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The Effect of Artificial Intelligence Generated Translation versus Human Translation on Reading Comprehension of the Speakers of Less Commonly Taught Languages

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Abstract

English as a Foreign Language (EFL) University students usually write in their native tongue and translate it into English using Artificial Intelligence programs. The study evaluated the quality of translations generated by AI in one hand and investigated the impact of Artificial Intelligence Generated Translation (AIGT) on EFL students in another. A human translator and an AI tool were used to translate two sample texts from English into Persian. The texts were given to 30 EFL teachers to examine the quality of AI translations. In addition, 152 students randomly divided into control or experimental groups were exposed to translated texts. Results from an independent t-test showed that there was a negligible difference between the two groups. The qualitative analysis of the interview data that involved 30 participants revealed that language teachers perceived omission, addition, syntax and punctuation errors in AIGT as adequately acceptable, despite their prevalence. However, a majority of the teachers were dissatisfied with AIGT's accuracy in rendering idiomatic expressions. Based on the results, EFL educators should acknowledge the prevalence and usefulness of AI among students, and aim to incorporate it effectively in their teaching instead of prohibiting its use.

Keywords: text analysis, reading comprehension, AI, less commonly taught languages, Persian

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1. Introduction

Translation has endured in English as a Foreign Language (EFL) reading classes due to the favorable reception of learners and their conviction about its efficacy (Liao, 2006). The persistence of EFL teachers in embracing translation as a technique for reading comprehension stems from the established research findings endorsing it, as well as the receptiveness of EFL learners to it (Boshrabadi, 2014). Despite the popularity of translation as a technique for enhancing reading comprehension, its implementation among EFL students has not proved effective, as they tend to seek assistance from human translators or resort to Artificial Intelligence (AI) systems readily available to them. The widespread utilization of AI among university students in general, and EFL learners in specific (Mirzaeian, 2020; Chang & Yamada, 2020) indicates the revival of translation as a learning aid in universities. This necessitates a fresh perspective on foreign language reading comprehension from a translation viewpoint, and the study of Artificial Intelligence Generated Translation (AIGT) regarding its usability and comprehensibility among EFL learners, as addressed in this research.

The focus of this study was not on the usability of translation as a technique for enhancing reading comprehension, but rather on the usefulness of AIGT to EFL learners as far as comprehensibility was concerned. Nowadays, with the rise of AI technology, an increasing number of students are utilizing it for personal and educational purposes. Theoretically speaking, AI has demonstrated its usefulness to students from both linguistic and cognitive perspectives. For instance, research by Chung (2020) suggests that exposing students to an AIGT text may significantly reduce the cognitive load of the text and improve comprehension, particularly among beginners, without requiring help from peers or instructors.

In recent times, some researchers (Mirzaeian, 2020; Murphy, 2020 & Hsu, 2019) have acknowledged the growing interest among university students in AIGT. However, more studies need to be conducted on the correlation between AIGT and reading comprehension. It is yet to be ascertained if AIGT is comparable to human translation output in terms of foreign language reading comprehension. In other words, when exposed to AIGT, do students experience the same benefits as they would when exposed to human translation output? This is an open question that still requires further research.

Hence, the aim of this research was to investigate how AIGT could help first-year foreign language students who did not have sufficient language proficiency to keep up with their studies in the target language. Building on the reasons mentioned earlier, this study assessed the reading comprehension of EFL students when they were presented with AIGT and human translation outputs. The study formulated the following research questions:

1. What was the level of text quality for the translations produced by AI?
2. Was there a significant difference in the reading comprehension ability of students who read AIGT compared to those who read human translation output?

2. Review of the Related Literature

Most of the research in the field of AIGT is focused on improving students' writing in the target language, and the impact of this technology on other aspects of language learning, such as reading comprehension, has not been taken into consideration. Amaral and Meurers (2011) concluded that AIGT can help language learners by increasing their vocabulary and grammatical knowledge. Correa (2014) has also shown with his research that AIGT can increase the learner's awareness of the target language and thus help to improve the writing process and strengthen the learner's final output. Garcia and Pena (2011) have shown that in order to improve students' experimental skills, they should be taught the main four language skills and AIGT can provide a lot of help in this field. In another study (Ali & Alireza, 2014; Iravi & Malmir, 2023), it has been proven that AIGT helps language learners to produce better writing. In one of these two studies (Garcia & Pena, 2011), it was shown that AIGT can be very useful for beginners. In another similar study (Godwin-Jones, 2015), it has been shown that AIGT is effective in improving foreign language learners' writing.

