Motivation and Language Learning Strategies Used by Moroccan University EFL Science Students: A Correlatioal Study

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Abstract
This study aims to investigate the overall use of language learning strategies (LLSs) and its relationship with English learning motivation by Moroccan non-English major students. The sample consists of 228 students enrolled in their second year at the Faculty of Sciences, Mohammed V University – Rabat – Morocco. To collect the data, the Strategy Inventory for Language Learning (SILL) developed by Oxford (1989) was adopted and adapted to the Moroccan EFL context. The motivation questionnaire was developed based on different sources including Gardner's Attitude/Motivation Test Battery (AMTB) (2004); Pintrich et al.'s Motivated Strategies for Learning Questionnaire (MSLQ) (1991); and Schmidt & Wattanabe (2001). The two questionnaires were tested for reliability and validity. Descriptive statistics and Pearson Correlation were selected to analyze the data. The results demonstrate that Moroccan university EFL Science students use LLSs at a medium level and exhibit a high level of motivation, and that their motivation to learn English and use of LLSs are strongly and positively correlated. This study yields a number of implications both for pedagogical purposes and for further   research
Key words: language learning strategies, Moroccan EFL context, motivation, Strategy Inventory for Language Learning

Introduction

Preliminary research on language learning strategies (LLSs henceforth) began in the early 1970's with Rubin (1975).This field of research became prolific, especially with the emergence of the notion of "the good language learner" (Rubin, 1975; Naiman, Frohlich, Stern & Todesco, 1978). Based on this notion, other researchers tried to develop lists of strategies and other characteristics supposed to be essential for "good L2learners". These strategies were classified into various types according to different learners in different contexts and in relation to factors such as age, gender, nationality/ethnicity, language experience, proficiency, motivation, aptitude, learning style, learning stage, language task and so on (Oxford, 1990). One of the learners' factors that has raised L2 researchers' interest is motivation because of its potential impact on the learning process in general including L2 learning. Hence the motive for investigating its relationship with LLSs among a specific population in the Moroccan EFL context, and find out whether the results will compare or contrast with those of previous research.

Before reporting the different components of the empirical study conducted to this end, the first section below will be devoted to a brief review of the literature related to this issue.

I.   Literature review
1. Definition and taxonomies of LLSs

In the field of LLSs, one of the major issues that has been and may still be of much concern to many researchers is the issue of defining LLSs. The fuzzy/ambiguous nature of the concept of 'strategy' makes it difficult to assign it one definition due to a number of reasons. One major reason concerns the different theoretical perspectives researchers have adopted in their definitions of the concept (O'Malley & Chamot, 1995; Weinstein & Mayer, 1986; Wenden, 1987; Ellis, 1997), which leads to a lack of agreement on what the concept really means. Another reason is that LLSs are bunched with all types of learner behaviors and, hence, their classification as observable or non-observable, conscious or subconscious actions is controversial. This critical point is supported by O'Malley, Chamot, Stewner-Manzanares, Kupper & Russo (1985a) who claim that:

> there is no consensus on what constitutes a learning strategy in second language or how these differ from other types of learner activities…even with the group of activities most often referred to as learning strategies, there is considerable confusion about definitions of specific strategies and about the hierarchic relationship among strategies (p.22)

Dornyei (2005), on the other hand, states that "…we cannot offer a watertight definition of 'learning strategies" (p.166). Oxford (1990) supports the same view when she claims that:

> there is no complete agreement on exactly what strategies are; how many strategies exist; how they should be defined, demarcated, and categorized; and whether it is - or ever will be - possible to create a real, scientifically validated hierarchy of strategies…Classification conflicts are inevitable. (p.17)

Thus, besides the definition issue, Oxford also highlights the problem relative to the classification of LLSs and the production of agreed-upon taxonomies. The lack of clarity and agreement among researchers concerning this issue has caused inconsistencies and mismatches

across existing taxonomies and classificatory systems developed by different researchers (O'Malley, Chamot, Stewner-Manzanares, Russo & Kupper (1985b); Rubin, 1987; Stern, 1992). However, Oxford (2001) offers one of the most comprehensive definition which covers different features of LLSs defined according to her as "…operations employed by the learner to aid the acquisition, storage, retrieval and use of information; specific actions taken by the learner to make learning easier, faster, more enjoyable, more self-directed, more efficient, and more transferable to new situations." (p. 166). She also offers a taxonomy of LLSs which is considered as the most comprehensive one (as it includes items from other taxonomies), and the most widely used in language learning strategy research reinforcing its validity. It should be mentioned that Oxford's orientation in this classification is towards the development of communicative competence. This taxonomy, adopted by the present article, classifies LLSs into two main categories: direct and indirect strategies which are in turn subdivided into six subcategories as reported below based on Oxford (2001, p. 359):

