

# Challenges And Strategies Of Translating Scientific Texts: A Comparative Study Of Human Translation And Artificial Intelligence

Awadh Nasser Munassar Awadh\*

\*Assistant Professor, translation studies, Amran University, Yemen. [awadhnasser83@gmail.com](mailto:awadhnasser83@gmail.com)

**Citation:** Awadh, A. (2024). Challenges And Strategies Of Translating Scientific Texts: A Comparative Study Of Human Translation And Artificial Intelligence, *Educational Administration: Theory and Practice*, 30(4), 9898-9909  
Doi: 10.53555/kuey.v30i4.4147

## ARTICLE INFO

## ABSTRACT

The advent of Artificial Intelligence (AI) has markedly influenced the field of translation, particularly within the scientific community. The study aims to explore the challenges faced by human translators and AI apps highlighting the strategies they use when translating scientific texts from English into Arabic and vice versa. It also seeks to compare the translations produced by human translators with those generated by Artificial Intelligence. Moreover, this study endeavors to identify potential solutions for enhancing translation efficiency and productivity, particularly in the domain of scientific translation. The author adopted an analytical-descriptive methodology and a comparative analysis of the translations produced. To achieve this, a comprehensive test comprising six texts, including (18) collocations, phrasal verbs and abbreviations was administered to assess (20) Arab translators' performance and challenges encountered. The same test was inputted to (10) AI applications to compare ultimately the performance of both human translators and AI tools efficiency in translating scientific texts. The outcomes were analysed and evaluated with the assistance of three professional translators in addition to slandered translation. The research's findings aim to advance translation efficiency and productivity, especially within the scientific translation domain, which is pivotal for international knowledge and collaboration. The data analysis was carried out according to Ghazala's classification (2008) for the challenges, Newmark's taxonomy (1980) for strategies, and Prieto's criteria (2015) for the assessment of the translations of translators and AI.

**Keywords:** Challenges, strategies, Translation, scientific texts, Artificial Intelligence

## 1. Introduction

The world witnesses a great revolution in science and technology that touches almost all facets of human life. Today there are more than 7000 languages spoken across the world, implying that there is an incalculable number of translation requirements every second of every day. The translation is a link bridge for transferring knowledge, sciences, and cultures worldwide. In fact, the world without translation is blind. The indispensability of translation in today's interconnected global landscape is universally acknowledged. Consequently, it serves as the principal method for the transference of knowledge across international borders. Salama-Carr (1995) affirms that, without translation, the modern phenomenon of 'technology transfer' would not exist.

On the other hand, the development of artificial intelligence has precipitated a paradigm shift in the professional translation jobs. People, even professional translators, are relying on AI translation. However, there is no research on whether AI software is superior to professional translators in translating various documents. However, scientific translation as an area of study has a demand for translation and a field of study may arise from the complex nature of such terms especially those that include acronyms and abbreviations. For this reason, this paper attempts to investigate the challenges and strategies of translating scientific texts by either human translators or AI to come up with some possible solutions to overcome such challenges and increase translation efficiency and productivity. Furthermore, it tries to evaluate the quality of the translation produced and determine to what extent the collaboration between humans and AI exists in

translating scientific texts.

### 1.1 The Questions of the Study

This study attempts to find answers to the following questions:

1. What are the challenges that Arab translators & AI Apps. face while translating scientific texts from English into Arabic?
2. What are the translation strategies followed by Arab translators or by artificial intelligence applications while translating scientific texts?
3. What are the differences between human translation and AI based on scientific texts?
4. What are the potential solutions to challenges that can help in translating scientific texts?

### 1.2 Scope and limitation

The study was conducted during the academic year 2023-2024. The population is (20) professional Arab translators and (10) Apps of Artificial Intelligence. The sample was taken from Saudi Arabia, Jordan, Egypt, Iraq and Yemen. Translating scientific texts by humans and AI apps was discussed in the present study. Scientific texts are very wide. However, the study was limited to medical texts including (18) collocations, phrasal verbs and abbreviations.

## 2. Literature Review

This section presents the literature review related to the current study. The literature review includes almost the most important points, which are divided into two parts. In the first part, it presents many aspects related to scientific translation and Artificial intelligence as the main topic of the study. In the second part, the previous studies will be discussed briefly to get benefits from them with a comparison with the present study.

### 2.1 Theoretical background

#### 2.1.1 Scientific translation

Scientific translation refers to the process of translating scientific texts, documents, and materials from one language to another. The texts may cover various scientific disciplines, such as medicine, biology, chemistry, physics, medicine, engineering, environmental sciences, and mathematics. Modern technology has left an impact on all aspects of life and society, and all branches of science, including translation. New scientific innovations need to be spread around the world. These sciences are more likely to be conveyed through scientific translation, which has played a great role in transferring knowledge of science and technology among nations throughout history. Krien-Kuhle (2005) emphasizes this fact by saying "Scientific translation has always played a pivotal role in disseminating knowledge. Today, the domain of science is the main area of translation work" (p. 1). Montgomery (2000) also believes that scientific translation has always played an important role in transferring knowledge throughout history. Actually, new science is closely linked to the field of translation.

To be able to effectively translate scientific content, the translator is expected to have a native-level proficiency or mastery of the source and target languages. This also includes having an in-depth knowledge of the rules of grammar, composition, and syntax governing both source and target languages. In many cases, the translator through writing and conversation in a personal or professional environment acquired these skills. But more than having the required linguistic and language translation skills, the scientific translator should also be a subject matter expert in a highly specialized field, such as medicine, engineering, or any of the different scientific disciplines. As a subject matter expert, particularly in the medical field, the translator has to complete a degree or acquire certification and training to be considered qualified for the job, so a translator with a medical background could easily work on this type of document.

