Chapter Three

Research Methodology

3.1 Introduction

This chapter is a description of the theoretical and methodological design of this research. It includes purposes, questions, framework, design, and the procedural analysis of the statistical methods of the research. It is a description of participants, materials, procedures and measurements included in this research. This chapter also includes a pilot study conducted for the purpose of putting a preliminary forecasting for any predictable extraneous variables or constraints that might bring the researcher into certain predicament while conducting his research.

As it was essential to collect and interpret the content of this research appropriately, quantitative and qualitative investigations had been adopted in order to attest different aspects of the practical use of MT as well as to investigate whether MT is able to produce more legible translation when students/translators come to post edit and correct errors of a given text. Qualitative analysis method has been followed in the research, mainly because it aims to gather an in-depth understanding of what actually happens when students come to use MT. So, it tries to answer how students deal with MT; do they get fewer errors; do they save time; and how effective are the results when using MT for translating texts. On the
other hand, the questions of the current research oblige the researcher to use qualitative research method. For instance, a question like, ‘do ready machine translated texts affect the students’ mental thinking and the way of re-phrasing a suitable lexical, pragmatic and grammatical output?’ is actually easily answered by yes or no, but a clear description for what has been reacted and responded requires certain qualitative investigations. Same thing is also required in a questions like, ‘is there any occurrence of a statistical difference in errors and time spent in translation when using MT? And what is the extent of teacher familiarity of using MT,’ etc. In short, the research methodology followed is empirical, analytical, interpretive, and evaluative by nature.

A matter of analyzing issues of performing PE opens new ways and strategies of improving PE training and developing pedagogical PE guidelines that explain its importance and get students familiar to the performance of the machine translation post editing.

Quantitative analysis method was also adopted in this research through a numerical representation of data collected, which prominently provides visible frequencies and calculations of different translation norms and uses. And this method, actually, leads us to base certain general principles concerning MT practicality. Specifically, quantitative method enables MT researchers to present the relationship summation between translation from scratch and translation with the use of MT since they can demonstrate readable figures to the exact percentage or average of different MT uses. Meanwhile, they can determine meticulous scales of the possible reduction of errors and the time needed in translating texts. In short, chapter three gives us a clearer idea about:
- The research methodology and procedures used to survey, search, collect, organize, classify, modify and figure the information and data collected such as students and teachers’ numbers, students’ translation, students’ and teachers’ answers/responses, reactions and so on.

- The research methodology used here reflects and shows the findings in an obvious numerical data.

- The research methodology used to conduct an empirical investigation and compare it with the previous elaborate literature of the same concern.

### 3.2 Research Structure

It seems to be a comparative description that entails comparing and analyzing a number of different translations of the same source text. According to C. K. Quah (2006: 38), such a research comes under the umbrella of the product-oriented research which, basically, is derived from Pure Translation Branch. Hughes & Hayhoe (2007) said, “as much as researchers try to suit the questions or goals of their researches to the research methodology as applicable and clear results they will find in their researches”. Therefore, researcher stated obvious questions and goals of the current research as he, totally, realizes the fact that research goals always direct researchers to the suitable ways of conducting their researches. In this research, both empirical and interpretive methods are closely relevant, since more and specific details would be mentioned and illustrated in the results and findings of this research. Through the empirical method, researcher secured objectivity by showing the results numerically, while interpretive method takes an open-ended approach of giving reactions, in which many suggestions and potential predictions can be pointed out.
and explained during the process of data analysis, and this is what, exactly, researcher sought in this research.

All questions of this research are empirical by nature, and by looking at the questions we realize the ideal and serialized hierarchy in their order. These questions were respectively, stated and arranged on the base of the following:

- In question one the focus is as to whether MT is actually used by Yemeni teachers and students of translation or not. Then, what type of MT is used by them.
- Question two investigates the extent of using MT by Yemeni teachers and students of translation in their classroom activities.
- Question three analyzes the given translations (both post edited and from scratch translated texts) in a comparative method to see whether MT helps students to recognize some distinctive linguistic features and improve the translation quality and quantity or not.
- Question four tries to determine whether MT reduces the amount of time needed for translating or post editing (time spent) texts or not.