Cognitive strategies which enable the learner to manipulate the target language material in direct ways such as note-taking, reasoning, analyzing, summarizing, synthesizing, outlining …etc

a. Metacognitive strategies which enable the learner to manage the learning process through identifying the learning style preferences, planning for L2 learning, gathering and organizing materials, arranging for learning, monitoring mistakes, and evaluating the learning process.
b. Memory strategies which enable the learner to link one L2 item or concept with another.
c. Compensation strategies which help the learner make up for missing knowledge such as guessing from context in listening and reading, using gestures … etc
d. Affective strategies which enable learners to control their mood and anxiety level, talk about feelings, reward oneself for good performance, use positive self-talk and deep breathing … etc
e. Social strategies which help the learner work with others and cooperate to understand the target language as well as the culture. For instance, learners ask questions, seek verification, ask for clarification …etc

2. Language learning motivation

Similar to the concept of LLSs, there is no consensus on the definition of the concept of motivation in the literature. This lack of consensus is due to the complex and multifaceted nature of this psychological construct. Nonetheless, most researchers focus on what specific factors conjure up to bring learners' motivation into play. For instance, Ellis (1994), in an overview of research on motivation, claims that motivation affects the extent to which language learners persevere in learning, the types of behavior they engage in and the actual achievement they manifest. Later, Ellis (2000, p. 75) states that "Motivation involves the attitudes and affective states that influence the degree of effort that learners make to learn a second language". Therefore, motivation is a crucial factor in successful language learning. This is further supported by Dornyei who contends that "Motivation has been widely accepted by both teachers and researchers as one of the key factors that influences the rate and success of second/foreign language (L2) learning." (1998, p. 117).

Other researchers consider motivation as a process and link it to goal-driven activities. Pintrich & Schunk (1996,), for example, define it as "the process whereby goal-directed activity is instigated and sustained."(p. 118) Dornyei (1998) shares this same view in considering motivation a process, and adds the feature of force to this complex construct which he defines as "[A] process whereby a certain amount of instigation force arises, initiates action, and persists as long as no other force comes into play to weaken it and thereby terminate action, or until the planned outcome has been reached." (p. 118). In another article, Dornyei & Otto expand on the definition of motivation by stating that

> In a general sense, motivation can be defined as the dynamically changing cumulative arousal in a person that initiates, directs, coordinates, amplifies, terminates, and evaluates the cognitive and motor processes whereby initial wishes and desires are selected, prioritized, operationalized and (successfully or unsuccessfully) acted out" (1998, p. 65)

Gardner (1985), another pioneering figure in research on motivation, developed a model of language learning motivation called the socio-educational model based on social psychology. According to this model, L2 motivation is defined as "the extent to which an individual works or strives to learn the language" (p. 10). Gardner also asserts that "motivation […] refers to the combination of effort plus desire to achieve the goal of learning the language plus favourable attitudes toward learning the language." (p. 10). This means that motivation is a construct which combines different factors including effort, desire, goal and attitude. As a psychological construct, motivation takes different orientations as highlighted by the literature (Gardner, 1985; Schmidt, Boriae, & Kassabgy, 1996; Ehrman, 1996; Green, 1999). Four main orientations (intrinsic/extrinsic and integrative/instrumental) have particularly been focused on in research (Gardner, 1985) including the present study.

To sum up, motivation can be considered as a complex process that results from an inner drive or strong desire to achieve a certain goal through favorable attitudes.

3. Language learning strategies and motivation

As mentioned above, the relationship between LLSs and motivation is an issue that has raised the interest of many L2 researchers from different contexts yielding mixed findings as shown in the studies reported below. Hence in the present study the researchers' interest in contributing to this line of research among a specific EFL population in the Moroccan higher education context.