Translation has become imperative due to the increasing demand for the dissemination of information in the technical-scientific fields. There is a demand for translating scientific texts. Byrne (2012, p. 29) gives some "factors for the increasing demand for scientific translation represented as follows:

1. Scientific and technical translation represents the backbone of international trade and the scientific endeavour that fuels it.
2. Scientific translation forms such a crucial part of modern industry and society that it is the subject of numerous laws, regulations, and directives, and many international scholarly scientific journals, even those that publish papers in various languages, require translations of abstracts at the very least.
3. Scientific translation is expected to be more essential, especially after the internet emergence that connects the globe and provides great opportunities for individuals of various languages to share information and scientific ideas for the creation and innovation of novel technologies comprising scientific terms and expressions.

#### 2.1.2 Translation and Technology

Technology is a very good and successful element that helps to move the translation circle forward. (Gil & Pym, 2006) considered that technology helps extend human capacities. Technology is so helpful in all aspects

of life generally and in translation particularly. Using technology in translation field is not only significant but a must. Therefore, the computer, as a technological device, is a valuable aid in translation that provides translators with new job opportunities at many multilingual organizations and agencies, but translation tools and AI apps are not case-replacing translators. (Balkul, 2016) confirmed that technology is so helpful. Nowadays, physical and virtual boundaries are collapsing in today's world, due to technology that has footprints that are larger and quicker than one can imagine. Without a doubt, technology is connected to various fields for which it provides solutions for such as education, health, and translation issues. Owing to the tight deadlines of translation tasks, using translation technologies is now more of a requirement than a luxury in professional settings.

### **2.1.3 Translation Technology**

Translation is a multi-step process that requires tasks involving a range of texts and formats. With the rapid development of science and technology associated with the massive and rapid demand of the market for translation services, the twenty-first century is witnessing a major leap in translation technologies, which has greatly enhanced the speed and efficiency of translation tasks or their outcomes. In addition, it brought about significant changes in practice and the translation industry. (Alcina, 2008) confirmed that there is an urgent need to combine computer processes and methods with those used to translate, as well as their ongoing growth, which has resulted in the creation of a new science called translation technology. Wallis (2006) stated that translation technology has grown in popularity in recent years, with machine translation (MT) and computer assisted translation (CAT) tools, including translation memories (TMs), being one of the most common tools on the market today. These services are now being addressed in translation classes, seminars, technical publications, and scholarly journals. Moreover, translators have recently begun to use AI apps as very helpful tools nowadays but there has not yet been a significant amount of research about the performance of such apps as well as the differences between human translators and AI apps to enable translators and concerned people to obtain the benefits of such apps in such digital era. For this reason, the researcher intends through this paper to focus on AI as the most important tools nowadays.

### **2.1.4 Artificial Intelligence**

There is no doubt that technology has become an essential part of our daily lives. Life is predominantly governed by technology and its advanced AI systems, which have outperformed humans in administrative and practical responsibilities. Nevertheless, humans can still excel in other undertakings that necessitate intellect and contemplation.. On the other hand, the volume of scientific translation is rapidly increasing. This is due to the rapid advancements of science and technology in various fields. Consequently, there is an urgent need to use technology as an appropriate solution to increase translation productivity since translators will not be able to cope with the huge volume of materials. Yang (2022) mentioned that with the development of automated translation tools, a new translation concept known as artificial intelligence translation has appeared. For a while now, there have been more and more versions in translation apps that are equivalent to human translators, but opponents argue that there is still a performance difference between the two (Li et al., 2020; Hassan et al., 2018). The most important types of AI apps will be mentioned as follows:

#### **1. ChatGPT**

The common and useful app nowadays is called chat GPT. For more details, Diaz (2023) highlighted OpenAI's development of Chat GPT, a chat bot released in November 2022. It utilizes the GPT-3 series and underwent improvements through supervised and reinforcement learning. ChatGPT was developed seamless integrations into conversation applications and messaging platforms. Based on the GPT-3.5 series, ChatGPT was recently upgraded to GPT-4, a multimodal model capable of processing images and text. While GPT-4 does not surpass human performance in real-world scenarios, it attains human-level proficiency on academic and professional benchmarks, thereby advancing artificial program.

#### **2. Bing Chat**

Moneus, nd Sahari, (2024) defined Bing Chat as a new feature launched by Microsoft that uses AI technology to provide a "copilot for the web" experience. It allows users to get personalized recommendations, answers, and insights while they browse the web, chat with friends, or use the Edge browser, Bing, and Skype apps. Bing Chat is now available on Skype and Bing Mobile, and it seems to be gaining popularity among users interested in AI-powered tools.

#### **3. Perplexity**

Perplexity AI is a conversational search engine positioned as an "answer engine" that provides responses to inquiries using natural language predictive text. It was launched in 2022 and generates answers by leveraging web sources and including links within the text response. The free version of Perplexity utilizes its Perplexity model, which combines OpenAI's GPT-3.5 model with the company's standalone Large language model that incorporates natural language processing capabilities. Perplexity Pro offers access to GPT-4, Claude 3, Mistral Large, and an Experimental Perplexity Model.

#### 4. ChatSonic

Chaudhary, (2023) considered ChatSonic as a powerful tool for anyone looking to improve their writing skills, save time, and boost productivity. It is an AI-powered assistant created by Writesonic, which allows users to create text and images using voice commands. It has a powerful connection with Google search that helps create hyper-relevant Content and generate unique digital artwork and images using AI. Additionally, it supports voice commands, so you no longer need to spend time typing inputs manually

#### 5. Gemini

Gemini, formerly known as Bard, is a generative artificial intelligence chatbot developed by Google. Based on the large language model (LLM) of the same name and developed as a direct response to the meteoric rise of OpenAI's ChatGPT, it was launched in a limited capacity in March 2023 before expanding to other countries in May.