Bernardini (2016) has concluded that the use of AIGT in language classes is very compatible with the interests and needs of language learners. This type of AIGT in the classroom is known as data-driven learning, which is very effective for language learners (Wong & Lee, 2016; Nation, 2001). In addition, it has been proven that AIGT plays an effective role in learning vocabulary by language learners (Chen et al., 2015). In some research (Frodesen, 2007 & Bahri & Mahadi, 2016) AIGT has been used to improve students' writing compared to other written sources such as electronic reference tools, and they have come to the conclusion that AIGT is much more successful in the field of equivalence for specialized vocabulary has done. Chen et al., (2015) have also shown that AIGT can have a positive effect on the vocabulary of language learners.

AIGT can draw students' attention to lexical and grammatical errors and give them self-confidence to identify and correct errors. To do this, students should acquire self-confidence skills and these skills should be strengthened by teachers (Bernardini, 2016; Garcia & Pena, 2011) Also, AIGT can help those language learners who have difficulty learning in the classroom. By providing feedback to the learner, AIGT can provide suggestions regarding vocabulary and order and help the learner identify and correct mistakes in his writing. A researcher (Kliffer, 2008) believes that AIGT allows the learner to re-edit and can improve his written output in the target language to a great extent. Two other researchers (Garcia & Pena, 2011) concluded that editing the output of AIGT makes language learners more focused on the process of writing and editing.

AIGT can be useful for language learners from an emotional point of view. Numerous researches (Bahri & Mahadi, 2016; Garcia & Pena, 2011; Kliffer, 2005; Jin, 2013; Nino, 2009; Shakouri et al., 2022) have shown that AIGT can make the learning environment informal and reduce students' anxiety in the classroom. It has been proven that when a language learner works on AIGT, his participation and motivation improve, and as a result, self-confidence in learning a foreign language increases. Amores (1997) believes that students have a negative attitude towards

correcting their mistakes by teachers. Therefore, their reaction to the feedback they receive from AIGT is different and they do not have a negative orientation towards machine translation.

Despite the advantages mentioned for AIGT, some of its disadvantages have also been reported in some studies. The quality of AIGT is highly dependent on the subject of the text, the type of text, its size, as well as the source and the target languages (Godwin-Jones, 2015 & Nino, 2009). A researcher (Shei, 2002a, 2002b) has shown that editing the text before giving it to AI to be translated greatly enhances translation quality. Moreover, if the input is poor, the output may be full of syntactic as well as lexical errors. Research has shown that AIGT cannot solve the syntactic problems of language learners (Josefsson, 2011). In addition, AIGT is not able to provide solutions at higher levels of lexicon and syntax, namely, semantics and discourse (Groves & Mundt, 2015).

Due to the rapid changes in this field, the output of AIGT is getting better on a daily basis, so its implementation in the field of learning will also increase. Therefore, more research is needed to clarify the dark areas in the use of AIGT for learning in general and language learning in particular. However, in the field of using AIGT in language learning (Barr, 2013), not muchr uch research s been done in this field and the majority of research in this field has focused on the quality of AIGT. Researchers claim that AIGT is not a suitable language model. In most research, language learning has not been measured after using AIGT, and most researchers have focused on surveys of language learners (Case, 2015). The only exception is Lee (2019) who has investigated the effect of AIGT on language learners' writings based on different data sources, i.e., interviews, examination of language learners' writings and their notes regarding this technology.

In addition, it has been neglected that almost all language learners and non-language students also use AIGT to understand foreign language texts, but no research has been done in this regard. Therefore, in this research, an attempt has been made to measure students' understanding of texts that have been translated into the students' mother tongue by AIGT.

3. Method

3.1. Materials and Instruments

English proficiency test: The Quick Placement Test was used to ensure the homogeneity of the participants in terms of their language proficiency. The test was a standardized 50-item multiple-choice test that assessed grammar, vocabulary, and reading comprehension. The entire test was designed to be completed in 40 minutes. The test had been used extensively in language learning research and had been found to have sufficient internal consistency and reliability. The reliability of the test used in this study was measured using Cronbach's alpha, which was a statistical measure of internal consistency reliability. The calculated Cronbach's alpha for the test was 0.82, which indicated a high level of reliability. This suggested that the test was consistent in measuring language proficiency levels across participants, and the results could be considered reliable for the purposes of the study.

3.2. Participants

To ensure that the study participants were representative of the target population of English as a foreign language learners the sample was selected randomly. All 167 EFL university students from three different universities in Tehran were invited to participate in the study, regardless of their gender, ethnicity, or previous language learning experience. To determine the language proficiency level of each participant, they were all given the Quick Placement Test. The scores of all participants were then calculated, and those who scored one standard deviation below and above the mean were selected as the homogeneous sample for further study.