To start with, Oxford & Nyikos (1989) conducted a study in which they highlighted the effects of motivation on strategy use by surveying 1,200 students studying various languages in a Midwestern American university in order to examine the kinds of language learning strategies the students reported using. According to their findings, the degree of expressed motivation was found to be the most influential variable affecting the participants' strategy choice. Another study was conducted by Liao (2000) on Taiwanese junior high school EFL students whose findings showed that these students lacked deep motivation to learn English, and when they happened to be motivated, they tended to be extrinsically oriented. Results also revealed that the majority of those students did not frequently report using a wide range of LLSs categories.

Hence, their low English-learning motivation was significantly correlated with their low use of learning strategies.

Like Liao, Peng (2001) explored the relationship between EFL learning motivation and strategy use among a total of 326 senior high school Taiwanese students. Significant differences were found between strategy use and each motivational aspect especially, motivational intensity, intrinsic motivation, extrinsic motivation, and requirement motivation. The latter was significantly but negatively correlated with strategy use, as well as with learners' achievement. Therefore, high school students who were forced to study English (requirement motivation) used strategies significantly less often and performed more poorly than those who were motivated to learn English either intrinsically or extrinsically. In another study carried out by Chang & Huang (1999), intrinsic motivation was found to significantly correlate with language learning strategies, more particularly with cognitive and metacognitive strategies. Pong's (2002) study, on the other hand, revealed that extrinsic motivation significantly correlated with cognitive and affective strategies, while intrinsic motivation correlated significantly with cognitive and metacognitive strategies, a finding which corroborates Chang and Huang's results.

Based on the findings reported above, it can be concluded that motivation as a psychological construct does have an impact on the use of LLSs. However, such an impact operates in differential ways, in that different types of motivation influence different types of strategies in different learning contexts.

II.   Research methodology
1. Objectives
The present study has two main objectives:
> (1) examine the overall use of language learning strategies by Moroccan university EFL Science students and the specific types of strategies they use in the learning process of English.
> (2) find out how the variable of motivation relates to the self-reported use of language learning strategies.

2. Research questions and hypothesis
Based on the above objectives, the present investigation attempts to answer the following questions:

> (1) What are the types of language learning strategies Moroccan university Science students use in their EFL learning process?
> (2) How does motivation relate to Moroccan university EFL Science students' use of language learning strategies?

The second research question can be reformulated into the following hypothesis: 'More motivated Moroccan university EFL Science students make a more frequent use of different types of language learning strategies than less motivated ones'.

3. Participants

This study focuses on Moroccan university EFL Science students enrolled at the Faculty of Sciences, Mohammed V University as the target population for investigation. A stratified random sample of 228 students was drawn from six fields of study as table 1 below demonstrates:

Table 1*Summary of biographical data of the subjects*

Academic major	Gender		Age range
	Female	Male	
Computer Science	16	19	18 – 28
Mathematics	8	14	19 – 21
Biology	27	25	18 – 23
Geology	13	7	19 – 22
Physics	22	27	18 – 25
chemistry	26	24	19 – 23
Total	112	116	18 – 28

4. Data collection instruments

To investigate students' use of LLSs, the researchers adopted and adapted Oxford's (1989) Strategy Inventory for Language Learning (SILL version 7.0) designed for ESL/EFL contexts. The SILL is a 5-point Likert-scale measurement which is composed of six categories of learning strategies divided into two broad categories: direct strategies which contribute directly to language learning and include memory, cognitive and compensation strategies; indirect strategies which help in language learning, but do not contribute directly to the learning process and include metacognitive, affective and social strategies. The original version of the SILL consisting of 50 items was administered in the piloting stage to test its reliability and validity. Based on the piloting results, 12 items were added to the original SILL to fit the first objective of the study: exploring LLSs used by Moroccan university EFL Science students.

The SILL was chosen because it is considered the most efficient and comprehensive tool to assess the frequency of language learning strategy use worldwide. As claimed by Ellis (1994), it is "the most comprehensive classification of learning strategies to date" (p. 539). This is supported by Oxford & Burry-Stock (1995) in the following statement "According to research reports and articles published in the English language within the last 10-15 years, the SILL appears to be the only language learning strategy instrument that has been extensively checked for reliability and validated in multiple ways" (p. 4). The two authors also assert that "the content validity of the SILL is very high" (p. 7), and that "ESL/EFL SILL strategy frequency is related ... to language performance in a number of studies, thus providing validity evidence for the SILL as a strategy instrument" (Oxford & Burry-Stock, 1995, p. 10). Another reason for choosing the SILL is that it lends itself to statistical analysis such as correlations, ANOVA, MANOVA, regression analysis … etc. On the other hand, in order to serve the purposes of the present study, and allow participants to feel more comfortable filling in the questionnaire to ensure the validity of the collected data, the SILL was translated into French (the language of instruction for science subjects in Moroccan universities).

