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Tackling the elephant in the language classroom: introducing machine translation literacy in a Swiss language centre

https://doi.org/10.1515/cercles-2023-2015
Received November 22, 2022; accepted March 31, 2023

Abstract: University students, especially language learners, have increasingly been using machine translation (MT) systems in the last decade and for all kinds of texts, including homework, assignments and exams. This ubiquity does not translate into visibility as few teachers address the subject in class. Several researchers have shown that MT systems, while technically very easy to access and use, are not always employed in a critical manner. They have therefore suggested that users should develop MT literacy skills. As part of a larger Swiss project on digital literacy in university contexts (DigLit), an action research project at the University of Neuchâtel Language Centre (UniNE LC) seeks to investigate whether delivering a 20-min presentation about machine translation in all L2 classes (French, German, English) at the beginning of the semester was sufficient to foster minimal MT literacy in language learners. All LC students were surveyed at the end of the semester. These survey results were compared with those from a survey of Swiss university students carried out in spring 2021 as part of the DigLit project. These results have allowed us to monitor and enhance the teaching of MT literacy skills in our LC.

Keywords: digital literacy; language centres; language teaching; machine translation; machine translation literacy

1 Introduction

With the advent of neural machine translation (NMT), language students have changed the way they look up words, as well as how they read and write a text in the L2. This tool has become ubiquitous in and out of the language classroom. However,

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research has shown that learners do not always use machine translation (MT) sensibly and/or correctly (Cotelli Kureth et al. to be published, O'Neill 2019). Moreover, this widespread use takes place under the radar: it is a "pratique buissonnière ou clandestine" as Aurélie Bourdais (2022: 296) aptly mentions, or the proverbial elephant in the language classroom (Delorme Benites et al. 2021). As team members of the "Digital Literacy in University Contexts" (DigLit) project,[1] we firmly believe that language students need to develop their MT literacy (see Section 2.2 below) and that our classrooms need to integrate MT. However, the short time allotted to language teaching (2 h a week during one semester) means that there is little time at our disposal to develop this MT literacy for language students. We thus conducted an action research project at the Language Centre (LC) and the Institut de langue et civilisation françaises (ILCF) at the University of Neuchâtel (UniNE), Switzerland, to test the minimal input needed to provide students with the maximum effect. This design is described in the first part of this article, preceded by a brief explanation of what is meant by MT literacy. The second part draws on the results from this action research to suggest practical ways of efficiently enhancing MT literacy in the language curricula.

2 MT: an elephant in the room? Developing MT literacy in higher education

2.1 Who is talking about MT?

It is interesting to briefly consider the culture of *omertà* surrounding MT in Higher Education. It could be linked to negative perceptions of MT, mainly that MT use is akin to cheating. As numerous researchers have mentioned, this is how many language teachers have felt about MT for decades (see "MT as Academic Dishonesty" in Jolley and Maimone 2022: 28). At the same time, however, language teachers now seem to be spearheading the development of MT literacy in many national contexts (Delorme Benites et al. 2021; Hellmich 2021), and many teachers have now gained experience in incorporating MT in the classroom (for recent examples see Vinall and Hellmich 2022).

1 This four-year project (2020–2024) is jointly funded by Swiss universities and the four participating universities: Zurich University of Applied Sciences (ZHAW, leading house); University of Neuchâtel (UniNE); Berner Fachhochschule (BFH) and Pädagogische Hochschule Zürich (PHZ).

If we look at the data gathered from all Swiss universities in 2021 and 2022 by the DigLit project,[2] language students are more likely than regular students and other users (mainly staff) to have already had instruction in MT. More than half of the language teachers who took part in the survey responded that they usually give their students some information about MT ("how it works, its potential and its risks") and, for about 11 %, this was "an explicit part of [their] teaching" (DigLit survey 2021–2022). In contrast, only a quarter of university teaching staff in other subjects presented any information about MT in their classes. Nevertheless, none of the language teachers had received any explicit instruction on using MT: 5.5 % of the respondents indicated that they did not remember but 94.5 % answered "no" (DigLit survey 2021–2022). It would thus be interesting to discover what these teachers show their students. Moreover, the question "How confident are you that you understand how MT systems work?" generated very diverse results. Language teachers had to rate their confidence from 0 (not confident at all) to 100 (perfectly confident) and the median fell at exactly 50 (see Figure 1).

