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The Impact of Translation on Reading Comprehension for EST Learners - A Case Study of Computer Science Students at Constantine 2 University

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Abstract

We study the impact of introducing EST concepts for computer science learners through the use of translation. We have opted for the use of an on-the-fly translation, in which the teacher uses translation just to explain ambiguous terms or ideas related to the presented material if needed. To check the effect of using translation on EST learners' comprehension abilities, we devised a test-based experimental study. The test and experiment groups, have been taught EST for one semester with the use and exclusion of translation into French/Arabic, respectively. A pre-test and post-test have been conducted. Then, a statistical analysis has been carried out. The obtained results have shown that the use of translation from English into the mother tongue of the learners, or into any other language the learners know, has a positive impact on the overall comprehension of the material provided in the EST course.

Keywords: English for Science and Technology, Translation, Reading comprehension.

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Résumé

Dans cet article, on étudie l'impact de l'utilisation de la traduction dans un cours d'anglais pour les sciences et les technologies sur le niveau de compréhension des apprenants. La traduction a été utilisée pour la clarification du sens des mots/expressions introduits dans les textes étudiés. Deux échantillons des étudiants de Master ont fait l'objet de notre étude. Pour le premier, seul l'anglais a été utilisé comme moyen de communication et de présentation du cours. Pour le deuxième, on a permis l'utilisation du français et/ou de l'arabe par l'enseignant. Deux tests ont été menés, l'un au début du semestre et l'autre à la fin, suivis par une analyse statistique des résultats. Les résultats obtenus prouvent la validité de l'hypothèse de recherche : 'L'utilisation de la traduction dans la séance d'anglais pour les sciences et les technologies aide à la compréhension du contenu présenté'.

Mots clés: Anglais pour les sciences et les technologies ; traduction ; compréhension du texte.

ملخص

نقدم في هذا المقال دراسة تجريبية لجدوى استعمال الترجمة خلال حصص اللغة الانجليزية عند تدريس طلبة العلوم والتكنولوجيا. قمنا بتقسيم المجموعة المدروسة لفوجين، حيث سُمح للأستاذ المدرس باستعمال العربية أو الفرنسية مع أحد الفوجين خلال حصة الانجليزية، لغرض شرح المفردات والمفاهيم الصعبة. أما الفوج الآخر فلم تُستعمل معه إلا الانجليزية كوسيلة للشرح والتخاطب. قمنا بإجراء اختبار لمستوى الفهم لدى الطلبة من خلال إجراء فحصين للمستوى أحدهما قبل التجربة والآخر بعد تدريس الفوجين خلال فصل كامل. أثبتت الدراسة الإحصائية أن الفوج الذي تم استعمال الترجمة معه تفوق على الآخر في التعبير عن معاني مجموع المصطلحات التقنية التي احتواها نص الفحص.

الكلمات المفتاحية: الإنجليزية للعلوم والتكنولوجيا؛ الترجمة ؛ فهم النصوص.

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I- Introduction

A very common problem that EST teachers face, nowadays, when dealing with Algerian university students is the inability of a big portion of these students to understand the lessons if the only used language during sessions, as medium of communication, is English. Many teachers, who have adopted the monolingual communicative approach (Howatt, 1984), prefer not to use any other language but English. They argue that the students' fluency and spontaneity in using English is likely to be negatively affected by the use of the other language (generally the mother tongue). However, students are all the time complaining that they would never be able to learn a language they do not understand at all. Besides, they claim that all they need from learning English as a foreign language is to become able to understand the documents they meet in their fields of study, or later in their jobs. The latter idea with the previously-stated problem would in many cases make them give up. This even makes them escape the EST sessions.

Primary observations got from teaching English for computer science students, at Constantine 2 University, showed that using the students' mother tongue, or any other language that students know better than English (French, for instance), would boost their interest in English as a module, and make them feel at ease during English class. In this perspective, this work investigates the impact of using translation for EST teaching on students' comprehension abilities. Hence, an English-into-Arabic/French translation approach has been adopted with an experimental group. Basically, translation has been introduced for explaining the studied material (the in-class presented text) whenever difficult words, expressions or structures are met.

The research question the present work tries to answer is: *"Does the use of translation from English into L1 (Arabic or French) for teaching EST improve students' comprehension of the presented material?"*. French is considered in the present study for two main reasons: (1) it is the L1 for the majority of foreign students, and (2) it is the main language used in the learning of all other speciality modules but EST class; they know it much better than English.