Concerning the second major variable of the study 'motivation', the questionnaire used to collect data was adapted from different sources including Gardner's (2004) AMTB (Attitude/Motivation Test Battery) questionnaire, Pintrich et. al.'s (1991) MSLQ (Motivated Strategies for Learning Questionnaire), and Schmidt & Wattanabe (2001). The final version administered to the participants included four types of motivation namely integrative, intrinsic, instrumental and extrinsic; and contained 28 items in total measured on a 5-point Likert-scale ranging from 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, to 5= strongly agree. The motivation questionnaire was also translated and administered in French for the same reasons mentioned above.

5. Data collection procedures

Data collection took place after getting permission from the dean of the faculty of Sciences-Rabat, the teachers' consent to allow the researchers into their classes, and the students' consent to take part in the study. The two questionnaires were then administered in one shot for two main reasons. First, to ensure availability of the same participants to fill in both questionnaires so that the data collected would be valid. The second reason is that the teachers were reluctant to spare another session for a second round of data collection. The administration of the two questionnaires to sub-groups belonging to six different academic majors took about two weeks, and completion of both questionnaires took about one hour (35 - 40 minutes to complete the SILL and 20 - 25 minutes to complete the motivation questionnaire). Prior to distributing the questionnaires, it was necessary first to assure the participants of the confidentiality of their answers that the latter would exclusively serve research purposes, and would have no impact on their grades. Then the study objectives were explained to them followed by clear instructions on how to fill in the questionnaires. Students were also invited to ask for clarification if they encountered any difficulties understanding the instructions or the questionnaire items.

6. Data analysis procedures

Collected data was then submitted to statistical analysis using SPSS version 21. First the two questionnaires were tested for reliability through the Cronbach's Coefficient Alpha for Internal Consistency Reliability and for validity through Factor Analysis. Then a test of normal distribution of the data was conducted generating histograms with normal curves to test for normality of distribution and decide on which statistical technique to use. As the data were found to be normally distributed, it was decided to use parametric tests. Thus, descriptive statistics were run to explore the nature of the data and answer the first research question concerned with the types and frequency of LLSs use. To explore the relationship between motivation and LLSs (research question2) a Pearson's Product Moment Correlation was used.

6.1 Normal distribution of the data

The data of the present study is normally distributed as the following two graphs show:

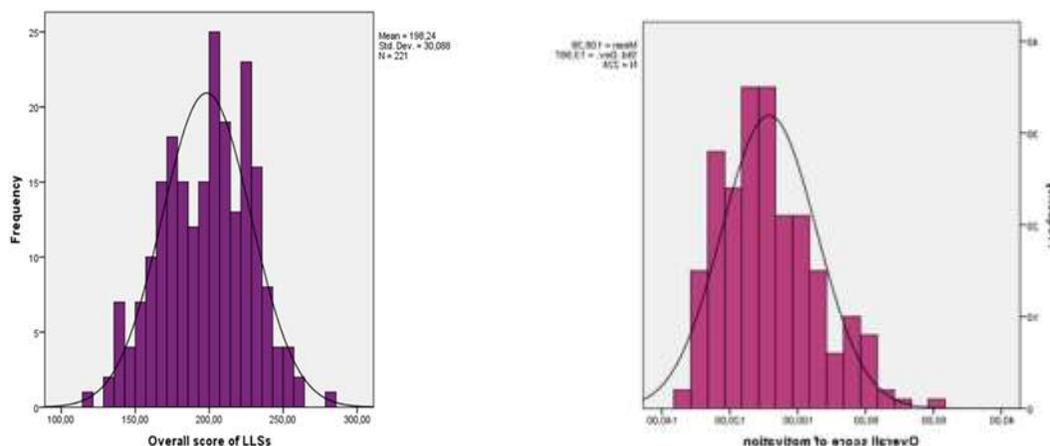*Figure 1* **Normal distribution of the SILL and the motivation questionnaire**

Figure 1 demonstrates two histograms with a bell-like shaped curve representing normal distribution of the scores of the SILL and the motivation questionnaire. This allows for the selection of the parametric test of Pearson correlation to explore the relationship between the LLSs and motivation since there are hardly any significant outliers.