On the basis of these results, the DigLit project has been offering MT literacy training to Swiss university language teachers (four sessions in spring-autumn 2022; more to follow in 2023). One of the main observations made by the workshop

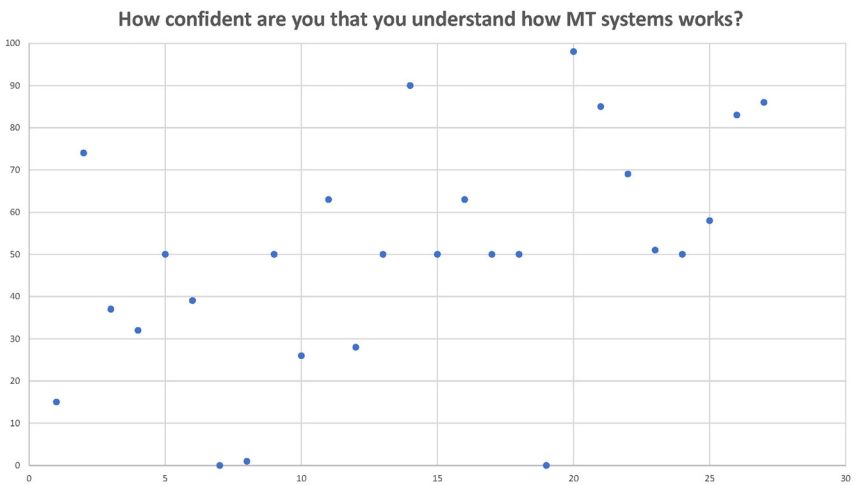

Figure 1: Answers to the question "How confident are you that you understand how MT systems works?": Lowest values: 0,0,0, 1,2; highest values 85, 85, 90, 98, 100; median = 50 (DigLit survey 2021–2022; language teachers *n* = 50).

2 To learn more about this survey, see Delorme Benites et al. (2021). More than 6,000 university staff and students completed the survey, but only around 75 were language teachers (compared to 900 who teach other subjects).

coordinators was that the participants had a strong need to talk about MT and share their experiences. Candid discussions repeatedly broke out, leading the coordinators to recognise that the participants needed this space to speak about these issues with their colleagues. For some, this was the first time they had done so.

Both our data and our experience thus show that even if there is some discussion and information exchanged about MT at Swiss universities, it is not enough. This is why we decided to implement a mandatory twenty-minute session on MT for all students attending language classes at UniNE in spring 2022. We based the content of our short information session on the extensive work done to date on MT literacy.

2.2 Machine translation literacy

The term 'machine translation literacy' was introduced by Bowker and Buitrago Ciro (2019) to describe the core skills needed by lay users of MT systems. These include the ability to comprehend the basics of how MT systems process texts, appreciate the wider implications associated with the use of MT, create or modify a text so that it can be translated more easily by an MT system ('pre-editing') and modify the output of an MT system to improve its accuracy and readability ('post-editing') (Bowker and Buitrago Ciro 2019: 88). Similar to the wider field of digital literacy, MT literacy therefore relates to cognitive skills, rather than techno-procedural ones (Bowker 2020). As Bowker states: "Using machine translation is easy; using it critically requires some thought" (2020: 28). To this end, MT literacy is about developing the critical thinking skills needed to assess *whether*, *when* and *why* to use this technology and *how* to interact with it (Bowker 2020).

In the context of language learning, MT literacy poses challenges for teachers and learners alike. For language teachers, MT literacy means recognising that NMT systems prioritise fluency (Loock and Léchauguette 2021), which renders obsolete the *bad model* approach of using MT to raise awareness of correct grammar and style through error identification (Yamada 2019a). Moreover, NMT is now capable of producing output that corresponds to the levels pre-A1 to B2 descriptors for overall written production employed by the Common European Framework of Reference for Languages (CEFR) (Delorme Benites and Lehr 2022). This calls for new approaches to language instruction, assignments and evaluation, particularly in light of the fact that students use MT even when explicitly asked not to (for a discussion, see O'Neil 2019).

For language learners, MT literacy involves developing an awareness of the strengths and limitations that result from how MT systems work. For example, although NMT output is highly fluent, it continues to exhibit errors of accuracy, including mistranslations and incorrect terminology (Yamada 2019b). However, the

quality of NMT output makes it very difficult for students to identify and correct MT errors (Loock and Léchauguette 2021). In addition, while studies have shown that language learners may be positively *primed* by syntactic constructs in MT output (Resende and Way 2021), lack of lexical diversity in MT output due to algorithmic biases may result in 'machine translationese', which Vanmassenhove et al. (2021: 2203) describe as an "artificially impoverished language". This in turn could have a negative impact on L2 production.

In light of the above, it is imperative that language learners develop an enhanced MT literacy so they can critically exploit the strengths of MT as a language learning tool, be aware of its limitations, and protect themselves from the possible negative consequences of its use. The question our study seeks to answer is what is the minimal instruction needed to begin fostering MT literacy.

3 How small and how short can an intervention be? Spring 2022 Action research at UniNE

3.1 The UniNE language centre (LC) and the ILCF

Like most universities, UniNE – a French-speaking university in Neuchâtel, Switzerland – offers its students extracurricular language classes to foster their communicative skills in foreign languages or to improve their French. Among other programmes, the UniNE LC holds classes in German and English open to all UniNE students and staff. In spring 2022, the six English courses (from B1 to C1 according to the CEFR) and six German courses (A2 to C1) hosted a total of 138 students.

