Assessing Awareness and Acceptability of Neural Machine Translation among Japanese University Students in Relation to Its Practical Application

関西外国語大学 研究論集 第110号（2019年 9 月）
Journal of Inquiry and Research, No.110 (September 2019)

Assessing Awareness and Acceptability of Neural Machine Translation among Japanese University Students in Relation to its Practical Application

Kazumi Tsutada

Abstract

With the advancing accuracy and reliability of machine translation, it is increasingly considered beneficial for English users and learners to have knowledge of and experience with machine translation as a practical aid of communication beyond language barriers. Focusing on Japanese-English translation, this study provided Japanese university students with opportunities to use machine translation for their own essays and for passages of their preference taken from the Web, and to explore rules in relation to Japanese pre-editing to increase the accuracy of machine translation. According to observation of their actual performance in a classroom and results of a questionnaire, their interest in machine translation proved to be unexpectedly high, and the rules they found had much in common with those revealed in previous studies. Another focus of this study concerned the pedagogical issue of whether to approve the introduction of machine translation into English education. Concerning the practical (*jitsuyo*) and cultural (*kyoyo*) aspects of English education, this study recommends that more emphasis be placed on the *kyoyo* aspect than has been the case, as machine translation will likely play an increasingly extensive and substantial role in terms of its *jitsuyo* aspect but the *kyoyo* aspect is critical for developing appropriate skills in logical thinking as applied to language learning.

Keywords: Neural machine translation, pre-editing, rules, English proficiency, pedagogical argument.

1. Background of the Study

With the increasing accuracy of machine translation (MT), the use of MT has become widespread both in business and academic fields. In general, MT has brought benefits in assisting communication across languages, but some issues remain unsolved. However, when considering the probability of continuous rapid MT development, this technology will likely offer greater assistance to English users in the near future. Given this context, it might well

be helpful for Japanese university students to know and acquire strategies in using MT so that they can be market-ready before embarking on their professional careers. Meanwhile, views have oscillated between approval and disapproval for the use of MT in education from a pedagogical viewpoint, specifically whether MT should be introduced for the future benefit of students, or not introduced due to concerns regarding its unethical application. With the advent of this state-of-the-art intelligent technology, now is an opportune time to reconsider what is the most reasonable pedagogical solution in relation to the use of this latest technology within education.

1.1 The revolutionary development of machine translation

There have been many concerns and much suspicion expressed concerning MT. However, its rapid progress has persuaded its users that such "pessimism was misplaced" (Gally, 2018, p. 43). In addition, Lample, Ott, Conneau et al. (2018) contend that it has achieved nearly human-level performance in some languages depending on their linguistic proximity to each other.

The recent advances in MT are primarily attributable to a paradigm change in MT from statistical machine translation (SMT) to neural machine translation (NMT). SMT employs "a method for computing translation probabilities, and finally, a method for searching among possible source sentences for the one that gives the greatest value" (Brown, Cocke, Pietra et al., 1990, p. 79). Although it has had desirable features yielding adequate translations, it has many shortcomings as well in "modeling long-distance dependencies and complicated alignment relations in the translation process" (Wang, Lu, Tu et al., 2017, p. 3330). In contrast, NMT has an "ability to learn directly, in an end-to-end fashion, the mapping from input text to associated output text" (Wu, Schuster, Chen et al., 2016. p. 1). With this innovative approach to MT that addressed limitations of the traditional MT system, MT has the capacity to "learn directly, in an end-to-end fashion" (Wu et al., 2016. p. 1). Particularly, Google, with its high-speed information processing computers and unique calculation algorism, has achieved "deep" NMT which has enabled more flexible translation, and obtained outstandingly high evaluations as an effective bridge linking humans and MT. In fact, Google's NMT (GNMT) is claimed to achieve accuracy equivalent to the average accuracy of bilingual human translators in some experiments (Wu et al., 2016). Accordingly, it would be reasonable to keep abreast of such marked progress in relation to the latest MT technology, given the increasing likelihood that MT will provide far-reaching benefits as a

reliable support tool for English users.