We have hypothesised that if teachers used translation when teaching English for science and technology; the learners' comprehension abilities would improve. To confirm or infirm this hypothesis, translation has been used for teaching one of two groups of students, the experimental group; while with the other group, the control group, English has been the only means of in-class communication. Both the experimental and control groups have undergone a pre-test and a post-test, for validation purposes. The statistical analysis, applied on the obtained results, has confirmed the hypothesis of research. In addition, other qualitative analyses are presented.

II. English for Science and Technology

Several definitions exist in the literature for ESP. A simple and expressive definition is that of Mackay and Mountford (1978) who state that ESP refers to the teaching of English for utilitarian purposes. This focus on the function of the language led, like Robinson (1980) explains, ESP content devisers to begin not from a structural theory of language but from a functional account of the learner needs. Such needs let El-Minyawi (1984) note that ESP courses are based mainly on the need "to express the facts and ideas of some special subjects after which the student should be able to read the specialised subjects confidently and speak about them fluently". Hutchinson and Waters (1987) argue that ESP is an approach to language teaching, not a product. They add that "all decisions as to content and method are based on the learner's reason for learning" (p. 19). They add that the foundation of ESP is the question: "Why does this leaner need to learn a foreign language?" (p. 19) (cited in: Breznica et al., 2017).

The tree of ELT, by Hutchinson and Waters (1987), subdivides ESP into three branches: a) English for Science and Technology (EST), b) English for Business and Economics (EBE), and c) English for Social Studies (ESS). Each of these subject areas is further divided into two branches: English for Academic Purposes (EAP) and English for Occupational Purposes (EOP). Actually, as Hutchinson and Waters (1987) note, "there is not a clear-cut distinction between EAP and EOP"; for instance, "people can work and study simultaneously." (p. 17). Evans (1998), however, makes a clear cut when he considers English for science and technology as a sub-branch of English for academic purposes (EAP).

EST dominated the earlier studies on ESP. Swales (1971) was one of the first pioneers of this field. Most of his work was associated with register. In EST, courses were usually built around lexical specifications which included field's terminology and grammar patterns (Moštěková, 2010).

Building upon the definitions suggested by applied linguists, Naoua (2016) states that EST is based on the study of registers from the fields of science and technology. According Thirrummurthy (2008, p. 3), the EST curriculum should then enable learners to:

- Obtain information by reading or listening to specialised sources in the fields of science and technology.

- Present scientific and technological information in an appropriate way.

EST course, like Thirrummurthy (2008) explains, is designed to help the international undergraduate and graduate students and professionals become more comfortable using English as a common language in the fields of Science and Technology.

The importance of EST as a sub-branch of ESP is well illustrated by Swales (1985, p. X) who states that "EST is the senior branch of ESP – senior in age, larger in volume of publications and greater in number of practitioners employed. [...] With one or two exceptions, English for Science and Technology has always set and continues to set the trend in theoretical discussion, in ways of analysing language, and in the variety of actual teaching materials".

In EST course design, we find that the vocabulary to be learnt has had the greatest attention in many previous studies. However, the teaching methodology and student attitudes have been seen marginal in many ways. This has resulted in three main issues:

1. A big portion of the vocabulary taught to EST learners, even found in EST textbooks, is too general, or at best semi-technical. Such a repertoire of words would not be enough for the learners to deal with specialised topics in their fields of study, especially for those dealing with academic discourse.

2. Even in the case of providing students with dozens of technical and semi-technical words; in many courses, these terms are not contextualised. This leads to some misunderstanding of the genuine meaning of these terms.

3. A third issue is that of banning the use of other languages but English, during classes; this would negatively influence the student's attitudes towards English sessions, and it is likely to prevent them from better learning the presented material.

In this line of thought, the present work aims at studying the usefulness of using translation, into Arabic/French, during EST classes for helping students to comprehend and learn the presented material.

III. Translation for EFL, ESP and EST Teaching

The emergence of monolingual communicative approaches has led to the vanishing of translation from EFL classes (Willis, 1981; Darginavičienė & Navickienė, 2015), even if translation had been widely used in foreign language teaching for centuries. Even though, "translation refused to disappear from classes teaching languages other than English" (Cook, 2007).

Both language accuracy and fluency led to a revival of interest to use translation in EFL classrooms, and so the idea of using it as a tool to improve language skills (Kavaliauskiene, 2013). L1 interference, or more precisely negative linguistic transfer has been the main argument for the ban of L1 from EFL classes (Kroll, 1994). Cross-linguistic similarities and differences between L1 and L2, on the other hand, are thought to be important for the development of the complex system of the learners' L2 (Kavaliauskiene, 2013).

On the whole, the objections to using translation in EFL classes, can be summarised in three points. (1) The fluency and spontaneity of students is threatened by the use of L1 in L2 classes. (2) Translation activities may be suitable for students who prefer analytical or verbal-linguistic learning strategies" (Kavaliauskiene, 2013), and not for all types of learners. (3) Translation is not always an easy skill to be acquired or taught.