At UniNE, French as a foreign language classes are managed by the Institut de langue et civilisation françaises (ILCF) at the Faculty of Arts and Social Sciences. We collaborated with the teachers of the 'Français-midi' classes, which consist of five different levels of French classes intended for non-native and exchange students (A1-C1 level). In spring 2022, 99 students attended Français-midi.

The MT literacy sessions were therefore held in 17 classes, with a cohort of approximately 237 students who participated in the action research project.

3.2 Interventions

We wanted to create the shortest intervention possible with the maximum effect. We thus planned our presentations carefully, considering several important

factors: content, format, timing, presenters and the overall information network on MT at UniNE.

3.2.1 Content

We based our content on Bowker and Buitrago Ciro's description of MT literacy (2019), as summarised above (see Section 2.2.), but focused on four main issues. The first three had all emerged in the data from the DigLit survey. The last was added to raise the question of how to use MT to foster long-term language learning.

1. The DigLit survey had shown that one of the most common misuses of MT was using it as an online dictionary rather than an online translator. We therefore underlined the risk of looking up words in MT systems as one would in a bilingual dictionary (see Cotelli Kureth et al. to be published). Without giving a detailed explanation about how MT works, we concentrated on the issues of large amounts of data, corpora and the importance of giving context to the MT system. The main message that we wanted to convey was that students should not enter single words in MT systems, as they work at the sentence level and require context to translate each word in the sentence correctly (Pérez-Ortiz et al. 2022).
2. Given that students find it difficult to identify and correct MT errors (Loock and Léchauguette 2021), we thus decided to focus our advice on pre-editing rather than post-editing. The DigLit survey had shown that only 18 % of users ever made modifications to the original text before running it through the MT system (DigLit survey 2021–2022, see Figure 7). Based on the idea of "translation-friendly writing" presented by Bowker and Buitrago Ciro (2019: 63–70), we taught the students to avoid ambiguous words, idioms and expressions and to provide extra context to the MT system.
3. The DigLit survey had also revealed that Swiss university staff and students were not really aware of many of the risks posed by MT systems. We reminded them to take some time to think before copy-pasting a text into a MT system for reasons of privacy, the environment or quality.
4. Finally, we reminded the students that they should take the time to work with the MT output to enhance their language skills, even though MT systems might allow them to do their homework more quickly. We mentioned that grammar and spelling are the strong points of MT and suggested they use it to check their L2 output and learn new vocabulary, as reviewing (and learning) unknown words presented by the MT system is essential to a good MT literacy.

3.2.2 Format and language

For our interventions, we opted for a 20 to 25-min presentation using an online interactive presentation programme.[3] The idea was to directly engage students by asking them questions and then reacting to the (anticipated) results with information about MT. This deductive and participative approach proved highly effective and prompted discussions and questions on MT between the students, the presenter and the language teacher. Many students expressed surprise at some of the information shared. All but one admitted that they used MT systems very regularly and most of them did so when working on their language homework.

These sessions were given in the students' L1, mainly French. We wanted students to understand our presentation without any language barriers. For the French A1 class, we offered the intervention in English, the language of instruction and the main language shared by the participants. We gave the presentation in English in all C1 English courses.

3.2.3 Timing

The interventions were carried out at the beginning of the spring semester. We waited for weeks 2 and 3 of the semester (14 weeks in total) to ensure that class numbers had stabilised. We also wanted to do this as early as possible in the semester to give students the opportunity to experiment further with MT tools. Moreover, holding the interventions too far into the semester would have meant missing any students who might drop out of the classes. For these reasons, weeks 2 and 3 were considered ideal to hold the interventions.

3.2.4 Presenters

In the context of this action research project, it was important that all intervention sessions were as similar as possible. We thus decided that the two UniNE members of the DigLit team (Sara Cotelli Kureth and Hasti Noghrechi) would go into the different classes and conduct the sessions. If such presentations become routine at the UniNE LC, we plan to have the language teachers take over this task after completing a teacher-oriented training session on MT literacy.

3 https://www.mentimeter.com/.

3.2.5 Information network on MT at UniNE

We embedded these short interventions in the overall MT information network for staff and students that the LC is building at UniNE. Since autumn 2021, several 90-min face-to-face and online workshops on MT have been offered regularly to all members of UniNE. At the end of the short interventions in spring 2022, we informed the students about three such workshops (two face-to-face and one online), which were specifically organised for those who wanted to explore MT further. Some of the information in the short interventions was purposely presented as a teaser to arouse interest among the students and motivate them to attend the longer sessions.

We thought the short interventions would boost participation in the longer workshops but this was not the case: one of the workshops had to be cancelled due to lack of enrolment, and the two that were conducted (one face-to-face in French and one online in English) were attended by only six people in total, none of whom were taking a language course at the LC or the ILCF that semester. We assume that the students in our interventions concluded they had learned enough during the short presentations and therefore thought that they did not need to learn more about MT to use it efficiently. However, as the evaluation of our action research shows, even if some progress was made, more is needed to assist these students in becoming critical MT users.