1.2 Pedagogical arguments

Despite the generally increased acceptability of MT, strong arguments have been made that the introduction of MT into education might lower motivation to learn English, leading to a decrease in English proficiency, and that the significance of English education itself might be downgraded as MT is promoted.

However, when considering the present quality of MT, it is clearly not ideal, and it is unlikely to become so. Although its performance is almost fully acceptable for daily English use, human intervention is often needed for social business or academic communication to determine both the form and meaning of the MT output. In this sense, the necessity for specific linguistic skills in relation to expressing specialized content precisely will continue to be required even when MT use is extensive and encouraged.

Another pedagogical argument arises in relation to two very different aspects of English education, namely, a practical or *jitsuyo* aspect and a cultural or *kyoyo* aspect. Concerning the practical aspect, MT technology is already enabling practical communication in various social scenes, making it less persuasive to demand substantial efforts of English learners to acquire English linguistic ability. In this sense, the effect of improved MT might be becoming more considerable in terms of reducing the necessity to learn English. However, Gally (2018) insists that the practical aspect is not the only reason to study English, and emphasizes the importance of the cultural aspect. The latter refers to general human development including the acquisition of general knowledge and logical thinking ability through deepened insight into one's own and other countries' culture and language. For instance, Kaneda (2007) argues that teaching of practical or functional English skills cannot encompass all that is involved for an adequate English education. More recently, Asano (2018) contends that the ultimate objective of English education and development of the practical four skills (listening, speaking, reading, and writing) should not be mixed up, and significance should be laid on the cultural aspects encouraging students to think logically and express their opinions with clarity.

With the advent of MC, it appears relevant to give more thought to this cultural aspect in English education, specifically on how English education in Japan should be directed toward educating students not only for the enhancement of their linguistic skills, but as social citizens who can think and act both independently and logically in an ongoing globalizing society.

2. Study Objectives

With a view to exposing university students to an MT-using environment, this study provided them with opportunities to use MT as part of their classroom activities, and investigated how acceptable they found MT to be, along with their expectations concerning MT, and what rules for the effective use of MT they explored. Furthermore, the study aimed to encourage student awareness of the necessity of English skills through post-editing tasks, in which they were required to improve the quality of their MT output in order to more adequately convey what they had originally intended to communicate.

Finally, after consideration of the results and observations of the students as they completed their tasks, this study offers views on a need for change in English education in Japan, involving a supportive integration of MT into English education.

3. Methods

To achieve these objectives, this study required participants to complete five tasks. In addition, based on a widely held perception that Google Translate is now the most reliable medium due to its huge datasets, this study employed Google Translate as a translation engine. This study focused on Japanese-to-English translation, and not vice versa, to concentrate on an examination and analysis of English production by MT. The five tasks were as follows:

- ✓ MT of their Japanese essays
- ✓ MT of a Japanese passage of their preference
- ✓ Exploration of the rules for pre-editing Japanese text
- ✓ English post-editing
- ✓ Questionnaire completion

The selected participants comprised thirty-nine university students in their third and fourth year, among whom four were excluded due to their not completing all the tasks scheduled. The final number of participants was thirty-five (eight men and twenty-eight women) from two classes in the spring and fall semesters respectively. With Test of English for International Communication (TOEIC®) scores ranging from 550 – 780, they were majoring in either English Language and Communication, or Global Communication

and Language, and had opted to take the course in which this was conducted, namely, Translation Practice, as one of their elective courses. Permission to use the data collected for the research was granted from all the participating students.

3.1 Machine translation of Japanese essays

The first task began with writing a Japanese essay (400-500 letters) titled "Learning English grammar through real-time English news." This title seemed relevant because the students had studied English grammar during the relevant course through intensive reading of authentic English sentences in various articles to improve their understanding of the syntax of each sentence. Furthermore, despite some issues and difficulties encountered during that grammar learning process, the method used had ensured appropriate engagement and output from the participants.