#### 6. Poe

According to the Web Search Results, Poe is a chatbot platform developed by Quora that allows users to interact with AI chatbots powered by large language models like ChatGPT. It was announced in December 2022 and launched to the public on February 3, 2023, with desktop browser access made available on March 4, 2023. The name "Poe" is an acronym for "Platform for Open Exploration". Poe aims to provide an easy-to-use interface for people to interact with and explore different AI language models through natural conversation and can answer any question and provide translation services.

#### 7. Sider AI

Sider AI is an advanced AI assistant platform that offers a wide range of tools and functionalities, including chat, writing, reading, translation, and image testing with AI models like ChatGPT 3.5/4, Gemini, Claude, and more. It serves as an all-in-one AI assistant, providing features like group AI chat, AI reader, AI writer, ChatPDF, integrated image tools, and support for various AI models like GPT-3.5, GPT-4, Claude, and Gemini, allowing users to ask questions and receive immediate solutions from multiple AI bot.

### 2.2 Previous studies

#### 2.2.1 Studies Related to Scientific Translation

Al-Smadi,(2022) conducted a study investigating the main problems encountered by translators in translating scientific texts from English into Arabic and revealed the main reasons behind these problems. A qualitative research design was applied, and the sample consists of one scientific text translated by twenty BA students. The study revealed that translators faced problems such as word diction, preciseness, terminological consistency, word order agreement, tense and aspect, and passive structure. Moreover, the study showed that a lack of translators' experience in this domain, and the lack of awareness of the sensitivity of scientific texts are some of the most important reasons for these problems. In the same line. Nouri (2011) investigated errors made by Iraqi students at the university level in translating a scientific text from English into Arabic. The study was conducted on 66 students of Level 4, Al-Mustansiriyah University. The students were given a scientific text to translate and then the text was analyzed according to a special scoring scheme to show the problems in translating the items. The result showed that students made errors and faced difficulties in translating the text because many of them depended in their translation on general dictionaries instead of using specialized scientific dictionaries. Additionally, Awawdeh (1990) conducted a study addressing the challenges faced by translators when translating scientific and technical texts from English to Arabic. The research analysed translated texts across different disciplines, compared Arabic, and European technical writing. The study identified various categories of problems, including lexical, syntactic, cultural, and cohesion issues.

#### 2.2.2 Studies related to Artificial Intelligence and translation

In a study titled "Impacts and Challenges of Artificial Intelligence Translation Tool on Translation Professionals," Wang (2023) explored the effects of AI translation tools on the translation industry. The research examined the benefits and drawbacks of AI translations compared to human translations, shedding light on the impact of AI advancements. The findings suggested that fostering collaborations between humans and AI can enhance translation outcomes and facilitate the delivery of high-quality translations in the rapidly evolving AI era. On the other hand, Moneus, and Sahari, (2024) identified the contrasts between human and artificial intelligence translation in the legal field. The study hypothesized no difference between human and artificial intelligence translation. However, their paper raises concerns about whether the need for human translators will decline in the face of artificial intelligence and if it will ever be possible to depend only on machine translation. Consequently, a collection of legal texts from various contracts was chosen, allocated to legal translators, and subjected to artificial intelligence translation systems. In this contrastive study, the differences between AI and human translation were investigated, examining their strengths and weaknesses and discussing the situations in which each approach may be most effective. **Reviewing the previous studies** was very significant. It provided theoretical background, practical guidelines to conduct



the study, and developing the current study tools. It also assisted in utilizing statistical methods to analyse the data and discuss the study results.

### 3. Methodology

The author followed an analytical-descriptive methodology and a comparative analysis in conducting the current study. A sample comprising twenty a proficient human Arabic translator participated in the translation of six texts including 18 statements extracted from diverse scientific texts from English into Arabic and vice versa. Simultaneously, ten distinct artificial intelligence programs were employed to translate the aforementioned scientific texts and terminologies.

#### Procedures for conducting the study

Two data collection instruments were developed to achieve the objectives of the study. In respect to the test, a set of six texts, including 18 (collocations, phrasal verbs and abbreviations) encompassing various scientific resources was prepared for translation purposes. These selected texts underwent validation by a panel of five translation professors. Furthermore, a group of 20 Arab professional translators was chosen to partake in the translation process. Simultaneously, and for comparison of human to AI performance the same test that was administered to the human translators was inputted into ten of the most renowned artificial intelligence systems as well. Subsequently, three respected assessors subjected the final translation outputs from both the artificial intelligence programs and the human translators, along with the approved translations, to evaluation. These evaluators reviewed and assessed the quality of the translations, providing corrections and assigning scores, which were then returned to the researcher. Finally, the obtained scores were encoded and input into SPSS program and other statistical analysis software, enabling a quantitative comparison between the findings from the human translator group and those generated by artificial intelligence. On the other hand, the second instrument is an interview. It aimed to collect data about the challenges that Arab translators face while translating scientific texts tools from (10) translators' perspectives. It also the interviewees suggested some solutions to overcome the challenges.

### 4. Results And Discussion

This section presents the findings and the answers to the questions of this study. The researcher used a test to investigate the differences between translation of human and AI highlighting the strategies they follow in translating scientific texts. It included 6 texts selected from various scientific resource including 18 of collocations, phrasal verbs and abbreviations. On the other hand, an interview is also used to identify the challenges that translators and AI Apps face with suggesting solutions to overcome the challenges of translating scientific texts. Percentage values and frequencies were used to highlight the challenges that face human translators and AI while translating selected items. SPSS and other statistical software were used for data analysis purpose. The researcher followed Ghazala's classification (2008) for the translation assessment. The data collected through the test was coded and entered into the SPSS program for the sake of statistical analysis.