3.3 Evaluation

In order to determine whether the interventions had the desired effect, we devised a comparative framework. The spring 2022 cohort was asked to fill in an online form with approximately 45 multiple-choice and open questions. Some of the questions were new and designed for this task (e.g. “Has the training changed the way you use MT?”), but most of the questions mirrored those from the 2021–2022 DigLit survey. This allowed us to contrast the cohort’s answers to a control group.

The students were asked to complete the questionnaire, which was implemented on Qualtrics[4] in English and French, on their computer or cell phone at the end of a class in week 13 or 14 of spring semester 2022. As mentioned earlier, by the end of the semester, a few students usually drop out of extracurricular classes due to exam stress and preparation load. Together with some students who were unwell and other students who had to leave early, this explains why less than half the cohort completed the questionnaire (105 responses out of a total of 237 students).

4 https://www.qualtrics.com/.

4 Results and discussion

It seems that our interventions were at least partly successful, but the results were mixed and sometimes contradictory. We report below on five main points, two related to MT in general and three linked to the content of the interventions (see Section 3.2.1). For purposes of consistency and readability, we have added a discussion after each point.

4.1 Change in the way students use MT

One of the most important questions in our survey was about the students' perception of the training: had it helped to change the way they use MT? Only a third of the respondents answered in the affirmative and slightly less than half said that nothing had changed (see Figure 2).

At first glance, this was very disappointing, especially as the discussions during the interventions had been lively and the students had expressed interest in and amazement at some of the information shared. However, as Sections 4.3 and 4.4 show, compared to our control group, the students in the cohort demonstrated a greater MT literacy, namely in understanding how to use MT more effectively and some awareness of its risks. We have no way of knowing whether they had this knowledge prior to the interventions, but, as Section 4.2 shows, this is not likely given that they had never received any instruction in MT previously.

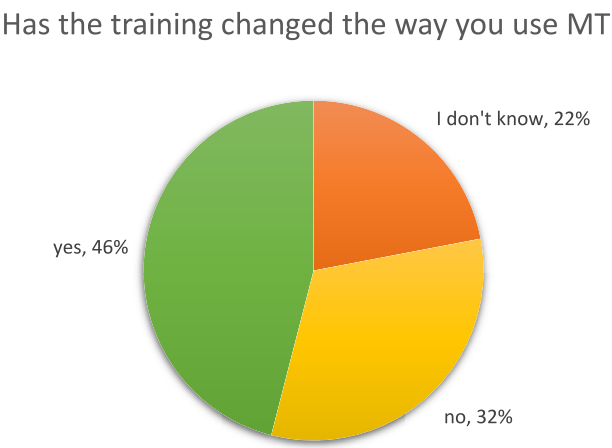

Figure 2: Answers to the question "Has the training changed the way you use MT?" (our data).

Moreover, when looking at the follow-up open question ("If you chose yes, please, tell us how"), the answers show that some students understood some key points: (1) never to look up single words ("Considerer [*sic*] davantage le contexte", "Je traduis des phrases complètes avec un peu de contexte", "Mettre plutôt des phrases complètes", "Je n'utilise que des phrases" ["I take more consideration of context", "I translate full sentences with a bit of context", "put full sentences instead", "I only use sentences]); (2) better awareness of data protection ("du point de vue de la protection des données", "Je fais plus attention à la nature des textes que je traduis" ["Regarding data protection", "I am more careful at the type of texts that I translate"]); (3) applying pre-editing tips ("De manière plus simplifiée ou alors éviter les expressions qui ne sont pas traductible [*sic*] littéralement" ["In a more simplified way or to avoid expressions that cannot be translated literally"]); (4) certain functionalities of the tool, such as the option in DeepL to right click on a word to display additional translation options ("Plus attentive aux possibilités de traduction" ["I am more careful of translation possibilities"]). These were directly linked to our main goal (see Section 3.2.1) and demonstrates that some information was retained and applied by the 10 % of students who answered this open question (n = 13/total = 105).

4.2 Training or guidelines about MT

We wanted to see if any of the students had already "had any explicit instruction on using MT" and if they considered our short session enough to say they had received some training. This did not seem to be the case as 55 % of respondents considered they had never received any explicit instruction on using MT (see Figure 3). Only 16 % said they had and, when answering the follow-up question (n = 11/total = 105), they all mentioned our interventions.

This was surprising, as the main goal of our interventions was to give "explicit instruction" to students on using MT. However, this result started to make sense when we looked at the responses to the question about whether their institution (in our case, UniNE) had "guidelines about the use of MT?". Nearly half the cohort (46 %) answered that their university had guidelines on using MT and only 22 % did not know. As shown in Figure 4, these results stood in complete contrast to the control group.