Due to the opulent enquiry that appears in the questions of the research, researcher had to use many approaches, methods, instruments and procedures to implement such a research. In fact, as what has been noted previously by Hughes and Hayhoe (ibid), goals and methods of this research are strongly associated. Empirical researches are always associated with quantitative methods, while interpretive researches are associated with qualitative methods. However, having qualitative or quantitative methods only may not be
sufficient in answering the current research questions, thereby researcher chose to employ a mixed-method research design.

3.3 Pilot Study

3.3.1 The Abroad Goal of Conducting a Pilot Study

One of the main reasons behind conducting a pilot study was to put a preliminary forecasting for any predictable extraneous variables that might bring the researcher into certain predicaments while implementing his research. This pilot study was conducted as a part of the research as a preliminary survey. It aimed for obtaining an obvious pre-indication and wide awareness concerning any unexpected problem or extraneous variable that may disturb the researcher while conducting the research. It was, later, developed to be a part of this chapter since it touches significant aspects of MT utility. It, generally, gives an advanced warning and indication to the researcher to know when the main research project needs more focus, especially when research protocols are not followed, or when the proposed methods or instruments meant for conducting the research are inappropriate for investigating the issue of the research. It gives a clear pre-indication to the predictable obstacles that might occur when conducting the current research, helps identifying the possibility of any problem occurrence in advance. However, Frankland and Bloor (1999: 154) argued that piloting provides the qualitative researcher with a “clear definition of the focus of the study”, which, in turn, helps researcher to concentrate data collection on a narrow spectrum of projected analytical topics.
3.3.2 The Procedural Goal of Conducting the Pilot Study

The first phase of the conducted pilot study involved using in-depth interviews with two categories of sample, teachers and students. In the part of students, certain procedures were implemented as having interviews and filling out some questionnaires relating to their reactions and reflections towards the use of machine translation after they had already carried out an experiment of translating texts using both tasks; 1) translation from scratch and 2) translation with the use of MT. Researcher interviewed three teachers of translation about their familiarity and knowledge towards the use of machine translation and potentialities of using machine translation in their classrooms. They filled out a determined questionnaire aimed to measure the extent of familiarity and use of the machine translation by the tutors of translation.

A group of 4 students were asked to translate select text (informative) from their scratch then they were asked to translate similar text using MT in a try to rephrase and correct the errors produced by machine translation for providing an appropriate translation, this is, actually, known as post editing MT output. They were given an equal and specific time for finishing each task. The most occurred difficulty researcher faced was the problem of finding an equipped lab that includes the necessary facilities of conducting such tasks. For instance, network, well-programmed computers, electricity and so on. Such circumstances reconsidered, researcher thought to conduct his research experiment in a lab, but on a ready machine translated texts as to avoiding the problems of getting an equipped lab, which might affect procedures and findings of his research.
Regarding the teachers of translation, researcher interviewed three teachers for noting down their opinions, suggestions and everything they know about MT that can proposed by them. Various aspects of MT were reviewed and discussed during the interviews. In fact, researcher has to admit that certain improvement had been made in many aspects of questionnaires and tasks of translation that were prepared for conducting this research due to some opinions given and suggested by the interviewee teachers. Upon their suggestions, some new topics had been added and some had been omitted according to the suitability of the real field of application.

3.3.3 Findings of the Pilot Study

In this section, researcher tries to state his finding, critically and analytically, to create a wide-ranging atmosphere of awareness about any predictable existence of non-expected situation or extraneous variable, thereby it can be treated and solved earlier, before conducting the research.

Starting with the part of students, who were four, researcher found one of them unable to use machine translation due to the lack of practicing the primary skills concerning to the use of computer. That weakness led him to spend much time in typing the text, accessing to online translation, getting the output of that text, then post editing that output. The other three students were in an acceptable level of using computer. Results showed a slight statistical difference in translating texts in favor of the use of machine translation tasks. Results in table 3.1 show that the total percentage of the time spent in translating the texts.