On the other hand, the use of translation in EFL classes helps to (Kavaliauskiene, 2013): (1) practicing all language skills, i.e. reading, writing, speaking and listening, (2) developing accuracy, clarity and flexibility, (3) putting students at ease with regard to the use of their mother tongue, and so helping in developing their communicative skills and (4) making a list of differences and similarities between languages, which helps students understand the problems caused by L1 when learning L2.

As far as the use of translation with EFL, ESP and EST is concerned, we find that most works focused on EFL and ESP with a lesser degree, while EST has not been treated in any separate work. We cite and analyse some of these works in the following. On the basis of some theoretical and methodological studies besides classroom observations, Koletnik (2012a) argued for the positive role of translation for ESP teaching; she stated that translation had led to some improvement with the observed students. Basically, she focused on business formal communications. However, her work did not contain any statistically-validated experimentation. Ghaiyoomian and Zarei (2015) chose to study the effect of translation on only one language aspect: grammar. They concluded that translation would help EFL teachers to reduce the amount of students' confusion and misunderstanding. They used a t-test to confirm their hypothesis, stating that translation helps in improving students' language accuracy. As will be seen in our experimental part, such a test is not the most appropriate validation tool for a pre-test post-test control experimental group design; it does not guarantee that the claimed effect of translation is not induced by other variables that have not been considered during the experimental setting.

Kavaliauskienë and Kaminskienë (2007) analysed the results of a survey to study the students' attitudes towards the use of the mother tongue during ESP classes. They concluded that the learners usually rely on their mother tongue to deal with ESP content.

Leonardi (2009) conducted a theoretical analysis of the translation effect on business ESP learners. She argues that translation helps students to learn "about problem solving strategies, improve their analytical skills and strengthen their grammatical and lexical competence and performance" (p. 141). That study, like many other theoretical studies, assumes that ESP learners already have a good level of general English as a result of their previous EFL courses. It is worth to mention, here, that this is not true for the population of our study, computer science students at Constantine 2 University. Besides, Leonardi (2009) did not support her theoretical ideas with any experimental analysis. In a similar way without providing any experimentation, Koletnik (2012b), states that translation can help in an effective and efficient development of linguistic and communicative skills. She also stresses the fact that this is particularly true at more advanced levels of education.

Reading comprehension, as a crucial task of ESP sessions, was considered by Marzban and Azizi (2013). The authors used some experimental investigation with 66 high school students to reject the hypothesis that translation has an effect on reading comprehension. The problem here is that the authors used a simplistic statistical analysis, a t-test was also adopted for a pre-test post-test control experimental group design; this is not the right way to deal with such a design; an analysis of variance (ANOVA) or a mixed model statistics is more appropriate to consider the influence of time (or other hidden factors) on the students' level in English. Besides, as stated above, those who argued for the use of translation in EFL/ESP classes have made it explicit that the benefits are more likely to occur with advanced learners who have a good mastery of general English; this is not generally the case of high school students (subjects of the just-mentioned reference).

We finish this previous-works exploration with citing the work of Avand (2009), since it is very close to ours. The author of that work implemented an experiment on 57 students of a medicine and nursing programme. Even though he argues for the use of translation and its positive role in ESP, the author, like the above-mentioned works, ignores the particularity of the test design he opted for, a pre-test post-test control experimental group design. Besides, two independent variables, not only one as considered by the author, should have been considered: time and treatment. Thus, any conclusions about the role of translation in aiding students to comprehend ESP texts would be partially invalid.

On the whole, the particularity of the present study, compared to previous works, can be summarised in the following points.

1. Our contribution consists of studying the effect of translation on EST learners, rather than general English or ESP learners.

2. The students we deal with have relatively low English proficiency level.

3. Another particularity of the subjects of our study is that they use French, the first foreign language they learn, as a medium of communication in all the other modules, but EST, of the training programme.

4. There is no well-established ESP, nor EFL, curriculum for the Master students of the population under investigation; this was not the case for other previous works.

5. More importantly, the conclusions drawn from the present study are based on an adequate statistical analysis, which considers not only the effect of time as another independent variable, but also other hidden variables that could affect the experimental analysis.

IV. The Study

This section presents the details related to the implementation of the devised experiment on a set of students and the methodology we followed to decide whether we accept or reject the hypothesis of research, related to the usefulness of including translation in EST classes. After formulating our question of research and defining the implied hypothesis and the research variables, we describe the subjects on which we carried out our experiment, then the pre-test post-test experimental control group design we opted for is presented.