Once their Japanese essays were completed (as source text 1), they were translated into English on the Google Translate site (as target text 1). The participants then read Google's translation, and recorded their subjective level of satisfaction in percentages. This was followed by editing the Japanese source text 1 into source text 2, with the aim of improving the quality of the English output, which was translated again on the Google site to produce target text 2. Their extent of satisfaction with target text 2 was also recorded by the participants. After completing the pre-editing of the source text, the participants were required to make a list of their findings of the applicable rules for editing Japanese, which had enabled the target text 1 to be enhanced as an English essay to more adequately convey the meaning and nuance of the source text. Figure 1 illustrates the flow diagram of the task execution. In a final stage, they were assigned post-editing of target text 2 with assistance from the teacher.

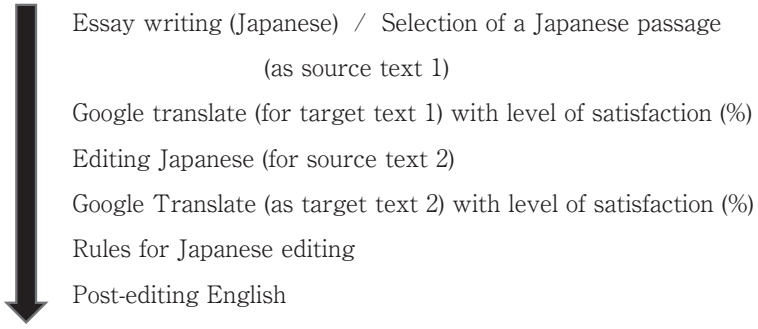

Figure 1. Task flow chart

3.2 Machine translation of passages on the web

The second task was conducted in the next class following the execution of the first task described in the previous section. Participants were asked to collect Japanese passages from any part of their favorite genre on the Web, and cut and paste them onto Google Translate. The MT procedures and the relevant tasks were the same as those for the first task, as shown in Figure 1.

3.3 Exploration of the rules for editing Japanese

Many recent studies on MT have discussed rules and strategies for effective use of MT, which have generally helped raise the quality of MT translation. However, it was considered more useful in this study for potential MT users to explore specific rules to pre-edit source texts on their own, through repeated trial and error. Specifically, the participants were asked to make a list of rules for pre-editing Japanese source texts which they had found applicable in improving the quality of English produced by MT.

3.4 English post-editing

As the final task, the students were asked to find phrases, sentences, or structures that seemed to require revision or correction when comparing Japanese and English texts (bilingual post-editing). This was reinforced through repeated interaction between the teacher and each individual to encourage locating a misleading or improper translation in the expectation of raising the quality level of the final translation after post-editing.

3.5 Questionnaire

This study also wanted to include the views of the participants as their views were considered likely to be highly relevant, rather than only examining their actual experience using MT. To collect responses from the participants, a questionnaire survey was administered, in which the students were asked to respond to seven questions (originally in Japanese) and fill in a box for open-ended comments, to elicit direct and candid responses from the participants. The students marked their responses on a five-point Likert scale to the following questions: 5: very much, 4: to some extent, 3: no opinion, 2: not much, and 1: absolutely not.

Question 1: Were you interested in MT before taking this class?

Question 2: Have you become more interested in MT after taking this class?
Question 3: Do you think the demand for MT will rise in society in the future?
Question 4: Do you think you will use MT yourself in the future?
Question 5: Would you like to be involved in the development of MT?
Question 6: Do you think MT will reach the equivalent level of human translation in the near future?
Question 7: Do you think the profession of "translator" will continue in the future?

The free comments were examined using data analysis based on a labeling and coding method (Saiki, 2005) to illuminate their meaning and significance.

4. Results and discussion

4.1 Levels of satisfaction

Table 1 indicates the satisfaction levels of MT in relation to the students' Japanese essays on "Learning English grammar through real-time English news." Concerning target text 1 (the first MT before editing the Japanese text), the level of satisfaction varied between 50% and 75% (mean: 60.43%; standard deviation [SD]: 8.57). Concerning target text 2 (the second MT after editing the Japanese text), the level of satisfaction generally rose, with a minimum of 50% and a maximum of 80% (mean: 68.00%; SD: 6.89).

