instructor needs to carefully design how to teach NMT. This may at least involve teaching the learners how to choose from and use the different types of NMT, how to assess the quality of the NMT output, how to post-edit the output, and how to use the output as a source of inspiration.

What this study focuses on is the learners of a translation course instead of the whole interpreting/translation program. These two groups of learners may use and perceive NMT somewhat differently. Therefore, the findings of this study which are meaningful for the sustainable development of the translation course may have difficulty to be fully generalized to interpreting/translation majors. This is exactly what we need to do in the future: investigating how the latter use and perceive NMT and providing more comprehensive pedagogical implications for the sustainability of the translation education as a whole.

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