IV.1. Aim of the Study and Question of Research

This study aims at investigating the impact of using translation for EST teaching on students' comprehension. The following question of research has been adopted: *"Does the use of translation from English into L1, Arabic - or French (for foreign students) - in our case, for teaching EST improve students' comprehension of the presented material?"*

We put the following hypothesis. *"If teachers used translation activities when teaching English for science and technology, this would improve the learners' comprehension abilities"*.

IV.2. Research Variables

Three variables have resulted from our hypothesis of research and the experimental design we opted for. The dependent variable is the learners' comprehension of the presented material. The independent ones are the introduction of translation on the one hand and time on the other hand. In fact, the latter variable resulted from the experimental test design we have chosen: a pre-test post-test control experimental group design. The dependent variable is a quantitative one, measured by a marking system, while the independent ones are of a qualitative nature.

IV.3. Subjects

The present study took place at the faculty of new technologies of information and communication, Constantine 2 University. Two groups of students, 25 each, were sampled from a class of computer science Master 1 students. These two groups constituted the control and experimental groups.

IV.4. Method

First, the two samples from the studied population (Master 1 Students of computer science) have been chosen randomly. The first sample is the control group which has been taught with the traditional approach, i.e. without any use of translation during EST classes. The second group, the experimental group, has been taught using some translation. We have proceeded as follows. A pre-test has been undergone by both groups in order to evaluate their initial comprehension abilities of EST texts. After that, both groups have been taught EST for one semester with the introduction of translation when teaching the experimental group, while only English has been used with the control group. Next, both groups have undergone a post-test. Finally, A statistical analysis has taken place in order to confirm or infirm the initial hypothesis of the research. The obtained results have been also analysed qualitatively.

IV.5. Test Design

In order to study the before/after control/impact aspects of the use of translation for teaching EST, we have chosen the pre-test post-test control experimental group design. It is the most appropriate to measure the effect that the experimental group had

from introducing translation when teaching it, without ignoring the effect that the teaching operation might have on the overall level of comprehension of students. In simple words, we have to be sure that if a more significant improvement of the experimental group's level over the control one is found, this should not be because of an initial difference between the groups.

In this type of experimentation, both the control and experimental groups are evaluated with regard to the dependant variable, abilities of reading comprehension, before implementing the treatment (using translation in our case). Then, the experimental group receives the treatment. Finally, the two groups are re-evaluated to see to what degree the dependant variable is affected by the independent one(s).

IV.5.1. Pre-test

A pre-test has been undergone by both groups, control and experimental groups, in order to evaluate their initial comprehension abilities. More precisely, we wanted to see if there were any significant differences between the two groups in terms of reading comprehension. For measuring the reading comprehension of students, we provided them with a text in their field of study, computer science, and asked them to give the meaning of some technical terms from the text. They were also asked to translate these words from English into French and Arabic, respectively. We started from the idea that if the text were comprehended, the student would be able to give the meaning of a given term, basically from the context. The presented text is given in the appendix; the terms in question are underlined. When marking the students' responses, giving the meaning of words has been given more importance; we assumed that a genuine comprehension of the term would be reflected by the ability of the student to express the core of its meaning. It is worth to mention here that we did not consider writing-related mistakes; if the main part of a terms meaning was given, the whole mark was attributed.

IV.5.2. Teaching With and Without Translation

After conducting the initial evaluation of students' comprehension abilities, both groups were taught EST material for one semester as follows:

- With the experimental group, we used French or Arabic during EST classes to explain difficult terms, expressions or even concepts and ideas related to the material being dealt with.

- We did not use translation with the control group, but we moderately allowed students to use Arabic or French.

- Both groups were taught EST for a whole semester, 1.5 hours per week; about ten sessions.

- Both groups were taught by the same teacher.

In the sessions, computer-science texts were dealt with. The students were asked to read the presented text. The role of the teacher was to read and explain the content of the text. Some grammar rules, phonology and other English language aspects were slightly presented in parallel. For the control group, only English was used by the teacher, and the students were encouraged to use only English. With the experimental group, difficult terms and ideas were translated or explained using basically French, the main language used in the students' training programme. Also, the teacher was allowed to use Arabic whenever the situation required it.

IV.5.3.Post-test

After the students had had about ten sessions of EST, both groups underwent a post-test. It aimed at evaluating their comprehension of a new text. The same procedure adopted in the pre-test was used. The post-test text was different from the pre-test text. In fact, it was more difficult, not in terms of the included technical terms, but it used a harder technical style. This difficulty is, in fact, a good way to check whether the students could get the meaning of new words from the context (the text). It is worth to mention that we consulted about twenty computer science teachers and PhD students to compare the two texts in terms of difficulty. The big majority of them agreed on the fact that the post-test text was harder to read and comprehend. Thus; when marking the post-test, we gave the scores of the students more importance than that we gave for their performances in the pre-test. The post-test text is also presented in the appendix.