Table 1

Levels of Satisfaction for Essays (N = 35)

	Mean	*SD*
Target text 1	60.43%	8.57
Target text 2	68.00%	6.89

Note. SD, standard deviation

Table 2 shows the levels of MT satisfaction concerning passages selected from the Web by each participant. The initial satisfaction levels for target text 1 varied depending on the genre, but the extent of satisfaction rose with no exceptions across all the selected genres for target text 2.

Table 2

Levels of Satisfaction for Passages taken from the Web (N = 35)

	Business (8)	Social (11)	Sports (5)	Trend (8)	Literature (3)	Total
Target text 1						
Mean	58.13%	60.00%	47.00%	53.33%	67.60%	57.21%
SD	8.26	6.47	5.10	8.50	2.5	6.87
Target text 2						
Mean	67.50%	69.09%	56.67%	61.88%	68.33%	64.69%
SD	6.12	3.58	4.71	6.09	2.36	4.75

Note. the figures in brackets indicate the number of students who selected those articles from the respective genre; SD, standard deviation.

All the thirty-five sets of texts involving differing examples of source text 1, target text 1, source text 2, and target text 2 were then examined thoroughly by the teacher to evaluate whether the students' satisfaction levels were based on reasonable and appropriate assessment. As a result, notwithstanding the general rise in satisfaction levels, it was found that some English sentences which were grammatically, semantically, or collocationally mistranslated were overlooked in the target texts. The following are instances of mistranslated sentences not detected:

- ✓ Learning English through English news means not only improves English proficiency but also acquires various knowledge about the world.
- ✓ … the sentence that the blank was inserted
- ✓ Urban city volunteers will guide transportation and sightseeing to airports, train stations, tourist spots, people gathered from home and abroad.
- ✓ It emphasizes the idea that English ability necessary as a common international language.

On the other hand, some students assessed grammatically correct sentences as incorrect, as shown in the following examples, due to their paucity of grammatical knowledge, which likely reduced their levels of satisfaction. Specifically, the students mistakenly assessed the following underlined parts as incorrect:

- ✓ I became able to write grammatically correct English when making my own English text.
- ✓ The US delegate fell into a situation where he was forced to apologize
- ✓ Not only can you learn the language of English but also you can learn things other than linguistic knowledge.

These faulty assessments of phrases and sentences indicated insufficient grammatical knowledge among some participants. This is a critical issue because, despite the increasing reliability of MT, it still requires careful human proofreading and appropriate revision, and a certain level of English proficiency is needed to enable MT to provide an improved result. Unfortunately, given this reality, the findings of this study on the self-assessed satisfaction levels of students with intermediate-level English proficiency (TOEIC® score of 550-780) cannot be readily generalized.

In addition, it should be noted that some participants seemed to have changed the content or nuance of Japanese source text while pre-editing it through excessively simplifying the Japanese text, particularly when target text 1 was found to be incomprehensible or too complicated. These types of modification seemed to have been driven by an intention to make the MT process easier and simpler. However, there was also an increased possibility in this situation that the MT output may have semantically deviated from the original meaning through such modifications.

4.2 The exploration of editing rules

Rules for pre-editing Japanese texts which the participants found useful while editing the text involved in this study are listed in Table 3, in their order of frequency.

Table 3

Rules Found by Students

1	Dividing long sentences
2	Clarifying subjects
3	Clarifying meaning (into direct expression)
4	Adding punctuation marks
5	Attention toward numerical expression
6	Converting '*hiragana*' into '*kanji*'
7	Clarifying tense

Instances of Japanese editing (involving source texts 1 to 2), and the subsequent changes of MT (involving target texts 1 to 2) are set out below in Table 4. The numbers on the left refer to those in Table 3.