#### 4.1. Result and discussion related to first question in respect to challenges

10 translators were asked to express their opinions in relation to challenges that human translators and AI Apps face while translating scientific texts from English into Arabic and vice versa. The result confirmed that both human translators and artificial intelligence Apps face numerous challenges when translating scientific texts. These challenges achieved a high degree of agreement among the interviewees as follows:

**Table (1): Interviewees' Responses to challenges**

N	Challenges of translating scientific texts	Frequency	Percentage
1	Scientific texts include neologisms that may be created every day.	5	50%
2	The language used in scientific texts is complex	8	80%
3	Lexical challenges	9	90%
4	Cultural differences are one of the most important challenges especially for AI	6	60%
5	Literal meaning in scientific content translation.	4	40%
6	Scientific texts involve specialized terminologies.	4	40%
7	Inability to consider the context while translating scientific texts	5	50%
8	Lack of Arabic equivalence for most scientific terms.	5	50%
9	Syntactic challenges	7	70%
10	Lack of updated English –Arabic scientific dictionaries.	3	3%
11	Using inappropriate strategies such as transliteration strategy	8	80%
12	Scientific translation is not scheduled in most university syllabus	4	40%

N	Challenges of translating scientific texts	Frequency	Percentage
13	The shortage of written scientific content originally produced in Arab	5	50%

The results indicated that the most common type of difficulties is lexic. This type of challenges obtained (90%) a high degree of agreement among interviewees. In addition, "language used in scientific texts is complex" and "using inappropriate strategies" came in the second level of challenges with 80% . That means a number of participants encounter challenges in translating scientific texts from English into Arabic and vice versa. This result agrees with Al-Smadi,(2022 and Awawdeh (1990) who confirmed that translators face real difficulties in translating scientific texts like lexical and syntactic problems.

#### 4.2 Result and discussion related to second question in respect to strategies

As the result of professional translators evaluation of the test in the respect of the strategies that participants followed while translating scientific texts. The study concluded that both humans and AI use various strategies based on Newmark classification (1988) in different level of use. For more details, the following table shows the strategies used by both humans and AI with the frequency and percentage of each strategy.

**Table 2: The strategies used by human translators and Artificial intelligence Apps**

Strategies	Human Translation		Artificial Intelligence	
	Frequency	Percentage	Frequency	Percentage
Semantic	14	70%	6	60%
Literal translation	4	20%	7	70%
Descriptive	6	30%	6	60%
Naturalization	4	20%	3	30%
Equivalence	18	90%	9	90%
Transliteration	3	15%	2	20%
Through translation	4	20%	3	30%
Couplet	6	30%	4	40%

Table 2: shows that equivalence has been the most common strategy in translation scientific texts, since it achieved 90% from validators' perspective. After equivalence, semantic received 70% which came in the second level in respect to human translators whereas literal translation obtained 70% which came in the second stage in respect to AI. However, transliteration strategy obtained only 15% and 20% as the last strategy used by both humans and translators while translating scientific texts. Therefore, as an answer to the second question of the research, it can be stated that equivalence is the most successful strategy for translating scientific text from English into Arabic and vice versa. However, Al-Smadi,(2022) confirmed that using unsuitable strategies in translating scientific texts like literal translation strategy is considered one of the common reasons behind the translation difficulties.

#### 4.3 Result and discussion related to the third question

To answer the third and crucial question, we have to refer to the selected criteria during the assessment of the test. First, the participants' responses were collected, and then given to three professional and certified translators who have more than ten-year experience in translation field. The translators were asked to rate the participants' translation of scientific terms as: *wrong*, *acceptable* or *accurate*. However, the main role of the professional translators was limited, to identify the accurate, acceptable and wrong translation. Moreover, slandered translation was available based on scientific resources and such translation is considered the guide for assessment. For statistical purposes, the scoring system was based on approval criterion, as follows: zero-point score was given to any untranslated or unacceptable translation; one-point score was given to each acceptable translation and two-point score was given to each accurate and comprehensible translation.

The answer was considered accurate if the scientific expression was rendered correctly without any mistake in respect to accuracy, competency, language, style, and equivalence based on Prieto's criteria (2015), Awadh (2018), and Monues (2023) for the assessment of translators and AI translations. Whereas the answer was considered acceptable if the translators conveyed the meaning correctly in language but sometimes with some linguistic errors regarding to style or equivalence but that did not change the meaning. Finally, the answer was considered wrong and unacceptable if the answer failed to render the meaning or committed some fatal linguistic errors that changed the meaning. Finally, SPSS program was used to do the calculations. Percentage values and frequencies were used to identify the difference between translation human translators and AI. For more details, the table in below give us the performance of human translation and AI translation in respect to translation scientific texts from English into Arabic and vice versa according to the above criteria.