V. Statistical analysis

In order to accept or reject the hypothesis of research, stating that the use of translation when teaching EST would help the learners improve their reading comprehension abilities, we have had to analyses the supposed students' improvement statistically. We have two independent variables, 'time' (before/after teaching) on the one hand and 'group' (introducing/excluding translation) on the other hand; and a dependent one: students' comprehension. Thus, the suitable statistical test is the mixed model analysis of variance (Mixed ANOVA). The latter statistics aims at measuring not only how the independent variables have had (or not) an effect on the dependent one; but it allows knowing whether there is some interaction between these variables. The choice of the mixed ANOVA statistics has been also motivated by two points:

a. It allows considering some randomness in the choice of subjects; this was our case, since there were many ways the two groups, of 25 subjects each, could have been chosen from the whole population. On the whole, there were about 300 Master 1 students, from which only 50 have been chosen to be subjects of the study.

b. The test, in addition to the whole vision it offers about the data, permits the mutual comparison, using a t-test, between each couple of pre/post experimental/control configuration. This permits a deeper analysis of the supposed improvement if it has taken place.

It is to be noted here that the subjects of the experiment have not been paired. Thus it is an independent-group test. Again, the mixed models test is suitable for the case. The significance level has been set to 0.05, and the hypotheses of the statistical test have been chosen to be:

- **Null hypothesis, H0:** There is no significant difference between the means of the four groups.

- **Alternative hypothesis, H1:** There is a significant difference between the means of the groups.

Table 1 presents the correlation matrix between the four groups and the dependent variable comprehension. As seen from the last line/column of the matrix, the greatest value, apart from the self-comparison values, is that of the post-test of the experimental group with the variable comprehension. This means that this group has a relationship with the variable comprehension stronger than the three other groups.

Tables 2-3 present the covariance parameters for both the random and fixed independent variable, 'time' (pre/post) and 'treatment' (with/without translation), respectively. We can see that the fixed variable error variance is significant and the random component variance is not significant. Thus, the random component has not a significant effect on the global model. This means that sampling other groups of students from the population would have the same effect on the whole study. As seen from Table 4, the experimental group has had a significant effect on the comprehension variable.

Figure 1 shows how the means of scores of the two groups being studied evolved over time. As well seen, the control group has had a better mean than the experimental group in the pretest (45.08 vs. 41.81). However; in the post-test, the experimental group has performed better (60.68 vs. 55.41). This proves that the use of translation with the experimental group has improved the students' comprehension abilities. This fact is also proved by the comprehension prediction model given in Figure 2. It is clear that even if the control group (with blue circles) performed better than the experimental one (with magenta circles) in the pretest; the inverse is true in the post-test (green vs. red). Figure 3 also confirms this effect.

Table 1. Correlation matrix

Variables	gr-ctrl-pre	gr-exp-pre	gr-ctrl-post	gr-exp-post	Comprehension
gr-ctrl-pre	1.000	-0.333	-0.333	-0.333	-0.160
gr-exp-pre	-0.333	1.000	-0.333	-0.333	-0.258
gr-ctrl-post	-0.333	-0.333	1.000	-0.333	0.116
gr-exp-post	-0.333	-0.333	-0.333	1.000	**0.302**
Comprehension	-0.160	-0.258	0.116	**0.302**	1.000

Table 2. Covariance parameters – Random effects

	Parameters	Standard error	Z	Pr > Z
Variance	**0.000**			

Table 3. Covariance parameters - Repeated factor

	Parameters	Standard error	Z	Pr > Z
Variance	590.555	83.517	7.071	**< 0.0001**

Table 4. Model parameters

Source	Value	Standard error
Intercept	53.669	4.860
Group-ctrl-pre	0.000	
Group-exp-pre	-4.645	6.873
Group-ctrl-post	7.872	6.873
Group-exp-post	**17.084**	6.873

Once the overall comparison of the groups proved that there is some difference of means between the four groups (experimental-pre, control-pre, experimental-post

and control-post), it becomes crucial to carry on with a multiple pairwise comparison. Tables 5-6 present the Tukey multiple pairwise comparison results. It is clear that there has been some difference in terms of means between the different pairwisely-compared groups. In Table 5, what matters is the last column that presents the existence or absence of differences between means of several pairs of groups. In our case, we are more interested in the pair: gr-ctrl-post vs gr-exp-post, reflecting a potential influence of translation on comprehension abilities. In fact, we have to be cautious about generalising to accept the hypothesis of research, because the same table indicates that there has been some difference between the control and experimental groups before applying the experimental procedure: gr-exp-pre vs gr-ctrl-pre. Table 6 confirms this conclusion.