6.2 Reliability and validity
6.2.1 Reliability of the SILL

Table 2*Reliability of the SILL items*

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.919	.922	62

Table 2 shows that the SILL reached a high Cronbach's Alpha Coefficient (.92). This is an excellent coefficient for internal consistency reliability. Interestingly, a similar result was achieved by Fazeli (2012) who found a reliability coefficient of .89 for the SILL translated into Persian, and Demirel (2009) who found a reliability coefficient of (.92) for the Turkish version. Similar Cronbach's Alpha results were also found by Yang (1992), Liao (2000) and Liu (2004) who translated the SILL into Chinese and found Alpha coefficients for reliability of .94, .96 and .94 respectively.

6.2.2 Reliability of the motivation questionnaire

The same measure was applied to the motivation questionnaire as shown in the following table.

Table 3*Reliability of the motivation item*

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.890	.899	28

Similarly to the SILL questionnaire, the motivation questionnaire reached a high level of internal consistency reliability with an Alpha Coefficient of .89. Other researchers who adopted the SILL questionnaires also measured the motivation construct and reached acceptable reliability. Examples of such cases are Chang & Liu (2013) whose Chinese version of the motivation questionnaire reached .90; and Nikoopour, Salimian, Salimian & Farsani (2012) whose Farsi version reached a reliability coefficient of .82

6.2.3 Validity of the SILL

Despite the fact that the SILL was validated in a number of previous studies, it was decided to test its construct validity. The reason is that it was translated into French and modified by adding 12 items to the original version consisting of 50 items. The French version was thus submitted to Factor Analysis technique, specifically Principal Component Analysis, using SPSS Version 21, to find out whether it still adheres to the six factors displayed in the original one. Results revealed the presence of the six factors in the French version of the SILL, hence its construct validity.

6.2.4 Validity of the motivation questionnaire

Factor Analysis technique was also conducted on the motivation questionnaire to test its construct validity since it was adapted from different standardized and well-validated sources, basically Gardner's (2004) AMTB questionnaire, Pintrich *et al.*'s (1991) MSLQ, and Schmidt & Watanabe (2001). Again, the Factor Analysis output revealed the presence of the four dimensions of motivation investigated in this study, hence the construct validity of the questionnaire.

III.   Results

To answer the first research question concerning the type and frequency of LLSs employed by Moroccan University EFL Science students, descriptive statistics were used mainly to find out means and standard deviations.

Table 4 displays means and standard deviations (SDs) of overall LLSs use and the use of each of the six individual categories as represented in the SILL. The overall mean score of LLSs is 3.15 (SD=.46) suggesting that Moroccan university EFL Science students are generally medium strategy users according to the assessment criteria set forth by Oxford & Burry-Stock (1995) which consider means of 3.5 – 5.0 as high strategy use; 2.5 – 3.4 as medium strategy use; and 1.0 – 2.4 as low strategy use (p. 12)

Table 4: *Means and SDs of overall LLSs and the six strategy categories*

Mean scores of language learning strategies			
	N	Mean	Std. Deviation
Overall mean score of language learning strategies	228	3.15	.46
Memory strategies	228	2.99	.60
Cognitive strategies	228	3.31	.59
Compensation strategies	228	3.39	.57
Metacognitive strategies	228	3.31	.70
Affective strategies	228	2.87	.68
Social strategies	228	3.04	.77

Concerning the six individual categories of LLSs, they also fall in the medium range. The participants reported using compensation strategies at a mean frequency of 3.39 (SD=.57), followed by cognitive and metacognitive strategies at the same mean frequency of 3.31 with SD=.59 and SD=.70 respectively. Then, social strategies were reported with a mean frequency of 3.04 (SD=.77). Memory (M=2.99, SD=.60) and affective strategies (M=2.87, SD=.68) were reported at a lower level than the other strategies.