These results were particularly unexpected, as UniNE has no guidelines on the use of MT. This led us to conclude that some of the students misunderstood our interventions. We intended them as instructive and a first step towards MT literacy, but it would appear that nearly half the students considered them as guidelines on the use of MT. This could have been reinforced by the choice of presenter: Sara

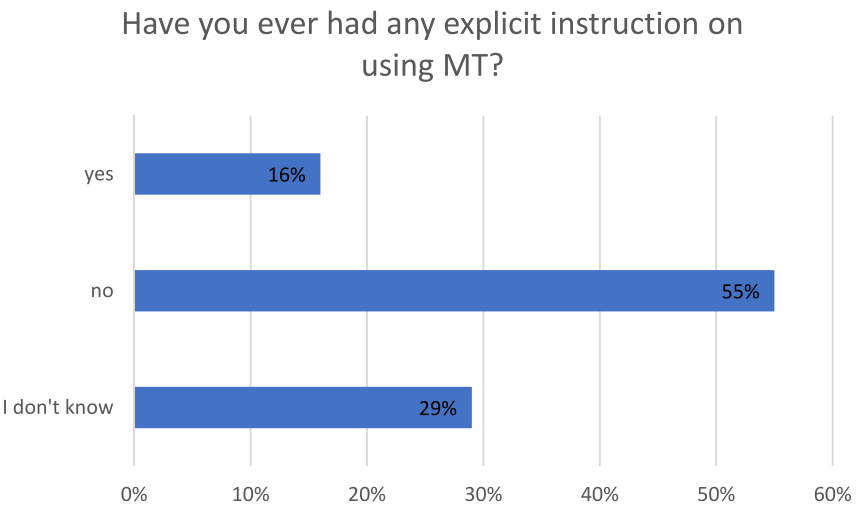

Figure 3: Answers to the question "Have you ever had any explicit instruction on using MT?" (our data).

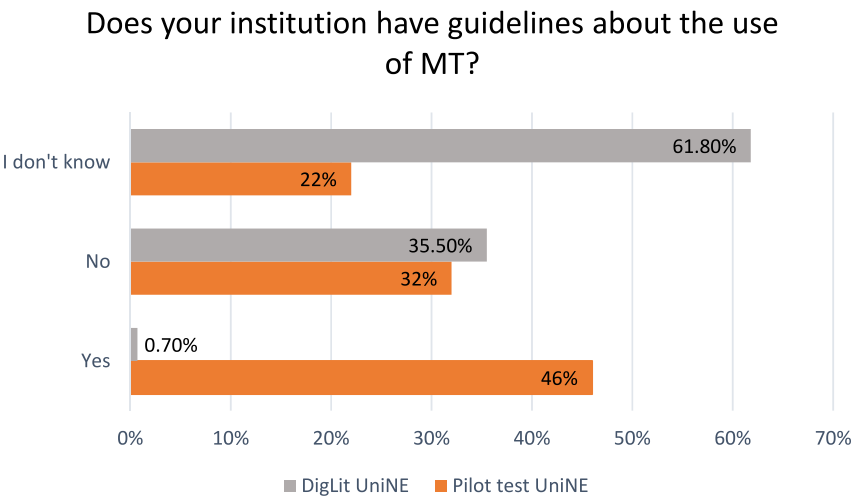

Figure 4: Answers to the question "Does your institution have guidelines about the use of MT?" (our data; DigLit survey 2021–2022, all users).

Cotelli Kureth, who is head of the UniNE LC, gave the majority of interventions, and it is possible that her position of authority in the LC[5] led the students to consider what was said as actual LC guidelines. In the next phase of our project aimed at

5 She was very often introduced by the language teachers as their "boss".

implementing MT literacy at the UniNE LC, the task of delivering the presentations will be handed over to the language teachers to avoid such misunderstandings. Asking the teachers to take on this role will also allow them to embed this theoretical knowledge into more hands-on tasks that foster MT literacy for all students and reinforce it by using MT in the classroom regularly. The DigLit project has thus started to create teaching material based on our short presentations that language teachers at UniNE will be asked to use as early as spring semester 2023.

4.3 Use of MT as a dictionary

When we looked at the question on the use of MT as a bilingual dictionary, the students appear to have understood this key point quite well. Figure 5 compares our data with the DigLit survey's responses to the question: 'How/Why do you use MT?'.

Only 20 % of our cohort indicated that they still use MT to translate individual words or phrases, a percentage that is significantly lower than what was found in the DigLit survey (58 %). While this initially seemed very encouraging, the results in fact contradict the responses to several other questions. In point of fact, when asked at the end of the survey to give an example of how they use MT to help with their language learning, some respondents provided responses that indicate that they still appear to think at a word level and use MT for single word searches:

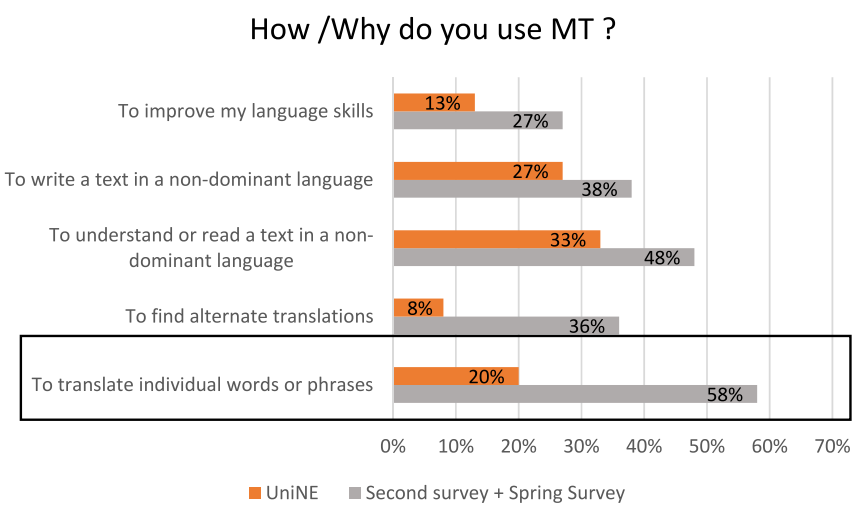

Figure 5: Answers to the question "How/Why do you use MT?" (our data; DigLit survey 2021–2022, all users).

"Traduire un passage obscur lors d'une lecture ou *un mot* difficile en visionnant un film en VO" ["Translate a difficult passage when reading or a difficult *word* when watching a film in the original language], "Traduire *des termes* techniques ou inconnus dans un texte" ["Translate technical or unknown *words* in a text"] (our emphasis).

In addition, we asked the students which tool they use to perform certain tasks: MT or a bilingual dictionary (see Figure 6). This question, which was not in the DigLit survey, was based on responses to a survey conducted by O'Neill (2019).

Our results show that 43 % of our cohort use MT to look up individual words, which directly contradicts the findings in Figure 5 above. However, we suggest that this second figure cannot be accepted at face value. When analysing data from our DigLit survey, it became apparent that MT users have an inadequate understanding of what an MT system is. When asked to provide the name of the MT system that they use, the students named a large number of online bilingual dictionaries and corpora (Leo.org, wordreference, Linguee, etc.) (Cotelli Kureth et al. to be published). This unfortunately casts doubt on the reliability of Figure 6, as it could be unclear to students what the difference between MT systems and online dictionaries is, even if this was very briefly mentioned in the interventions.

It is therefore important in future presentations and/or tasks to introduce a substantial focus on tools for language learning. Fostering MT literacy alone is not enough, and language teachers should be aware that their students may have a very shallow understanding of the difference between the various tools, which may result from the way different companies market their products. DeepL and GoogleTranslate, for example, allow users to make lists of searches that some students actually use to learn vocabulary (Bin Damash 2020), and Linguee, a bilingual automatically aligned corpus, presents itself as a dictionary. It is thus very

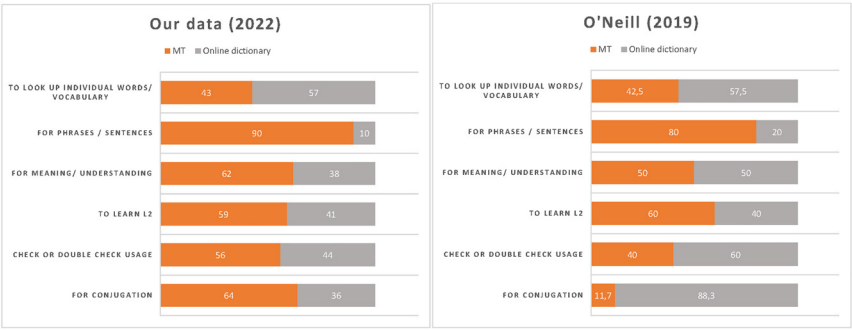

Figure 6: Comparison between our data and O'Neill's data (2019) with regard to which tool students use to perform certain tasks.

important for teachers to foster digital tool literacy, which encompasses MT literacy, to allow students to adopt the right tool for the correct type of search.

4.4 Pre-editing

Another focus of the interventions was to give information on MT-friendly writing to induce users to pre-edit rather than only post-edit. This seems to have been well understood by the cohort as 84 % mention they now modify a text before putting it in the MT system (see Figure 7). Only 23 % of the control group had done so (DigLit survey 2021–2022).

The responses to the following two questions (a multiple-choice question to check how often users changed the input and an open-ended question to see what type of content they changed) would indicate that this part of the training had worked well. The first follow-up question shows that half of our cohort often changed the output and about a third rarely did so (see Figure 8). Still, a significant number of users understood that they could make changes to the input when they needed to.