In order to make things clear regarding this point, we give in Tables 7 and 8 the results of pairwise comparisons of different groups given by the Dunn-Sidak statistics. Table 7 states that there has not been a significant difference between the two groups under study before applying the experimental method (see gr-exp-pre vs gr-ctrl-pre), but once the treatment (use of translation) was applied, the two groups behaved differently. So, we conclude that the introduction of translation into the EST class has had a significant effect on the experimental group. Table 8 confirms this conclusion, it shows that before the experiment, both groups belonged to the same class: A; but after having applied the method, the control group has become different: class B. More importantly, the experimental group has moved to another class: class C. In simple words, both the control and experimental groups have improved over time, but the improvement of the experimental group has been larger, which can be interpreted by being the effect of introducing translation in classes.

Table 5. Tukey (HSD) / Analysis of the differences between the categories with a confidence interval of 5%:

Contrast	Difference	Std difference	Critical value	Pr > Diff	Significant
gr-exp-pre vs gr-exp-post	-18.872	-3.637	0.536	0.002	**Yes**
gr-exp-pre vs gr-ctrl-post	-12.601	-2.429	0.536	0.078	Yes
gr-exp-pre vs gr-ctrl-pre	-3.278	-0.632	0.536	0.922	**Yes**
gr-ctrl-pre vs gr-exp-post	-15.594	-3.006	0.536	0.018	Yes
gr-ctrl-pre vs gr-ctrl-post	-9.324	-1.797	0.536	0.281	Yes
gr-ctrl-post vs gr-exp-post	-6.271	-1.209	0.536	0.623	**Yes**
Tukey's d critical value:			0.758		

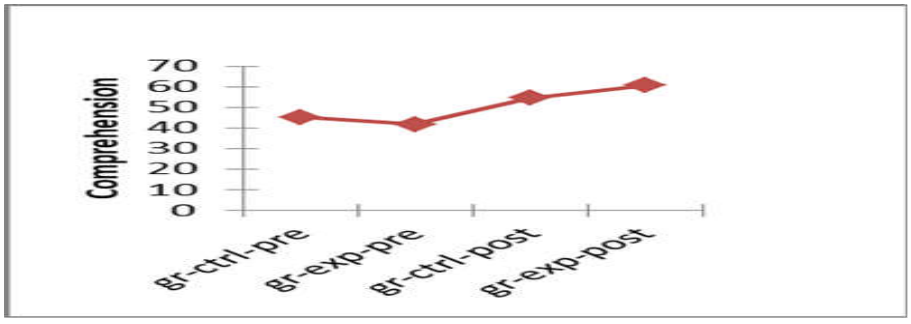

Figure 1. Means charts: comprehension Mean for different groups

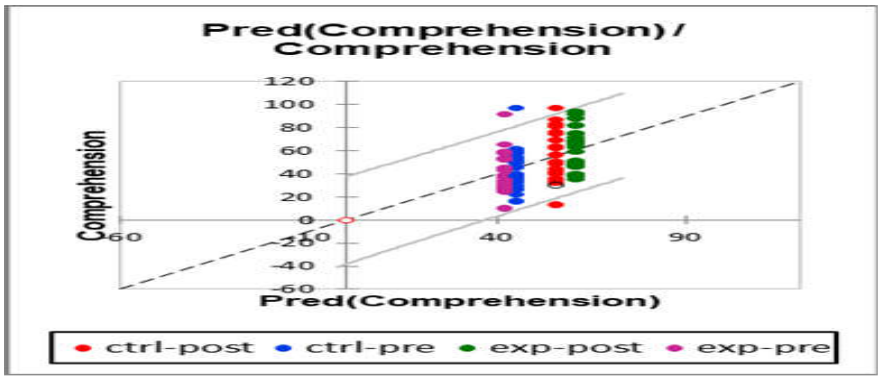

Figure 2. Comprehension prediction

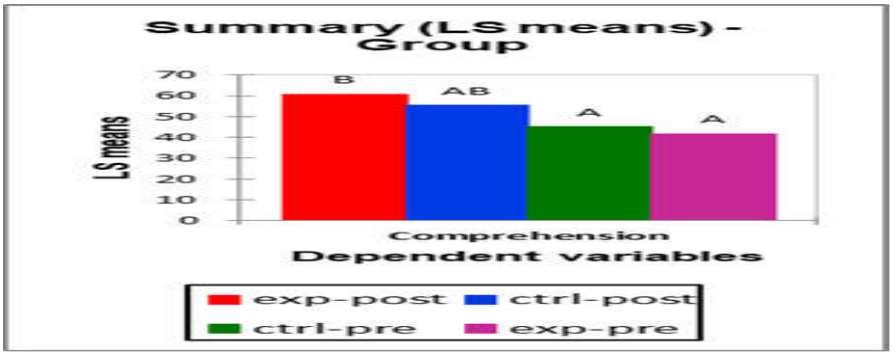

Figure 3. Comparison of means between groups over tests

Table 6. Categorisation of groups according to Tukey (HSD)