**Table (3): Participants' Performance on the Translation Test**

Item	Criteria	Human Translation		Artificial Intelligence	
		Frequency	Percentage	Frequency	Percentage
Translating from English into Arabic	Wrong	6	3.4%	7	7.8%
	Acceptable	33	18.3%	26	28.9%
	Accurate	141	78.3%	57	63.3%
	Total	180	100.0%	90	100.0%
Translating from Arabic Into English	Wrong	2	1.2%	1	1.2%
	Acceptable	43	23.8%	19	21.1%
	Accurate	135	75.0%	70	77.7%
	Total	180	100.0%	90	100.0%
The overall performance for both humans translation and AI from English into Arabic and vice versa	Wrong	8	2.2%	8	4.4%
	Acceptable	76	21.1%	45	25.0%
	Accurate	276	76.7%	127	70.6%
	Total	360	100.0%	180	100.0%

Table (3) shows the frequencies and percentages of the human translators' performance on the translation test. It indicates that (96.8%) of the participants' translation was either accurate (76.7%) or acceptable (20.1%). However, (2.2%) of their translation was unacceptable. On the other hand, the table also reflects the outcomes of AI Apps on translation test. It indicates that (95.6%) of the AI' translation was either accurate translation (70.6%) or acceptable (25.00%). However, (4.4%) of AI translation was wrong. The mentioned data reflect the level of performance that participants achieved in translating scientific texts. This means that some of the participants were unable to translate the test accurately but semantically. In addition, the result above indicates that the participants' performance in translating the test from English into Arabic is less than the performance from Arabic into English especially AI apps translation. The following table will show the comparison of translation by human and AI from English into Arabic direction according to the mean with a focus on identifying the significance differences.

**Table 4: Comparison of Translation from English into Arabic: Human vs. Artificial Intelligence Translations**

Translating Scientific Texts include:	Human Translation			Artificial Intelligence			P value
	Mean	SD	Percentage	Mean	SD	Percentage	
Text 1	1.68	.350	84.0%	1.43	.353	71.5%	0.077
Text 2	1.77	.360	88.5%	1.80	.233	90.0%	0.793
Text 3	1.80	.313	90.0%	1.43	.417	71.5%	0.012*
<b>Total</b>	1.75	.207	87.5%	1.56	.216	78.0%	0.024*

\*Statistically significant p value  $\leq 0.05$

The table shows the mean and standard deviation for both human translators and artificial intelligence according to the translation test from English into Arabic. As shown in the above table, there are no differences in participants' performance on translation test from English into Arabic between human translation and artificial intelligence in respect of text 1 and 2, where the p values were higher than the significance level of 0.05. However there is a difference in translation between human translation and artificial intelligence in respect of text 3 which includes abbreviations where the p value was 0.012, which is less than the significance level of 0.05. This indicates that there are statistically significant differences between human translation and artificial intelligence, and these differences are in favor of human translation. Additionally, there is a significance difference of translation from English into Arabic between human translation and AI in general, where the p value was 0.024, which is greater than the significance level of 0.05. The following table will reflect the comparison of translating by human and AI from the Arabic into English direction.

**Table 5: Comparison between human and AI translation from Arabic into English**

Translating Scientific Texts include:	Human Translation			Artificial Intelligence			P value
	Mean	SD	Percentage	Mean	SD	Percentage	
Text 1	1.70	.239	85.0%	1.83	.176	91.5%	0.130
Text 2	1.67	.306	83.5%	1.67	.272	83.5%	1.000
Text 3	1.85	.253	92.5%	1.80	.233	90.0%	0.605
<b>Total</b>	1.74	.150	87.0%	1.77	.152	88.5%	0.638

As shown in the above table, there are no differences in participants' performance on translation test from Arabic into English between human translation and artificial intelligence, where the p values were higher than the significance level of 0.05. For more clarification, the following table will state the overall performance of participants in respect to translating scientific texts from English into Arabic and vice versa.

**Table 6: Comparison human and artificial intelligence translation in scientific texts**

Item	Human Translation			Artificial Intelligence			P value
	Mean	SD	Percentage	Mean	SD	Percentage	
<b>The overall performance of both human and AI on translation test from English into Arabic and vice versa</b>	<b>1.31</b>	<b>0.168</b>	<b>87.25%</b>	<b>1.66</b>	<b>0.184</b>	<b>83.25%</b>	<b>0.300</b>

Table 6 shows there are no significant differences between human translation and AI in translating scientific texts in general as the P value was higher than the significance level of 0.05. However, there is a difference in translating scientific texts from English into Arabic according to table 4. To conclude, human and AI translators achieved a close performance in translating scientific texts from Arabic into English, while human translators got better performance in translating from English to Arabic. The researcher believes that professional translators have more knowledge of Arabic as their native language not only that, but understanding cultural differences plays a big role in achieving accurate performance. After identifying the difference in the performance of both humans and AI and for more details with reference to table (3), the researcher will discuss briefly the performance of translating scientific texts highlighting scientific collocations, phrasal verbs and abbreviations as taken examples in scientific texts:

**1. Texts (1 & 2) include (6) scientific collocations, from English into Arabic and vice versa.**

Oxford Collocations Dictionary gives the definition of collocations as: "Collocation is the way words combine in a language to produce natural-sounding speech and writing." (2002-7). Table (7) below shows the participants and AI Apps' performance in translating such expressions in scientific texts.

**Table (7): The Participants' Performance on translating scientific texts including collocations**

Direction	Texts	Criteria	Human Translation		Artificial Intelligence	
			Frequency	Percentage	Frequency	Percentage
English into Arabic	<b>Text 1</b>	Wrong	3	5.0%	3	10.0%
		Acceptable	13	21.7%	11	36.7%
		Accurate	44	73.3%	16	53.3%
		<b>Total</b>	<b>60</b>	<b>100.0%</b>	<b>30</b>	<b>100.0%</b>
Arabic into English	<b>Text 2</b>	Wrong	0	0.0%	0	0.0%
		Acceptable	18	30.0%	5	16.7%
		Accurate	42	70.0%	25	83.3%
		<b>Total</b>	<b>60</b>	<b>100.0%</b>	<b>30</b>	<b>100.0%</b>