<table>
<thead>
<tr>
<th>Time spent</th>
<th>From Scratch</th>
<th>Post editing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 3.1 shows the amount and the percentage of the time spent in translation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 3.1 shows the total amount and percentage of the time spent by students in translating texts (both translation from scratch and post editing the MT output).

<table>
<thead>
<tr>
<th></th>
<th>Translation</th>
<th>MT output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student1</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Student2</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Student3</td>
<td>28</td>
<td>15</td>
</tr>
<tr>
<td>Student4</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>Time spend (total amount)</td>
<td>92</td>
<td>84</td>
</tr>
<tr>
<td>Percentage</td>
<td>76.66%</td>
<td>70%</td>
</tr>
</tbody>
</table>

It is shown in both table and figure above that students needed what was estimated by 76.66% from the whole amount of time given to accomplish translation when they translated from scratch, whereas they needed what was estimated by 70% from the whole time given to carry out translation when they used MT and modified its output. The total percentage of spending time on translation using MT was as a reflection that time spent in translating texts has no statistical difference. From the researcher’s point of view, the slight difference occurred in favor of translating with the use of MT would have increased if the
student was not familiar with the use of computer. We can say, here, that his weak performance of the computer applications affected the results of the translation task.

Concerning the errors made by them, results demonstrate, a number of 36 errors when they translated the text from scratch and 18 errors were found when they corrected /post edited MT output. This obvious difference is a sign for MT effectiveness in reducing errors comparing to translating from scratch, albeit the researcher deliberateness towards generalizing the results of the pilot study, stated the MT effectiveness, until he presents and analyzes different type of texts in his research.\(^1\)

Table and figure 3.2 show the frequencies of grammatical, lexical and spelling errors made by students as follows:

*Table 3.2 shows the errors frequencies in each category*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Student translation From scratch</th>
<th>Machine Translation Post editing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grammatical errors</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Lexical errors</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Spelling errors</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Total number of errors</td>
<td>36</td>
<td>18</td>
</tr>
</tbody>
</table>

*Figure 3.2 shows the errors in each category*

\(^1\) Texts used for conducting the pilot study were informative, which might be easier for MT to translate them quickly and understandably.
Regarding the students’ reflection towards the use of machine translation, they, generally, reacted positively towards the possibility of using MT as a tool of translation practice indicating, from another point, to some problems they faced when they used MT.

### 3.4 Population & Sampling Method of the Research

#### 3.4.1 Sampling

This research determines 60 students and 15 professional teachers of translation as a chosen sample representing all translation students and teachers in Sana’a University, the research population. Teachers filled out a questionnaire. Students were divided into two groups of 30 students each. Group 1 translated the chosen texts from scratch and the other group post edited the raw MT output of the same chosen texts.

Researcher tries to investigate the effectiveness and positive contribution of post editing tasks in various aspects of translation such as: 1) Producing an accurate and adequate translation in a measurable time. 2) Drafting preliminary texts of the target language as a first step for adapting and re-constructing final draft in an eligible translated form. It also investigates the error types detected in both human and MT outputs from two points of view:

- Determining whether machine translation reduces the amount of errors compared to human errors or not.
- Determining the extent of saving time when using machine translation.

### 3.5 Participants

Two kinds of participants are involved in this study, students and teachers of translation.
3.5.1 Students

The first phase of the research participants is a random choice of 60 third-year undergraduate students from the translation department, faculty of languages, Sana’a University, Yemen. Time limitation of implementing the experiments and data collection was the second semester of the academic year 2012/13 held between April and August 2013. The exact time of conducting the experiment and distributing questionnaires was implemented in June 2013. Student sample was divided into two groups, both are homogeneous by nature in terms of year of enrollment, level and average of age and so on. Both groups, here, received no specific training on MT, only a single set of instructions delivered by the researcher to them before starting to do the tasks of the experiment (See Appendix 3, page 214).