Table 4

Reported Changes in MT after Pre-Editing Source Texts (July of the first semester and December of the second semester, 2018)

1	ST1	ネットが至る所で普及している現代においてニュースがネット上で基本的には誰もが見ることができるツールであるということは学習者にとって入手しやすい学習ツールであるとも言え、高い問題集を買わずに知識を養うことができる。
	TT1	It can be said that it is an easy learning tool for learners that news is basically a tool that anyone can basically see on the net in the modern times where the net is widespread, and it is highly recommended You can cultivate knowledge without buying.
	ST2	ネットが至る所で普及している現代においてニュースがネット上で基本的には誰もが見ることができるツールである。ということは学習者にとって入手しやすい学習ツールであるとも言え、高い問題集を買わずに知識を養うことができる。
	TT2	News is a tool that anyone can basically see on the Internet in the modern times where the Internet is widespread. It can be said that it is an easy-to-learn learning tool for learners, and it is possible to cultivate knowledge without buying high-quality questions.
2	ST1	文法はもともと得意だったのですが・・・
	TT1	Although grammar was originally good at it,
	ST2	以前私は文法が得意だったのですが
	TT2	Although I was previously good at grammar,
3	ST1	・・・にまだ開きはある /世間で起こっている情報
	TT1	It is still open / Information that is happening in the world
	ST2	・・・にまだ差はある /世間で起こっていることに関する情報
	TT2	It is still different / Information on what is happening in the world
4	ST1	ニュースを通して英語を学ぶことは英語スキルが上がるだけでなく社会的知識も同時に得ることができるのでとても効率な勉強法だと思います。
	TT1	I think learning English through news not only improves your English skills but also social knowledge, I think is a very efficient study method.
	ST2	ニュースを通して英語を学ぶことは、英語スキルが上がるだけでなく社会的知識も同時に得ることができるので、とても効率な勉強法だと思います。
	TT2	Learning English through news is a very efficient way of studying because I can acquire not only English skills but also social knowledge at the same time.
5	ST1	・・・2万467人に達した /約500分の1
	TT1	reached 24,67. / about 500 It is said to be only 1

	ST2	・・・20,467人に達した　/　約0.2%
	TT2	reached 20,467. / about 0.2%
6	ST1	（パンダのこどもは）生後24ヶ月で中国にかえすこととする。
	TT1	Shan Shan may change to China in 24 months after birth
	ST2	（パンダのこどもは）生後24ヶ月で中国に返すこととする。
	TT2	Shan Shan is returned to China in 24 months after birth
7	ST1	チームAが６対３のスコアで勝利し、リーグ戦進出。
	TT1	Team A will win a score 6 to 3 and advance to league.
	ST2	チームAが６対３のスコアで勝利し、リーグ戦に進出した
	TT2	Team A won with a score of 6 to 3 and advanced to the league game.

Note. ST: source text; TT: target text.

Participants made presentations individually on those pre-editing rules that they had found applicable. It was commonly mentioned in their presentations that even minor changes significantly improved MT output. For instance, the addition of only one or two quotation marks drastically changed the quality of English output in terms of appropriate syntactical structure (such as with examples under No 1 and No 4 in Table 4). In fact, although their presentations were to be finished in two weeks, it was necessary to add two more weeks as their individual demonstrations lasted much longer than scheduled. This seemed to illustrate their heightened interest in strategies to handle MT technology. Furthermore, their individual findings seemed to be reconfirmed in each other's presentations, which often had many features in common. All these aspects were reflected in the results of the questionnaires, as described in a later section.

In addition, it was noticeable that, despite there being minimal engagement with guidelines before the pre-editing activities, the participants found many reasonable rules on their own similar to those often noted in previous studies by academic researchers. This finding indicated the benefits of asking the students to discover applicable rules from scratch, rather than passively applying rules offered to them in advance of the pre-editing tasks.

It should also be noted that in some cases the participants were not able to successfully pre-edit Japanese text to produce appropriate English output to their satisfaction. This made them realize the significance of effective English post-editing and the extent of their own skill deficiency in this area.

4.3 English post-editing

Given the currently quality of MT, it is generally inevitable to proofread and correct text; in other words, to post-edit English output. For this purpose, it is crucial for MT users to be equipped with a certain level of grammatical competence, mainly focused on linguistic forms of English. Furthermore, it is also important to pay attention to whether Japanese source text has been logically transformed into English target text as a complete text, including nuances and emphasis intended for communication in the source text. The latter requirement is referred to as bilingual post-editing, which examines both source text and target text to ensure adequate translation between the two texts, in contrast to monolingual post-editing where editing is performed through reviewing output English text only. In this study, with the objective of raising the quality of the final translation, the participants were asked to work on bilingual post-editing in relation to the original nuances and meaning of Japanese source texts. This seemed a necessary step as the content of the Japanese source was not always conveyed well enough even if the English text was produced correctly in terms of both word meaning and sentence structure.