Category	LS means	Groups			
gr-exp-pre	41.811	A			
gr-ctrl-pre	45.088		B		
gr-ctrl-post	54.412			C	
gr-exp-post	60.682				**D**

Table 7. Dunn-Sidak / Analysis of the differences between the categories with a confidence interval of 5%:

Contrast	Difference	Std difference	Critical value	Pr > Diff	Significant
gr-exp-pre vs gr-exp-post	-18.872	-3.637	0.858	0.000	Yes
gr-exp-pre vs gr-ctrl-post	-12.601	-2.429	0.858	0.017	Yes
gr-exp-pre vs gr-ctrl-pre	-3.278	-0.632	0.858	0.529	**No**
gr-ctrl-pre vs gr-exp-post	-15.594	-3.006	0.858	0.003	Yes
gr-ctrl-pre vs gr-ctrl-post	-9.324	-1.797	0.858	0.075	Yes
gr-ctrl-post vs gr-exp-post	-6.271	-1.209	0.858	0.230	**Yes**
Modified significance level:			0.393		

Table 8. Categorisation of groups according to Tukey (HSD)

Category	LS means	Groups
gr-exp-pre	41.811	A
gr-ctrl-pre	45.088	A

gr-ctrl-post	54.412	B	
gr-exp-post	60.682		**C**

VI. Discussion, pedagogical implications and limitations of the study

The aim of the present work was to study the effect of using translation on EST learners' reading comprehension abilities. The experimental results show that such an effect is likely to be positive. Statistically speaking, the risk that such an effect is the result of randomness is lesser than 5% (the higher bound is the significance level). The numbers and hypothesis testing are in favour of the hypothesis that translation would help EST learner to deal with the texts they are supposed to learn English from, and more importantly with the research papers they would need to read later to accomplish their Master 2 projects. In addition to the mentioned quantitative results, we want to give in the following some extra arguments in favour of using translation with EST learners. They are mainly based on classroom observations; in addition to our experience and that of some teachers who taught the subjects of our study. The same teacher also taught post-graduate students at the same faculty.

1. Maybe, the upmost motivation that justifies the use of translation when teaching EST is that the learners feel at ease during EST classes. This was observed with the subjects of our study. Actually, some students from the experimental group stated that they had never been in such a motivating context when learning English. They explained that the handicap they felt for many years had started to vanish. The same thing has been observed with other, mainly PhD, students in the years following the implementation of the experiment.

2. Surprisingly, some of the PhD students we dealt with, who have been thought EST using translation, have opted for writing their research papers directly in English; while the old classes (that have been taught EST only in English) used to write the paper in French, then translate it.

3. The use of translation during EST classes has had other benefits such as some contribution to the L1 language. Many students enriched their French/Arabic technical repertoire by new terms.

4. The teacher could make a list of the difficulties the learners faced when learning English. They were, for the first time, allowed to state explicitly in their mother tongue the difficulties they had to learn English. Actually, this step is a crucial pre-requisite of ESP content design: needs analysis.

5. Some tips for the use of translation when devising future EST courses for computer science students have been collected by the teacher. This has been later implemented especially with PhD students.

As a summary of the pedagogical implications, we cite the following:

1. Algerian EST students should be allowed to use their mother tongue during English classes.

2. Working on improving EST students' fluency in English should not be with a brutal total ban of the use of their L1. A gradual reduction of the amount of L1 use in L2 classes would give better results than a total sudden ban.

3. Even when banning L1 from EST classes, translation should be kept as an activity in the curriculum.

4. It has also been observed that the accuracy of the subjects when using French and Arabic was weak. Again, implementing translation as a supporting activity would help the learners work on their accuracy in these two languages.

5. The inclusion of translation in the EST curriculum becomes a need for a better mastery of the presented EST-related material.

Finally, the main limitation of this study can be summarised in two points. First, the samples that have been considered for the experimental analysis are relatively small to provide more confidence when generalising the findings of the research. Second, ten sessions of tutoring the students, about 15 hours, is not really a sufficient period that allows seeing the predicted positive effect of translation on EST learners.