Participants were divided into experimental and control groups and instructed to read allocated texts in their mother tongue and answer multiple-choice reading comprehension questions. The experimental group was given AIGT whereas the control group was given the human translation. However, they both answered the same questions designed by the researchers. As for the evaluation of AIGT, 30 language teachers with at least 10 years of experience volunteered to take part in the study. The selection was based on frequent experience with AIGT and willingness to attend interview sessions voluntarily. To ensure that the interview questions were relevant and general, three experts were consulted.

3.3. Data Collection Procedure

The first phase of the study involved administering the Quick Placement Test (second version) to all participants to identify a group of homogenous students. Those who scored one standard deviation (1 SD) below or above the mean score were excluded from the study. This resulted in 152 participants being selected for the study. The second phase of the study involved conducting semi-structured interviews with 30 participants using the refined interview questions. The interviews were recorded to ensure the accuracy of the data collection process. To analyze the data obtained from the interviews, the researchers used a classification system developed by Popovic (2018) to categorize errors identified in the AIGT.

To ensure the validity and reliability of the instrument used in the study, the researchers conducted a pilot study before the actual experiment. Additionally, the researchers calculated the instrument's reliability using Cronbach's alpha coefficient, obtaining a score of 0.85, which indicated that the instrument was reliable. To ensure the instrument's efficacy in covering the target content, the researchers sought input from three members of the English Language Teaching (ELT) department. These experts evaluated the instrument and provided feedback, which the researchers incorporated into the final version of the instrument.

3.4. Data Analysis

To answer the first research question regarding the accuracy of AIGT, the researchers analyzed qualitative data from interviews using Popovic's (2018) classification of errors. Each

participant's comments were carefully transcribed and coded according to the different error types, and the frequencies and percentages of their answers were tabulated on a scale ranging from strongly satisfied to strongly dissatisfied. Regarding the second research question, the researchers used human translation and AIGT reading comprehension test scores to compare the accuracy of the two types of translations. Having confirmed the normality of distribution, the researchers used an independent-samples t-test to compare the mean scores of the two tests. By utilizing both qualitative and quantitative methods, the researchers aimed to provide a comprehensive understanding of the accuracy and effectiveness of AI compared to human translation.

4. Results

4.1. Interview Results

The subsequent sections present the outcomes obtained from the qualitative analysis of the interview data that involved 30 participants. The results are primarily relevant to the initial research inquiry. The resultant table displays the discerned trends in the participants' evaluations of distinct facets of machine translation.

Table 1

Teachers' Views Regarding the Output Quality of AIGT

	Strongly satisfied		Satisfied		No idea		Dissatisfied		Strongly Dissatisfied	
Extracted Patterns	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Omission	3	10	18	60	5	16.6	4	13.4	0	0
Syntax	1	3.3	14	46.6	6	20	7	23.3	2	6.6
mistranslation	3	10	10	33.3	2	6.6	14	16.6	1	3.3
addition	3	10	16	53.3	5	16.6	4	13.4	2	6.6
register	0	0	4	13.4	3	10	15	50	8	26.6
idiom	0	0	1	3.3	1	3.3	6	20	22	73.3
punctuation	3	10	14	46.6	3	10	7	23.3	3	10
acceptability	4	13.4	21	70	2	6.6	3	10	0	0

Table 1 reveals that language teachers perceived omission (60%), addition (53.3%), syntax (46.6%), and punctuation (46.6%) errors in AIGT as adequately acceptable, despite their prevalence. However, a majority of them (73.3%) were dissatisfied with AIGT's accuracy in rendering idiomatic expressions. Similarly, deficiencies in the output's register and syntax were secondary and tertiary sources of dissatisfaction. Nonetheless, a significant proportion of language teachers (83.4%) expressed overall satisfaction with the AIGT.

4.2. Reading Comprehension Test Results

In this section, we present the outcomes of the quantitative analysis of reading comprehension scores obtained from administering both AI and human translation tests to participants. This analysis primarily addressed the study's second research question. Table 2 illustrates the findings.

Table 2

Quantitative Analysis of Reading Comprehension Scores between Control and Experimental Group

				Kolmogorov-Smirnov test					
Group	N	M	SD	Z	df	p	t	df	p
AIGT	72	14.86	2.11	0.89	152	0.40	-0.61	150	0.52
Human translation	80	15.59	2.14	0.67	152	0.74			

The data presented in Table 2 confirms that both the AIGT and human translation reading comprehension scores exhibit normality, as evidenced by their respective Z values (.89, $p=.40<.05$; .67, $p=-.74<.05$) exceeding the critical value (.05). Consequently, a parametric statistical test, independent samples t-test, was conducted to compare the mean test scores of the participants' human and machine translation reading comprehension. The results ($t=-0.613$, $df=151$, $p= 0.52>0.05$) indicated that there were no significant differences between the two groups' reading comprehension performances. Therefore, it could be concluded that the participants' comprehension of the AIGT was comparable to that of the human translation output. This suggested that AIGT was as successful as human translation in producing comprehensible texts.