The first group No Ready Machine Translated Text (NRMTT) translated texts from scratch, the other group With Ready Machine Translated Text (WRMTT) re-translated or post edited the given ready machine translated texts. Texts distributed to both groups were the same. NRMTT group considered as the control group, its results were compared to what has been done by the WRMTT group. Certain comparative analysis was obtained touching various aspects such as time consuming for translation, types of errors, output of the translation; sentences, vocabularies, grammar, etc.

Actually, they (students) all speak Arabic as a mother tongue (first language). They almost started learning English as a foreign language (second language) from the seventh grade in their primary school study. To some extent, they already have studied classes in translation. Logically, as they are level three, they should have learnt different subjects
relating to the translation theories and practice, including MT uses, but unfortunately subjects related to MT were virtually absent from their literature background. Appendix 5 page 223 shows the department syllabus, which has been taught to the students in all levels. This syllabus is annual plan which involves a specific classification and description for the courses taught in the department of Arabic and Translation during the whole course duration, which is of minimum four years duration. Its description determines course titles, course numbers, levels and semesters durations. It gives brief classification for the course objectives and content, intended learning outcome, prescribed reading, required reading, suggested reading and references for each course.

Participants involved both male and female; all of them took part in this research on a voluntary basis, with their permission and help. Finally, participants were administered a questionnaire to test how post MT editing tasks affected their opinions or feelings towards MT, Thereby researcher was able to collect identifiable information for the purpose of providing certain feedback during analyzing their translations and post editing.

3.5.2 Teachers

To measure the attitude and reaction of teachers towards the use of MT in translation classes, a survey was addressed to 15 teachers of translation and languages. They were given a questionnaire about MT and asked to fill it out with their opinions based on their experience. The questionnaire (See appendix 2 page 210) involved a number of 18 questions touching many aspects of employing MT in the process of translation. The aim of questionnaire was to evaluating their overall attitudes and general responses towards translation with and without pest MT editing. It was substantial in this research to have a
space for demonstrating the extent in which MT is used by the Yemeni teachers of translation based on their responses and reflections toward post MT editing assistance. This sample included teachers of translation of other languages who teach in other departments as French, Italian, German, and Turkish at the same faculty.

3.6 Tools and Materials of Collecting Data

3.6.1 Tool of Translation

As it is mandatory to have ready machine translated texts in the current research, researcher chose Google Translate System to translate all texts used in this research from English into Arabic and vice versa in order for getting the output that should be post edited by the select group of students (WRMTT group).

3.6.1.1 Google Translate

Google translate is a free multilingual statistical machine-translation service provided by Google Inc. (Google is an American Multinational Corporation) to translate written text from one language into another. Before October 2007, for languages other than Arabic, Chinese and Russian, Google used a Systran based translator which is used by other translation services such as Yahoo! Babel Fish AOL (America Online) and Yahoo.³

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On May 26th 2011, Google announced that the Google Translate API (Application Programs Interface) had been deprecated and that it would cease functioning on December 1st 2011, which was "due to the substantial economic burden caused by extensive abuse."\(^4\) The shutting down of the API, used by a number of websites, led to criticism of Google and to developers questioning the viability of using Google APIs in their products.\(^5\)

On June 3rd 2011, Google announced that they were cancelling the plan to terminate the Translate API due to public pressure. In the same announcement, Google said that it would release a paid version of the Translate API.

### 3.6.1.3 Features and Limitations of Google

Google Translate, like other automatic translation tools, has its limitations. While it can help the reader to understand the general content of a foreign language text, it does not always deliver accurate translations. Some languages produce better results than others. Google Translate performs well especially when English is the target language and the source language is one of the languages of the European Union. Results of analyses were reported in 2010, showing that French to English translation is relatively accurate and 2011 and 2012 showing that Italian to English translation is relatively accurate as well. However,

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rule-based machine translations perform better if the text to be translated is shorter; this effect is particularly evident in Chinese to English translations.\(^6\)

The service limits the number of paragraphs, or range of technical terms, that will be translated. It is possible to enter searches in a source language that are first translated to a destination language allowing you to browse and interpret results from the selected destination language in the source language. For some languages, users are asked for alternate translations such as for technical terms, to be included for future updates to the translation process. Text in a foreign language can be typed, and if "Detect language" is selected, it will not only detect the language but will translate it into English by default\(^7\).