VII. Conclusion

In this paper, the effect of using translation on EST learners' reading comprehension abilities has been studied. In addition to a state-of-the-art synthesis of the works discussing the usefulness of translation in the EST class, we devised, implemented and statistically analysed an experiment on two samples of computer science students at the Faculty of New Technologies of Information and Communication, Constantine 2 University.

The findings confirmed the hypothesis of research, which states that translation helps EST learners improve their reading comprehension abilities. Some pedagogical implications have been also given to a better exploitation of translation in the EST curriculum. As a perspective of research, we plan the extension of the present study to conduct a survey that measures the EST learners' attitudes toward including translation in their curriculum and its use during EST classes.

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Appendix 1 : Pre-test

This test is devised in the context of a research study. So, we will be very thankful if you could respond to the following questions.

Read the following text carefully then answer the questions.

Object-oriented programming (1) is a type of programming in which programmers define not only the data (2) type of a data structure (3), but also the types of operations (functions) that can be applied to the data structure. In this way, the data structure becomes an object (4) that includes both data and functions. In addition, programmers can create relationships (5) between one object and another. For example, objects can inherit (6) characteristics from other objects.

Before writing code (7) lines in any software (8) development process, it is needed to accomplish two tasks: needs analysis (9) and design (10). In the first task, the developer (11) is needed to analyse the needs of the future clients of the designed (12) system. In other words, the future functionalities of the system are defined in this step. The second task is the most important task in the development process (13). In this phase, the general structure and algorithmic behaviour of the future system are given.

In order to be able to communicate adequately, computer scientists (14) invented a Modelling language allowing them to express the requirements (15), architectures and even behaviour of their systems. This language is abbreviated as UML. Nine diagrams constitute the basic system of notation in this language. However, many other diagrams are being added periodically to this system of notation.

For designing their systems, software developers use several approaches. Recently, a new approach has been adopted by the majority of object oriented developers. It is called the Unified Process (16) (UP). This method is based on UML as a modelling language, and is based on an incremental and iterative process.

Generally speaking, many software systems in use need the storage (17) of data in large quantities to be used later by clients. For this reason, databases (18) are used. The latter are managed by special software systems called DataBase Management Systems (DBMS). The main used type of database management systems are relational (19) database systems. This type of RDBMS is based on relational algebra (20) as a consistent mathematical theory.

Questions:

1. Provide the meaning of the underlined words.
2. Give the French equivalent of the underlined words.
3. Give the Arabic equivalent of the underlined words.

Appendix 2 : Post-test

This test is devised in the context of a research study. So, we will be very thankful if you could respond to the following questions.

Read the following passages carefully then answer the questions.

The Internet (1) is, quite literally, a network (2) of networks. It is comprised of ten thousands of interconnected networks spanning the globe. The computers (3) that form the Internet range from huge mainframes in research establishments to modest PCs in people's homes and offices. Despite the recent hype, the Internet is not a new phenomenon. Its roots lie in a collection of computers that were linked together in the 1970s to form the US Department of Defense's communications systems (4). Fearing the consequences of nuclear attack, there was no central computer holding vast amounts of data (5), rather the information was dispersed across thousands of machines. A set of rules, of protocols (6), known as TCP/IP was developed to allow disparate devices (7) to work together. The original network has long since been upgraded and expanded and TCP/IP is now a "de facto" standard.

Large databases (8) can contain hundreds of interrelated files. Fortunately a database management system (9) can shield users from the complex inner workings of the system, providing them with only the information and commands (10) they need to get their jobs done. The earliest file management (11) programs could only do batch processing (12), which required users to accumulate transactions (13) and feed them into (14) computers in large batches. These batch systems weren't able to provide the kind of immediate feedback we expect today. Today; disk drives, inexpensive memory, and sophisticated software (15) have allowed interactive processing to replace batch processing for most applications. Users can now interact with data through terminals (16), viewing and changing values in real time. Batch processing is still used for printing periodic bills, invoices, and reports and for making backup copies (17) of data files. But for applications that demand immediacy, such as airline reservations, banking transactions, and the like, interactive, multiuser (18) database systems have taken over.

Many computer scientists believe that the relational data model (19) may be supplanted in the next decade by an object-oriented data model, and that most future databases will be object-oriented databases (20) rather than relational databases. Instead of storing records in tables and hierarchies, object-oriented databases store software objects that contain procedures (or instructions) along with data. Object-oriented databases often are used in conjunction with object-oriented programming languages.

Questions:

1. Provide the meaning of the underlined words.
2. Give the French equivalent of the underlined words.
3. Give the Arabic equivalent of the underlined words.