For example, as shown in the first set of sentences below, the second sentence became much closer to the Japanese text through emphasizing "I learned many things," and through incorporating subordinate clauses using "because" and "as." Similarly, with the second set of sentences below, through using the subordinate conjunction "as" effectively, the meaning of the source Japanese text was conveyed more naturally.

✓ I neglected to see the news recently, so there were many things I knew for the first time through the class, and I learned not only grammar and words through English news but also many things.

✓ I learned many things including grammar and words through English news because there were many things I knew for the first time through the class as I neglected to see the news recently.

✓ It became easy to understand the content, and I solved more questions, I got used to it and it became easier to read long sentences.

✓ As I solved more questions in news articles, I got used to them and it became easier for

me to understand the content of the articles and read long English sentences.

Sometimes it was appropriate to make an addition or deletion of a word or phrase, or reorganize the structure or order of sentences or phrases, to make the target texts semantically much closer to the meaning of the source texts. Although it was not an easy task for these participants, it was considered useful to enable them to grasp the need for improvement in their English ability and logical thinking ability. Despite frequent difficulties in English post-editing among the participants, many of them expressed their satisfaction based on their recognition that the quality of target texts was greatly enhanced after careful post-editing. This occurrence seemed to help them increase their willingness to further develop their overall English proficiency. It appears, therefore, that there were real and significant advantages for the students in experiencing satisfaction or a sense of achievement through being able to express or convey their views and opinions in English using MT as effectively as possible.

Nonetheless, it was also found that some of the final post-edited English passages lacked a logical development of the original discussion in the source text or an overall general coherence. This might indicate the participants' tendency to place much more focus on linguistic aspects than on the content of the original Japanese for communication. This finding also suggests that English education in Japan needs to promote cultivation of logical thinking ability more as part of the cultural aspect of English education, as well as working to ensure practical linguistic competence.

Incidentally, post-editing involves two types of editing, namely, full post-editing and light post-editing, with the former generally corresponding to bilingual post-editing, and the latter to monolingual post-editing. Although these two types are usually selected according to the quality of editing required, it might be worthwhile to assign full post-editing for students when considering the multi-faceted environment they are likely to encounter as practical English users in society.

4.4 Questionnaires

Table 5 shows the results of the survey, based on a five-point Likert scale. Concerning previous interest in MT (Q1), the responses were closely balanced, with a mean of 2.46, and with almost half the respondents not indicating an interest in this technology. However, after a series of experiences using MT in their classes, their interest rose significantly to give a

mean of 4.49 (Q2), and thirty-two respondents indicated their high expectations of increasing MT demand in society in the future, with a mean of 4.31 (Q3). In addition, twenty-seven students indicated a high probability of using MT themselves in future, with a mean of 4.14 (Q4).

On the other hand, concerning the technical development of MT, their interest was much lower, with a mean of 2.49, and six students showed no interest in being involved in its development. However, this was predictable as the participants in this study were all from humanities departments. In relation to views on the level of MT compared with human translation, more than half indicated an expectation of possible MT enhancement to reach a level equivalent to human translation, with a mean of 3.43 (Q6), but twenty-nine respondents considered that the profession of translator would continue, with a mean of 4.31 (Q7).

Table 5

Questionnaire Results using a Likert Scale (5 – 0) (N = 35)

	5	4	3	2	1	0	*Mean*	*SD*
Q1	6	4	8	5	6	6	2.46	1.70
Q2	20	12	3	0	0	0	4.49	0.65
Q3	14	18	3	0	0	0	4.31	0.62
Q4	13	14	8	0	0	0	4.14	0.76
Q5	0	14	6	4	5	6	2.49	1.54
Q6	8	10	8	7	2	0	3.43	1.20
Q7	17	12	6	0	0	0	4.31	0.75

Note. Q1 (Were you interested in MT before taking this class?), Q2 (Have you become more interested in MT after taking this class?), Q3 (Do you think the demand for MT will rise in society in the future?), Q4 (Do you think you will use MT yourself in the future?), Q5 (Would you like to be involved in the development of MT?), Q6 (Do you think MT will reach the equivalent level of human translation in the near future?), Q7 (Do you think the profession of "translator" will continue in the future?)