### 3.6.1.3 Reason for Choosing Google Translate System

Google Translate is the most popular MT used for translating any document into 90 languages\(^8\), which is available for free on the Internet; it is powered by its own statistical translation system. Google Translate is an automatic translator, which works without the intervention of human translators using state of the art technology. Google Translate feeds the computer billions of words, both monolingual text in the target language, and aligned text consisting of examples of human translations between the languages. Statistical learning techniques are then applied to build a translation model. Google Translate currently supports translation between 90 languages.

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\(^8\) Retrieved from: http://translate.google.co.in/about/intl/en_ALL/languages.html  
Last Access on 7 August 2015.
Figure 3.3 below is a captured screen that demonstrates Google Translate interface, in which options of choosing SL and TL are clearly displayed. Users may input source language into the SL box and translation is processed by clicking on the “translate” button. The pull-down menu, in both SL and TL, includes a list of the whole languages, so translators can also select their desired language pairs through.

*Figure 3.3, shows a Screenshot that demonstrates Google Translate interface*

Google is easily accessible electronic device for translation on line, it is 24/7 free of charge and enables the translation of sections of text or Webpages, as shown in figure 3.3 where users may input source language into the box and get its translation with an effortless click on the “translate” button. There are two on-screen buttons that users may contribute and offer their rendition of the source text for improving the translation quality or to be used for future updates to the translation process: 1) “provide better translation” and 2) send
feedback about Google in general, which enables you to send any suggestion about the outcome of Google. Text in foreign language can be typed, such as Chinese or Arabic, and if “detect language” is selected, it will not only detect the language, but it will translate and transliterate into English by defaults.

Few years ago, Google Translate single-handedly improved the reputation and usability of automated online translations. Until it was released, online machine translation solutions were marginally useful at best.

Google Translate has largely changed from the point of using a statistical approach to machine translation and by allowing users to help the system learn adaptively. And with a service that allows millions of amateur translators to pour their translations into an open translation memory. Online machine translation has the power to revolutionize communication by eliminating language barriers, bridging the gap between cultures, providing services and information to speakers of minority languages, and transforming global e-commerce by allowing even the smallest online vendor to serve the international market.9

Franz Josef Och10, the head of Google’s machine translation department, said in his keynote speech at the Machine Translation Summit 2005 that a solid foundation for building a usable statistical machine translation system for new language pair from scratch would require a bilingual text corpus of each more than a billion words. Statistical models from

9Quoted from Foreign Exchange Translations (last access on 20th May 2015) http://blog.fxtrans.com/2009/11/is-google-translate-accurate-enough-for.html
10Franz Josef Och, born in (1971) is a German computer scientist. He is working as Distinguished Research Scientist and head of machine translation at Google. He is based at Google's Mountain View, California, headquarters south of San Francisco.
these data are then used to translate between the languages. To obtain this enormous amount of linguistics data, Google uses United Nations and European Union documents (Tanner, 2007).11

The same document is normally available in all official UN or EU languages (e.g. Arabic, Chinese, English, French, Russian, Spanish), Google now has a large corpus of billions words’ worth of human translation.

Google translation, like any other machine translation systems, has its limitations. It can help readers understand the gist of a foreign language text, but it doesn’t always produce accurate translations. This is part of the reason why post-editing is needed to alter and refine the MT-translated text if it is to be published. Nonetheless, Google Translate is improving over time.

Figure 3.4 shows the process of automatic translation in Google System Translate

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3.6.2 Questionnaires and Reflections

General Aim of using questionnaire and Reflections

Researcher used questionnaires to collect responses and reflections as an evaluative process for what has been known and practiced, concerning MT, by the students and teachers of translation. It is a measurement of the overall impression of the students toward the use of automatic translation. Questionnaire’s responses gave more opportunities for the respondents to support researcher with valuable remarks that help to understanding many aspects of translation and post MT editing analysis. It also contributes pulling together a large amount of information collected from the concerned group in a short period of time and a relatively cost effective way.