As shown in Table (7), 73.3% of translators achieved accurate translation while 21.7 % acceptable in respect to translation collocations in scientific texts from English into Arabic whereas AI Apps obtained 53, 3 % of accurate translation and 36.7 % acceptable. Yet, (5.0%) of translators and (10.0%) of AI Apps translated such collocations wrongly. That means translating collocation is difficult but human translators achieved better results than AI apps especially from English into Arabic. **For instance**, the collocation "develop symptoms" is a clear example of this type as shown:

*If you do not consume enough of one or more vitamins, then you might **develop symptoms** of vitamin deficiency.*

[

It was translated in various ways. 83.7% of the participants achieved an accurate translation, i.e. ((تظهر الأعراض), and 10 % produced acceptable such as (تتضح) while 6.7% wrong translations, such as (تتطور الأعراض). On the other hand, 70 % of translators achieved accurate translation and 30.0% acceptable translation in respect to translation scientific collocations from Arabic into English whereas AI apps achieved 83% accurate while 16% acceptable especially AI translation. That means translating collocation from Arabic into English is much better than translating from English into Arabic. For example,



يجب عليه تثقيف المرضى وتشجيعهم على تحمّل مسؤولية الحفاظ على صحتهم

It was translated in various ways. 90 % of the participants (both humans and AI) achieved an accurate translation, i.e. (educate) and 10 % of participants produced acceptable translation, such as (raise their awareness).

The result indicates that the participants face a few difficulty especially while translating from English into Arabic in scientific texts including collocations, which could be due to the following reasons. First, the participants may be unable to find Arabic equivalents. Second, it was noticed that some of the participants used unsuitable strategies, such as literal or transcription in translating this kind of expressions. The third reason is related to the difficulty of scientific texts themselves, which could be a reason behind the participants' inability to find the proper meaning. This result is in accordance with Ghazala's (2008) conclusion which indicates that translating collocations is problematic since it is strongly connected to scientific developments and since the dictionaries do not often help translators find the intended meaning, especially when these collocations come as neologisms. Therefore, most participants used literal translation and consequently few of translations were not accurate. McKeown, Smadja, and Hatzivassiloglou, (1996) confirmed that collocations are notoriously difficult for non-native speakers or Machine translation to translate, primarily because they are opaque and cannot be translated on a word-by-word basis.

## 2. Texts (3 & 4) include (6) Phrasal verbs

According to Oxford Advanced Learner's Dictionary International Student Edition, (2002) "Phrasal verb is a verb combined with an adverb or preposition or sometimes both to give a new meaning. The participants' performance in translating scientific texts including phrasal verbs is shown in the following table:

**Table (8): The Participants' Performance on Translating Scientific Texts Including Phrasal Verbs**

Direction	Text / criteria		Human Translation		Artificial Intelligence	
			Frequency	Percentage	Frequency	Percentage
English into Arabic	Text 3	Wrong	2	3.3%	1	3.3%
		Acceptable	10	16.7%	4	13.3%
		Accurate	48	80.0%	25	83.3%
		<b>Total</b>	<b>60</b>	<b>100.0%</b>	<b>30</b>	<b>100.0%</b>
Arabic into English	Text 4	Wrong	1	1.7%	0	0.0%
		Acceptable	18	30.0%	10	33.3%
		Accurate	41	68.3%	20	66.7%
		<b>Total</b>	<b>60</b>	<b>100.0%</b>	<b>30</b>	<b>100.0%</b>

Table (8) shows that human translators obtained 80% of accurate translations for scientific phrasal verbs from English into Arabic while (16.7%) as acceptable. Yet, 3.3 % of the translations was wrong. However, 83.3% of the translations of scientific phrasal verbs, by AI Apps from English into Arabic, was accurate while (13.3%) acceptable. Yet, only 3.3 % of the translations were unacceptable as AI. Generally speaking and as the above result translating phrasal verbs is difficult but AI achieved better translation than human as shown in the above table especially from English into Arabic. The data reveals that a small number of the participants did not translate phrasal verbs well. *Ex. Over the next hour, the pain eventually **wore off**.*

The phrasal verb, **wore off**, is an example of such a scientific expression, 76.7% of the participants produced accurate translation as (يختفي) while 20% obtained acceptable translations, such as (تلاشى) and only 3.3% gave a wrong translation such as (تفاقم) whereas 10.9% of the participants did not translate this phrasal verb at all. On the other hand, 68.3 % of translators achieved accurate translations and (30%) acceptable in respect to translation scientific phrasal verbs from Arabic into English whereas AI translations produced 66.7 % accurate translations and (33.3%) acceptable. Yet 1.7 of the human translations were wrong while there is no wrong translation by AI Apps. The following example is for translating from Arabic into English as follows:

يجب تناول الدواء لتستقر حالة المريض

The phrasal verb لتستقر is an example of this type, only 63.3 % of the participants produced accurate translation such as (settle down) while 36.7% achieved acceptable translations, such as (to stabilize the case).

The result indicates that some participants encounter difficulty in translating phrasal verbs. Ghazala (2008) describes translating phrasal verbs into Arabic is a big problem for many translators as well as Machine. That is because phrasal verbs have special semantic and structural features, which make their translation into other languages a difficult task. Therefore, finding and understanding Arabic equivalents of phrasal words can be done through using the context that plays a major role in translating such expressions.