Concerning open-ended comments, students added frank and distinctive comments, with only two students leaving this space blank. To illustrate the comments in terms of their characteristics, the data were labeled and categorized according to open coding procedures. First, the data collected were segmented and labeled. This was followed by categorization, in which the common data or labels were grouped into categories, and tagged respectively. Figures in parentheses indicate the number of labels which construct each category (Table 6). All the comments were written in Japanese initially, and then translated into English by the

present author, and the categories and labels were also designated in English by the author.

As shown in Table 6, Category A consisted of twenty-seven labels through which the students indicated their interest in MT, from multiple perspectives. Concerning negative comments, fourteen students showed little interest in MT due to its inferior performance, but this was mostly based on their past experience. Concerning Category B, twenty-six labels indicated a belief in a rising demand for MT in the future and a high possibility of using MT themselves, while twelve labels seemed to indicate more cautious attitude because of frequent inaccuracies experienced when working on their chosen genre text, and subsequent concerns about using MT themselves. Among all the categories, the number of comments in relation to their level of MT was significantly the highest, with forty-four affirmative and thirty-six negative comments (Category C). Regardless of these opinions, it was noteworthy that the students showed considerable interest in the present quality of MT, based on their own experience and analysis after working on how they could familiarize themselves with this latest technology, which suggests the usefulness of becoming familiar with MT (MT-literate). Category D, although closely connected with Category C, included fifteen affirmative labels concerning the further possibility of MT application in the future, while eleven labels indicated a belief that there would be an ongoing definite need for human translation. Finally, concerning Category E, eleven labels indicated the students' recognition that a user needed to be proficient in English when using MT. Three labels indicated some concerns that MT might be unfairly used by some English learners to have their assignments done without putting in the effort themselves.

What was most significant throughout the survey was that the participants showed unexpectedly high interest in state-of-the-art MT technology, and it appears that greater familiarity with it as a functional communication tool might help them advance in an increasingly globalized society.

Table 6

Results Obtained from Open-Ended Comments (N = 35)

Category	Label	
	Affirmative	Negative
A. Interest in MT	✓ Change of attitudes toward MT (18) ✓ Enhancement of English translation due to minor change of Japanese text (5) ✓ Enjoyment in editing Japanese (4)	✓ Funny expression (8) ✓ Obvious disadvantage (6)
B. Demand and use of MT in society	✓ Rise in demand along with the improvement of its accuracy (21) ✓ Expanded use for inward and outward global communication (5)	✓ Varied level according to a field (9) ✓ Remaining concern (3)
C. Level of MT	✓ High level of MT far exceeding prior expectations (22) ✓ Large extent of improvement after editing (22)	✓ Remaining problems (13) ✓ Difficulties in expressing subtle nuances (12) ✓ Level of accuracy according to a field (11)
D. Expectations for the future.	✓ Higher expectations with appropriate application (12) ✓ Possibility of becoming nearly perfect in the future (3)	✓ Absolute necessity of human translation (11)
E. Pedagogical viewpoints	✓ Necessity of learning and developing English skill (11)	✓ Concerns regarding a decrease in English skill due to greater use of MT (3)

5. Pedagogical Implications

The results of all these tasks can be seen to have certain pedagogical implications for English education in Japan. First, it would be worthwhile to provide opportunities for university students to become familiar with the latest MT technology because the participants' interest in MT showed a considerable increase after their experience in using MT. It seems unreasonable not to draw students' attention to relevant current technology when it is highly likely to be of a great assistance for English users in general. Furthermore, through their practical knowledge developed in using MT, they became aware of the need for greater English proficiency and logical thinking, to ensure that MT is a useful, practical tool for future use. Given these considerations, it seems important that an MT user have the skills to access whether he or she is sufficiently well-qualified to make use of this technology,

instead of making a simple decision to entrust translation to MT. Therefore, just as the term "computer-literacy" has become common from the late twentieth century, the term "MT literacy" could usefully be used to indicate an ability to use MT technology with an appropriate degree of knowledge and of the relevant strategies. Being MT-literate would give students greater opportunities for advancing in their future careers.