For the second follow-up question, users mention paraphrasing when they encounter problems, by saying things in their own words ("dans [leurs] propres mots") or by adding context ("je rajoute des phrases pour contextualiser si j'ai l'impression que les termes employés ne correspondent pas à la situation

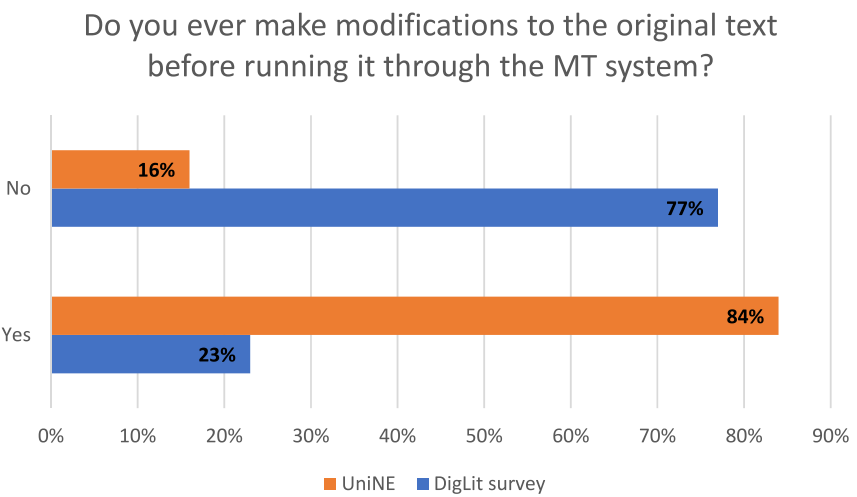

Figure 7: Answers to the question "Do you ever make modifications to the original text before running it through the MT system?" (our data; DigLit survey 2021–2022, all users).

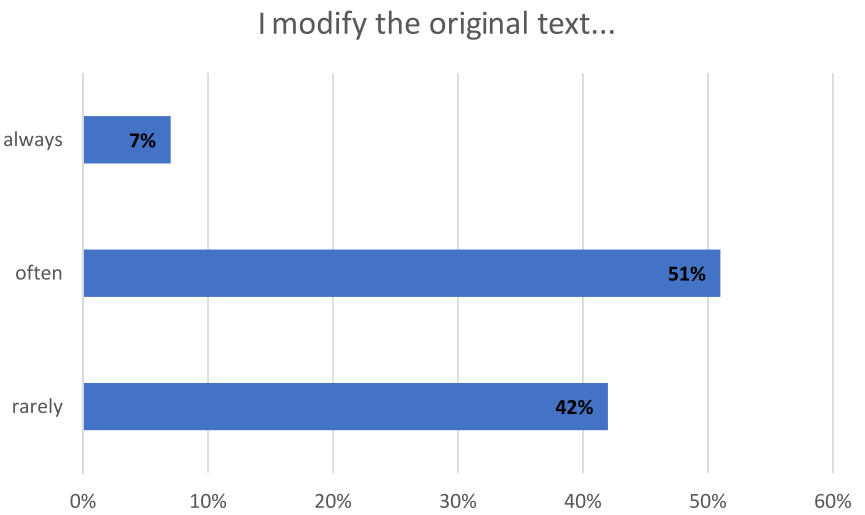

Figure 8: Answers to the follow up question, "I modify the original text: always, often, rarely" (our data).

recherchée" ["I add more sentences to give more context when I feel that the words provided do not fit the proper context"]).

These results indicate that a short presentation is sufficient to change our students' use as far as pre-editing is concerned.

4.5 Awareness of risks

Finally, we wanted to see whether the awareness of the risks associated with MT use had changed after our intervention. The DigLit survey was able to confirm such a change when we isolated the data for first-year BA translation students at the Zurich University of Applied Sciences who had received an in-depth ninety-minute training by two members of the project. Their awareness of the risks was significantly higher than other users. This, unfortunately, was not the case for our cohort, as shown in Figure 9.

As the results indicate, UniNE students do not recognise that using MT could entail high risks for a writer's reputation or result in ethical problems or miscommunication and misunderstandings. This clearly suggests that our input, which focused mainly on data protection, was not sufficient to trigger any change in the students' behaviour and perception. Personal safety was the only point that had slightly higher results for our cohort, but the difference does not seem significant as

Figure 9: Answer to the question "On a scale of 1–100, how would you rate the risks of using MT in the following domains" (our data; DigLit survey 2021–2022, all users).

it is too small and there are no changes to the risks associated with academic integrity, which we also touched upon in our interventions.

This point will need to be developed in any future presentation as an awareness of the risks is crucial to a critical use of MT. We feel that a longer presentation will likely be necessary for all students, one that features some of the aspects that worked well in our interventions and additional ones that have emerged from the evaluation above.

5 Conclusion and further developments

The results show that our short interventions were not completely in vain. Users seem to have acquired some MT literacy (especially regarding pre-editing) and a minority have changed their behaviour and developed MT literacy on several points (using MT with full sentences, being aware of some privacy and quality issues). However, we would have liked to see more participants achieve this. In hindsight, we likely did not spend enough time in our sessions on the risks and opportunities associated with MT use. In addition, we did not sufficiently emphasise the question of MT versus other tools. Future versions of our presentation should therefore include a brief description of the different types of MT systems and contrast them to online corpora, such as Linguee and online dictionaries. In addition, a further distinction

should be made between collaborative dictionaries (such as Leo) and those written by lexicographers. This will help users develop a much needed and broader digital literacy than just MT literacy (Cotelli Kureth et al. to be published).