In a similar applied research as the current, results of the questionnaires can usually be quickly and easily quantified by either a researcher or through the use of a statistical package that could be analyzed more qualitatively, scientifically and objectively than other forms of research, particularly when data has been quantified and used to compare and contrast other research and measure changes. This is, specifically, what was aimed by the researcher in this research.

3.6.2.1 Teachers’ Questionnaire

3.6.2.1.1 Goals of questionnaire

Teachers’ questionnaire is one of the data collection used in the current research, which actually aims at providing a clear perspective about teachers’ familiarity of using
automatic translation in general and investigating the use of post MT editing in particular. Researcher tries to know whether post MT editing is being, pedagogically, used in the translation classes, so through this questionnaire he collected the teachers’ opinions towards using MT as a helpful instrument in processes like, translating, correcting or analyzing texts as well as showing the advantages and disadvantages of MT from the prospective view of the teachers.

3.6.2.1.2 Structure of the Teachers’ Questionnaire

Teachers’ questionnaire involved 18 enquiry items. From item 1 to item 8 the concern was about the familiarity of using Machine Translation by teachers of translation. Items from 9 to 16 focus on the purposes of using Machine Translation and discuss the aspects of its difficulty and simplicity. 17 and 18 focus on the teachers’ opinions, reflections, and potential suggestions towards using Machine Translation as to whether it is worthy to be used. They also attest the advantages of Machine Translation and question how post MT editing could be developed. (See appendix 3 page 214)

3.6.2.2 Students’ Questionnaire and Reflections

3.6.2.2.1 Goals of Questionnaire and Reflections

Students’ reflections is one of the tools used in this research for collecting data trying to provide a clear perspective about the students’ reflections towards using Machine Translation and investigates the level of difficulty of the text and the translation speed, accuracy of the translation. It provides the researcher with the students’ opinions in respect of the usefulness of Machine Translation since it investigates the following aspects:
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- Whether MT text is helpful during the translation process or not.
- Whether MT text is helpful in improving your translation speed or not.
- Whether MT text is helpful in improving the accuracy of the student translation or not.

Questionnaires or reflections collected relate to the many aspects that must be investigated such as, vocabulary, terminology, comprehension and saving time on thinking of words to be used in translation.

Generally, the purpose of using questionnaire in the current research is obtaining a clear understanding about how post MT editor deals with the process of re-editing or correcting raw MT output and obtains opinions about MT and post MT editing. It, also, helps in investigating the differences of MT output correction that might affect the process of post editing and suggesting remedial solutions.

3.6.2.2.2 Structure of the students’ questionnaire

The students’ questionnaire involves 13 different enquiry items that collect quantitative and qualitative data in an integrated form of closed and open-questionnaire. Some items were designed to obtain quantitative information, e.g. ‘how many are using MT?’, ‘what kind of MT?’ others investigate both aspects, quantitative and qualitative data, for example, ‘was it bad or good, how useful is it, do you think..., could you explain, how difficult, how appropriate were the text’ and so on. (See appendix 2 page 209). Items from 1 to item 6 concerned about three aspects; familiarity of using automatic translation, purposes that students have for using MT, and their future plan and intention towards using MT in future. Items from 7 and 13 investigated students’ overall reaction and opinion towards post MT
editing uses, difficulties, simplicity, and potential suggestions for using and developing Machine Translation in general.

3.7 Experiment Tasks

This research involved an experimental task represented by a set of chosen texts that were given to the students of translation at the Department of Translation, Faculty of Languages, Sana’a University, in an orderly procedure that, intentionally, carried out for collecting various data for determining the extent of effectiveness of using post MT editing in many aspects in translation such as time spent in translation, lexical and vocabulary choices, and the number of errors conducted by students/translators during the process of translation.