5. Discussion

This research is the first in the field of AIGT that has been used for reading comprehension not writing and therefore one should be cautious in generalizing its results. In addition, the output of AIGT has also been analyzed and all types of errors have been identified and categorized. Therefore, first, we will discuss the quality of AIGT and then we will talk about its impact on reading comprehension.

It is obvious he input plays an important role in the output quality of AIGT (Aiken and Balan, 2011). That is why it is usually recommended to check the text before giving it to AIGT. It is interesting to note that scientific texts and translated very well by AIGT and literary texts are poorly translated. One point that needs attention is passive sentences. It should be noted that one of the criteria of text difficulty is the number of passive sentences in the text (Clifford et al., 2013). Experience has shown that as far as the Persian language is concerned, the translation of passive sentences is more difficult for AIGT than active ones and this point should also be taken into account when using AIGT for Persian learners of English.

It might be the right time to reconsider the criteria for text difficulty level (Doherty & Kenny, 2014). If we examine the data on the errors made by AIGT, most of the errors are related to the wrong lexical selection (Enkin & Mejias-Bikandi, 2016). This seems quite natural because a big challenge in AIGT is the lexical issue. Words almost always have different meanings and for AIGT, it is very difficult to decide which meaning of a word to choose (Kumar, 2012). In the field of computer science, this is called Word Sense Disambiguation (WSD), and since AI is evolving rapidly, more such errors are continually eliminated. Therefore, AIGT has reached such maturity and evolution that it can be used as a language-learning tool.

Since the researchers of this study have been supporters of using AIGT in language teaching, they have realized that many of their colleagues do not use AIGT correctly, as a result, their wrong input causes errors in the output, and the quality of the output is greatly affected. They consider AIGT to be weak and encourage colleagues and students not to use this tool. Some pre-editing techniques to improve the quality of AIGT output are briefly introduced here. The text should not be entered in the AIGT environment directly from other sources, especially in Portable Document Format (PDF). The text must first be saved in pure text format and then entered into the AIGT. These types of texts often have invisible characters that disrupt the performance of the AIGT system. The difficulty level of the text and genre should also be taken into consideration (Nino, 2004).

In AIGT, scientific texts are translated more accurately than literary texts. The quality of the original text should be checked before giving it to AIGT. Many texts that are especially taken from the Internet have problems, which also have an impact on the output of AIGT. The text should be pre-edited and all acronyms such as AIGT should be replaced with their full form throughout the document. Humans have the ability to recognize these acronyms, but this task is extremely difficult for the AIGT system (Kumar, 2012). After translation, the acronyms can be automatically returned to their original form using a simple find-and-replace feature. Care must be taken in the consistency of the technical terms used. The AIGT may use one lexical item for a concept in one sentence and another lexical item for the same item in another sentence. This consistency can easily be checked by a human post-editor.

Complex sentences should be converted into simple sentences. The authors of this article have noticed that there is a negative correlation between the length of a sentence and the quality of AIGT. Very long and complex sentences should be shortened before being given to AIGT. Converting complex sentences into simple ones can be done in the classroom and is an interesting activity for language learners to learn more about grammar and see the difference in the output of AIGT. (Williams, 2006).

6. Conclusion

The findings of this study support the notion that the suitability or usefulness of an AI system can be measured based on the informativeness, comprehensiveness, and fluency of its output, as evaluated through a reading comprehension test. The approach used in this study was different from previous studies that focused on artificial intelligence-oriented methods. Instead of relying on mathematical and automated methods to evaluate AI output, this study focused on the quality of AI output in terms of its usefulness as perceived by human readers. Therefore, the findings add to the growing body of research that highlights the importance of evaluating AI output through human-centred measures rather than relying solely on automated metrics.

While this study provides valuable insights into the cognitive evaluation of AI output, there is still much to be explored in this area. Future research should consider the contribution of text difficulty to AI output quality, including variations in readability, style, and academic fields. Further investigation is needed to evaluate the interchange between AI output characteristics and the comprehension of Persian readers. Additionally, further research should consider the unique generic features of different text types, such as different sections of research papers, when evaluating AI output. The role of readers' expectancy should also be taken into account in future studies. Finally, it is important to examine the possible effects of using AI on improving foreign language learners' reading comprehension ability in English for academic purposes. By addressing these issues, future research can further enhance our understanding of AIGT and ultimately improve the quality of AI technology.

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