## 3. Texts (5 & 6) include (6) Abbreviations

Abbreviation is the shorted form of a word or phrase. It consists of a group of letters taken from word or phrase Al-Asal and Smadi (2012) define abbreviations as "A shorted form of a term used to represent the complete form". The participants' performance in translating technical texts including abbreviations is shown in the following

table:

**Table (9): The Participants' Performance on Translating Scientific Texts Including Abbreviations**

Direction	Text / criteria		Human Translation		Artificial Intelligence	
			Frequency	Percentage	Frequency	Percentage
English into Arabic	Text 5	Wrong	1	1.7%	3	10.0%
		Acceptable	10	16.7%	11	36.7%
		Accurate	49	81.7%	16	53.3%
		<b>Total</b>	<b>60</b>	<b>100.0%</b>	<b>30</b>	<b>100.0%</b>
Arabic into English	Text 6	Wrong	1	1.7%	1	3.3%
		Acceptable	7	11.7%	4	13.3%
		Accurate	52	86.7%	25	83.3%
		<b>Total</b>	<b>60</b>	<b>100.0%</b>	<b>30</b>	<b>100.0%</b>

Table (9) indicates that human translators obtained 81.7% of accurate translations for scientific abbreviations from English into Arabic in scientific texts while (16.7%) as acceptable. Yet, 1.7 % of the translations was wrong. However, 53.3% of the translations of abbreviations, by AI from English into Arabic, were accurate while (36.7%) acceptable. Yet only 1.7 of human translation was wrong whereas 10% of AI translations were unacceptable.

Ex. The **CT** scan revealed a tumor in the patient's abdomen.

The participants (human and AI) translated this abbreviation **CT** in various ways. 66.7% of the participants gave accurate translations, such as (أشعة مقطعية) or 23.3% acceptable such as (أشعة سيني إسكان) whereas 10 % gave wrong translations such as (أشعة حاسوبية). This shows that some of the participants still face difficulty in translating scientific abbreviations because they may not benefit from dictionaries and other translation sources. However, the researcher thinks that some of the participants may resort to translate such abbreviations by using literal strategy or guessing the meaning wrongly in respect to human while some inputs of AI are not updated. On the other hand, 86.7 % of translators achieved accurate translations and (11.7%) acceptable in respect to translation abbreviations from Arabic into English. Yet only 1.7 was wrong of translating such abbreviations. However, AI translations produced (83.3 %) as accurate translations while (13.3) acceptable. Yet, 3.3 of AI Apps committed wrong translation. The following is a clear example of translating scientific abbreviations from Arabic into English as follows:

أمر الطبيب بإجراء أشعة بالرنين المغناطيسي للحصول على صور مفصلة لدماغ المريض

The abbreviation "أشعة بالرنين المغناطيسي" is an example of scientific abbreviation. The participants (human and AI) translated this abbreviation in various ways. 90.00% of the participants gave accurate translations, such as (MRI) and 10% acceptable such as (magnetic resonance ray).

The result indicates that participants (human and AI Apps) did well in translating of scientific abbreviations generally. It is considered one of the easiest type of scientific terms. Most of the participants (human and AI) seem to do better with translating abbreviations especially from Arabic into English. However, the performance of humans is better than AI performance. Generally speaking, translating this type constitutes a difficulty for only a few participants, especially in translating uncommon abbreviations in the scientific field. Some of the participants (human or AI) used an inappropriate strategy which may not be helpful in translating scientific abbreviations. In the same regard, Najeeb (2005) describes translating abbreviations as a difficult task, so specialized dictionaries and references should be used to avoid falling into bad consequences in the case of guessing the meaning. Moreover, the common use of abbreviations should be known to be translated properly.

#### 4.4. Result and discussion related to the fourth question related to Solutions

Based on the results obtained by the interview with 10 professional translators, there are many possible **solutions** to overcome the challenges of translating scientific texts from the interviewees' viewpoints. These solutions, which achieved a high degree of agreement among the interviewees, are related to,

- Training translators to use translation resources effectively.
- Translators should rely on technology as a help in their job, since it allows them to be faster and, thus, more productive.
- Technology should not be feared, but rather considered as a benefit and a support to humankind. After all, humanity has been facing technological changes since the dawn of time, and it has evolved thanks to technology.
- Continuously updating artificial intelligence applications databases to contain all scientific terminology.
- Training translators to apply suitable strategies in translating scientific texts
- Updating curricula regularly to match the revolution in science and technology

- Providing translators with updated and specialized scientific dictionaries.
- Effective translation demands expertise in navigating scientific terms, grasping context, acknowledging language nuances,
- considering cultural differences,
- Staying updated on evolving terminology.
- Ultimately, precision, accuracy, and simplicity are crucial in faithfully conveying equivalent messages while ensuring precise terminology.
- Finally, to achieve better translation results and output high-quality translations in the era of rapid development of AI, we have to enhance human-AI partnerships.

## 5. Conclusion

The study focused on distinguishing the performance disparities, between translators and AI applications. It highlighted the challenges that translators and AI Apps encounter and the strategies they adapt while translating scientific texts from English into Arabic and vice versa. The findings showed that translating scientific texts accurately is somehow hard for few of the participants. It is noticed that only about 76% of the human translators were able to achieve accurate translation and 70% by AI. The results indicated that the performance of human translators and AI is comparable, particularly when translating from Arabic into English. However, human translators exhibited better performance when translating from English into Arabic. It seems to be difficult for both human translators and AI apps to find the equivalents especially for some English scientific terms. The study uncovered many challenges that both humans and AI encounter while transiting scientific text. Most of the challenges are related to lexical, culture differences and strategies. Additionally, the study revealed that equivalence strategy is the most common and successful strategy in translating scientific texts, as it achieves the highest percentage success among various translating strategies. After equivalence, semantic strategy in respect to human translators whereas literal translation strategy in respect to AI came as the second used strategies. The findings also showed the most possible solutions to overcome the difficulties are; training to use translation resources, using suitable strategies in translating various types of scientific texts and updating AI databases and dictionaries to match the revolution of technology. Moreover, to achieve better translation results and high-quality translations in the era of rapid development of AI, we have to enhance human-AI partnerships based on Shao's study (2022). Finally, conducting further research on this area will undoubtedly help reduce problems of this kind.