Two kinds/versions of task were given to the sample, the translation from scratch group that called No Ready Machine Translation Text (NRMTT) and the translation with the assistance of ready machine translated text group that called With Ready Machine Translation Text (WRMTT). These tasks provided insight into the effectiveness of MT text in translation, either to approve the post MT editing effectiveness or to disapprove it. Results collected from the students’ responses showed the difference between NRMTT and WRMTT translation obviously. The outcomes of the collected responses were also observed clearly. Quantitative and qualitative analysis of the collected data are discussed and analyzed elaborately in the next chapter (Chapter Four Discussion).

3.8 Translation Assessment Form (TAF)

Translation Assessment Form (See appendix 4 page 220) is a formulated scale designed by Hutchins and Somers (1992) as criteria for evaluating translation. It was used,
here, as a criterion of assessing the translation of the texts given to the sample and considered as a tool used to calculate the average difference between both groups. It evaluates three aspects of translation quality; 1) Clarity 2) Accuracy and 3) Style of translation. It was used because it is difficult to calculate each criterion in a separated manner, so researcher only calculated the assessment average based on the criterion of the TAF. For each criterion, there were 4 scores as to determine the exact assessment of the students' performance. Scores' calculation is the leading process to the final comparison between both results findings and deciding whether the translation output quality produced by WRMTT group has recorded a significant improvement better than NRMTT group translation or not. So, each text in both sides (post MT editing and translation from scratch) was evaluated according to the TAF. Scales of the students' evaluation are clearly shown in the TAF as follows:

1- Not understandable
2- Small part understandable
3- Mainly understandable
4- Totally understandable

Translation Assessment Form was, accordingly, assigned to match the mentioned criteria. Five Machine-translated Texts\textsuperscript{12} (See appendix 1 page 206) were given to the WRMTT students for post editing them. Analogously, the same texts were given to NRMTT students (without any machine automatic translation provision) to translate them from scratch. 

\textsuperscript{12}Machine-translated Texts are a chosen number of texts determined by the researcher to be used in the current study. These texts are given to both groups of the study. Texts given to WRMTT group were assumed to be provided by their automatic translation produced by Google Translate System in the same paper just for post editing purpose.
Assessing the average and percentage of the students’ translations and post editing quality was calculated based on the following statistical formula:

\[
Av = \frac{x_1 + x_2 + x_3 + \cdots + x_{30}}{n \text{(students)}}
\]

\[
av = \text{average}
\]

\[
x = \text{thescoreofthestudent}
\]

\[
n = \text{numberofthestudents}
\]

Then, by summing up the averages of each translation of the same criteria and dividing them by the number of students, we obtained the total average of each criteria according to the following equation:

\[
Totalaverage = \frac{av_1 + av_2 + av_3 \gg av_{30}}{n \text{ (output) or students}}
\]

### 3.9 Methods of Analysis

#### 3.9.1 Quantitative aspects

of data analysis procedures of the research, orderly, touched the following concepts:

1- Listing the types of MT that are familiar and/or used by the students and teachers according to their answers.

2- Determining the extent percentage of students and teachers’ familiarity with MT and calculating the overall percentage of their positive or negative impression about MT.

3- Calculating the average of errors resulted by both groups of the sample (WRMTT and NRMTT groups) through a comparative analysis of their translations determining which one helps reducing the amount of errors that might impair the translation accuracy and style.
4- Errors calculation was carried out by assessing each translated text determining whether the student made grammatical, lexical or spelling mistake in each one. These errors were carefully numerated and classified as to be included in statistical processes for the sake of showing them in numerical values.

5- Calculating the time spent on translation. Time calculation is straightforward, where the statistics are taken directly from the time recorded by students. They were, firstly, asked to record the time they started in the space meant, on the top of the paper, as immediately as they commenced the task and once again as they finished it.

6- Comparing linguistic features existed in both translation tasks, from scratch and with MT students’ output to check whether MT post editing helps recognizing certain linguistic features.

3.9.2 Qualitative analysis mainly involves discussing the following:

1. Tasks of translations (process of translating NRMTT texts and post editing WRMTT).

2. Interpreting the researchers’ questionnaire.

3. Interpreting students’ reflections.


3.12 References