Second, concerning a long-standing argument within English education in relation to the relative importance of its *kyoyo* and *jitsuyo* aspects, there has been a general tendency to prioritize the *jitsuyo* aspect and focus on understanding and using English as a language, without which skills English communication cannot readily take place effectively. However, some of the final post-edited English essays revealed a lack of clarity or coherence in the students' opinions of passages as a whole. Accordingly, when taking into account the rapid evolvement of MT which has unexpectedly allowed for a quality improvement in English production that exceeds the quality of English composition produced by average-level university students in Japan, it would be plausible and realistic to focus more than before on the *kyoyo* aspect, which is largely concerned with theoretical or logical thinking, or the communicability of one's argument. This aspect is not likely to be addressed effectively by MT in the foreseeable future. Incidentally, a Companion Volume with New Descriptors was added to the Common European Framework of Reference for Languages (CEFR) in 2018 by the Council of Europe (CEFR Companion Volume with New Descriptors, 2018). This work emphasizes the multiple aspects of language learning, which entails no longer focusing primarily on the traditional four-skills development approach. It specifies that "the CEFR replaces the traditional model of the four skills (listening, speaking, reading, writing), which has proved inadequate to capture the complex reality of communication" (p. 30). It also lays stress on fostering students as "social agents" (pp. 25-26) who can act autonomously and actively participate in society.

Given recent progressive technological developments, it is reasonable to expect university students to become familiar with and use current MT technology, to facilitate their use of English as a means of communication. However, assuming that a properly developed skill in using English is also linked to one's own cultural perceptions and opinions, and, not entirely based on one's linguistic skills per se, it could be concluded that more attention needs to be paid and a higher priority assigned to culturally relevant aspects of English learning, including logical thinking ability. While taking full advantage of rapidly developing MT technology, it is hoped that Japanese university students can also advance

in their roles as members of society, combining skills as practical MT-literate English users with the skills necessary to operate as logical thinkers in their use of English.

References

Asano, K. (2018). *Jinko chino jidai no gaikokugo kyouiku.* [Foreign language education in Japan in the era of artificial intelligence]. *Nanzan Daigaku Tanki Daigakubu Kiyo* [Journal of Nanzan Junior College]. *39*, 95-105.

Brown, P. F., Cocke, J., Della Pietra, S. A., Della Pietra, V. J., Jelinek, F., Lafferty, J. D. et al. (1990). A statistical approach to machine translation. *Computational linguistics, 16*(2).

Council of Europe (2018). CEFR Companion Volume with New Descriptors. Retrieved from www.coe.int/lang-cefr.

Gally, T. K. (2018). Machine translation and English education in Japan. *Komaba Journal of English Education, 9*, 43-55.

Kaneda, M (2007). *Eigo kyoiku mokuteki ron.* [Theory on objectives of English education]. *Monograph Series, 10*, 13-14.

Lample, G., Ott, M., Conneau, A., Denoyer, L., and Ranzato, M. A. (2018). Phrase-based & neural unsupervised machine translation. *arXiv preprint arXiv:1804.07755.*

Saiki, C. S. (2005). *Shitsuteki kenkyu hoho zeminaru: Guraundiddo seori wo manabu.* [Seminar on qualitative analysis method: Learning grounded theory]. Tokyo: Igakushoin.

Wang, X., Lu, Z., Tu, Z., Li, H., Xiong, D., and Zhang, M. (2017). *Neural machine translation advised by statistical machine translation.* In Thirty-First AAAI Conference on Artificial Intelligence.

Wu, Y., Schuster, M., Chen, Z., Le, Q. V., Norouzi, M., Macherey, W. et al. (2016). Google's Neural Machine Translation System: Bridging the Gap between Human and Machine Translation. *arXiv preprint arXiv:1609.08144.*

（つただ・かずみ　短期大学部講師）