## Acknowledgements

This research received grant no. (127/2024) from the Arab Observatory of Translation (an affiliate of ALECSO, which is supported by the Literature, Publishing, & Translation Commission in Saudi Arabia).

## References

1. Al-Asal, M. S., & Smadi, O. M. (2012). Arabicization and Arabic expanding techniques used in science lectures in two Arab universities. *Perspectives in the Arts and Humanities Asia*, 2(1), 15-38
2. Alcina, A. (2008). Translation technologies: Scope, tools and resources. *Target. International Journal of Translation Studies Target / International Journal of Translation Studies Target*, 20(1), 79-102. <https://doi.org/10.1075/target.20.1.05alc>
3. Alomari, R. S., & Alharthi, A. A. (2023). The Use of Category Shifts in the Translation of Scientific Texts. *Journal of Translation and Language Studies*, 4(2), 86-109.
4. Al-Smadi, H. M. (2022). Challenges in translating scientific texts: Problems and reasons. *Journal of language teaching and research*, 13(3), 550-560. DOI: <https://doi.org/10.17507/jltr.1303.11>
5. Awawdeh, Y. (1990). *Major Problems of Scientific –Technical Translation from English into Arabic* (Unpublished Master Thesis), Yarmouk University.
6. Choudhury, R., & McConnell, B. (2013). Translation technology landscape report. De Rijp, The Netherlands: Translation Automation Users Society (TAUS).
7. Diaz, M. (2023). How to use ChatGPT: Everything you need to know. Retrieved 25 oct 2023 from <https://www.zdnet.com/article/how-to-use-chatgpt/> This preprint research paper has not been peer-reviewed. Electronic copy available at: <https://ssrn.com/abstract=4441379> Preprint not peer.
8. Ghazala, H. (2008). *Translation as Problems and Solutions: A Coursebook for University Students and Trainee Translators* (Special ed.). Beriut, Labnan: Dar El-ilm Lilmalayin
9. Hassan, H. Hassan et al. (2018). Achieving human parity on automatic Chinese to English news translation. arXiv preprint arXiv:1803.05567.
10. Krein-Kuhle, M. (2005). *Equivalence in Scientific and Technical Translation: A text incontext-based study*. Unpublished PhD thesis. Salford: Salford University.
11. McCarthy, J. 2007. WHAT IS ARTIFICIAL INTELLIGENCE? Stanford University, 15 oct. Retrieved from <http://www-formal.stanford.edu/jmc/>.

12. Li, B., et al. 2020. Does multi-encoder help? A case study on context-aware neural machine translation. arXiv preprint arXiv:2005.03393.
13. McKeown, K., Smadja, F., & Hatzivassiloglou, V. (1996). Translating collocations for bilingual lexicons: A statistical approach.
14. Moneus, A. M., & Sahari, Y. (2024). Artificial intelligence and human translation: A contrastive study based on legal texts. *Heliyon*, 10(6) <https://doi.org/10.1016/j.heliyon.2024.e28106>
15. Montgomery, S. L. (2000). Science in translation: movements of knowledge through cultures and time. Chicago: University of Chicago Press.
16. Najeeb, E. (2005). *Translation from English to Arabic and Vice Versa* (5 ed.). Cairo, Egypt: Ibn Sina Library for Publishing and Distribution.
17. Awadh A. N., & Khan A. S. (2020). Challenges of Translating Neologisms: Comparative Study, Human and Machine Translation. *Journal of Language and Linguistic Studies*, 16(4), 1987-2002.
18. Newmark, P. (1988). *A Textbook of Translation*. London: Prentice Hall
19. Nouri, A. A. (2011). Difficulties Faced by Translation Students in Translating Scientific Texts from English - into - Arabic. *Diyala Journal for Human Science*, (50), 437-554
20. Oxford Collocations dictionary for students. Of English. (2002) Oxford. Oxford University Press
21. Oxford Advanced Learner's Dictionary 6th edition, (2000). Oxford University Press
22. Salama-Carr, M.. (1995). Translators and the dissemination of knowledge. In J. Delisle & J. Woodsworth (Eds.), *Translators through history* (pp. 101-127). Amsterdam, the Netherlands: John Benyamin's Publishing Company/UNESCO.
23. Shao, Y. (2022). Human-Computer Interaction Environment Monitoring and Collaborative Translation Mode Exploration Using Artificial Intelligence Technology. *Journal of Environmental and Public Health*, 2022.
24. Prieto Ramos, F. (2015). Quality assurance in legal Translation: Evaluating process, competence and product in the pursuit of adequacy. *International Journal for the Semiotics of Law-Revue internationale de Sémiotique juridique*, 28: 11-30.
25. Wallis, J. (2006). Interactive Translation vs Pre-translation in the Context of Translation Memory Systems: Investigating the effects of translation method on productivity, quality and translator satisfaction [MA thisis . Faculty of Arts University of Ottawa]. <http://www.localisation.ie/resources/Awards/Theses/ Thesis - Julian Wallis.pdf>.
26. Yang, C. (2022). The Application of Artificial Intelligence in Translation Teaching. In *Proceedings of the 4th International Conference on Intelligent Science and Technology*, 56-60. <https://doi.org/10.1145/3568923.3568933>.
27. Wang, L. (2023). The Impacts and Challenges of Artificial Intelligence Translation Tool on Translation Professionals. In *SHS Web of Conferences* (Vol. 163). EDP Sciences. <https://doi.org/10.1051/shsconf/202316302021>