In addition, since our teaser approach to motivate participants to attend the longer MT workshops did not succeed, this suggests that more information needs to be included in the mandatory presentation and follow-up tasks. The students regarded the little information provided in our presentation as sufficient, which indicates that even when presented with some astonishing facts they still do not feel the need for more instruction. Our results indicate otherwise, and it is important that Higher Education institutions take this issue seriously. However, the fact that our presentation was embedded in the language courses and focused on MT use in language learning is an argument in favour of integrating MT literacy training directly into the (language) teaching curriculum rather than as a separate or stand-alone workshop. This in turn indicates an urgent need to train language teachers in MT literacy so that they can not only assist their students in developing a critical and effective use of MT as a language learning tool but also adapt to the changing demands of language teaching and evaluation brought on by this disruptive technology.

References

Bin Dahmash, Nada. 2020. 'I can't live without Google translate': A close look at the use of Google translate app by second language learners in Saudi Arabia. *Arab World English Journal* 11(3). 226–240.

Bourdais, Aurélie. 2022. *Traducteurs en ligne et enseignement-apprentissage de l'anglais: Pratiques de littératie numérique au lycée*. Lyon: University of Lyon. PhD dissertation.

Bowker, Lynne. 2020. Machine translation literacy instruction for international business students and business English instructors. *Journal of Business & Finance Librarianship* 25(1–2). 25–43.

Bowker, Lynne & Jairo Buitrago Ciro. 2019. *Machine translation and global research: Towards improved machine translation literacy in the scholarly community*. Bingley: Emerald Publishing.

Cotelli Kureth, Sara, Alice Delorme Benites, Mara Haller, Hasti Noghrechi & Elizabeth Steele. 'I looked it up in DeepL': Machine translation and digital tools in the language classroom. In *Papers collected from the Tralogy III conference*, to be published.

Delorme Benites, Alice & Caroline Lehr. 2022. Neural machine translation and language teaching: Possible implications for the CEFR. *Bulletin Suisse de Linguistique Appliquée* 114. 47–66.

Delorme Benites, Alice, Kureth Sara Cotelli, Lehr Caroline & Steele Elizabeth. 2021. Machine translation literacy: A panorama of practices at Swiss universities and implications for language teaching. In Naouel Zoghlami, Cédric Brudermann, Cédric Sarré & Muriel Grosbois (eds.), *CALL and professionalisation: Short papers form EUROCALL 2021*, 8–87. Voillans: Research-Publishing.net.

Hellmich, Emily A. 2021. Machine translation in foreign language writing: Student use to guide pedagogical practice. *Apprentissage des langues et systèmes d'information et de communication* 24(1). Online. https://doi.org/10.4000/alsic.5705.

Jolley, Jason R. & Luciane Maimone. 2022. Thirty years of machine translation in language teaching and learning: A review of the literature. *L2 Journal* 14(1). 22–44.

Loock, Rudy & Sophie Léchauguette. 2021. Machine translation literacy and undergraduate students in applied languages: Report on an exploratory study. *Revista Tradumàtica: tecnologies de la traducció* 19. 204–225.

O'Neill, Errol M. 2019. Online translator, dictionary, and search engine use among L2 students. *CALL-EJ: Computer-Assisted Language Learning–Electronic Journal* 20(1). 154–177.

Pérez-Ortiz, Juan Antonio, Mikel L. Forcada & Sánchez Martínez. 2022. How neural machine translation works. In Dorothy Kenny Felipe (ed.), *Machine translation for everyone: Empowering users in the age of artificial intelligence*, 141–164. Berlin: Language Science Press.

Resende, Natália & Andy Way. 2021. Can Google translate rewire your L2 English processing? *Digital* 1(1). 66–85.

Vanmassenhove, Eva, Dimitar Shterionov & Matthew Gwilliam. 2021. Machine translationese: Effects of algorithmic bias on linguistic complexity in machine translation. In *Proceedings of the 16th Conference of the European Chapter of the Association for Computational Linguistics: Main Volume. 2203–2213*. Online. Association for Computational Linguistics.

Vinall, Kimberly & Emily Hellmich. 2022. Special issue "Machine translation & language education: Implications for theory, research & practice". *L2 Journal* 14(1).

Yamada, Masaru. 2019a. Language learners and non-professional translators as users. In Minako O'Hagan (ed.), *The Routledge Handbook of Translation and Technology, 183–199*. London: Routledge.

Yamada, Masaru. 2019b. The impact of Google neural machine translation on post-editing by student translators. *The Journal of Specialised Translation* 31. 87–106.