Table 5 displays means and standard deviations of overall motivation and the four motivational orientations as represented in the motivation questionnaire. To interpret the mean scores of motivation, the same scale suggested by Oxford & Burry-Stock (1995) for interpretation of LLSs was used. Thus, the overall mean score of motivation obtained is 3.86 (SD=.49) suggesting that Moroccan university EFL Science students are highly motivated.

Table 5: *Means and SDs of overall motivation and four motivational orientations*

Mean scores of motivation			
	N	Mean	Std. Deviation
Overall mean score of motivation	228	3.86	.49
Integrative motivation	228	3.90	.72
Intrinsic motivation	228	3.98	.72
Instrumental motivation	228	4.25	.55
Extrinsic motivation	228	3.32	.58

As the table shows, the four motivational orientations fall within the high range except for extrinsic motivation. Thus, Moroccan university EFL Science students display a high level of instrumental motivation (M=4.25, SD=.55), followed by intrinsic motivation (M=3.98, SD=.72) and integrative motivation (M=3.90, SD=.72). However, extrinsic motivation falls within the moderate range with a mean score of 3.32 (SD=.58)

Based on the second research question, it was hypothesized that more motivated Moroccan university EFL Science students would use LLSs more frequently than less motivated ones. To crosscheck this hypothesis, a Pearson's Product Moment Correlation was run. Before generating the correlation table, a Scatterplot was generated to check the linearity and direction of the correlation between the two variables.
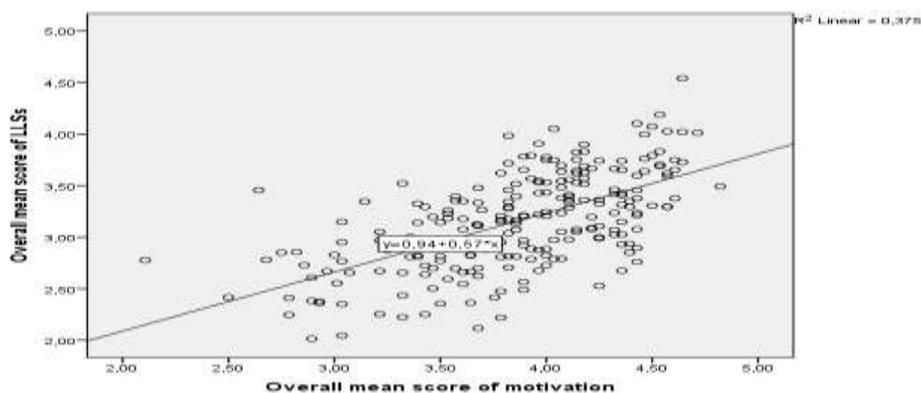
Figure 2: **Scatterplot of motivation and language learning strategies**

The scatterplot shows that the principle of linearity was respected. In other words, there is a positive relationship between motivation and LLSs. Thus, as scores of motivation increase, the scores of LLSs do increase too and vice versa. To interpret the correlation coefficients, the guidelines set forth by Cohen (1988, pp. 79-81) were adopted:

r=.10 to .29 indicates small correlation

r=. 30 to .49 indicates medium correlation

r=.50 to 1.0 indicates large correlation

Table 6*: Pearson's correlation between motivation and language learning strategies*

Correlation between motivation and LLSs		Language learning strategies	Motivation
Language learning strategies	Pearson Correlation	1	.612**
	Sig. (2-tailed)		.000
	N	228	228
Motivation	Pearson Correlation	.612**	1
	Sig. (2-tailed)	.000	
	N	228	228
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 6 displays a large correlation between motivation and LLSs. The two variables strongly and positively correlate r=.612, N=228, p<.0005 which is less than the significant level set at 0.01 (2-tailed). The coefficient of determination R^2=.3745 suggests a 37.45% of shared variance between motivation and LLSs.

To explore relationships between the four dimensions of motivation and the six categories of LLSs, there was a need to create a correlation matrix.

Table 7*Correlation matrix between the four dimensions of motivation and the six categories of LLSs*

Correlations between subscales of LLSs and subscales of motivation		Integrative motivation	Intrinsic motivation	Instrumental motivation	Extrinsic motivation
Memory strategies	Pearson Correlation	.300**	.311**	.349**	.294**
	Sig. (2-tailed)	.000	.000	.000	.000
	N	228	228	228	228
Cognitive strategies	Pearson Correlation	.404**	.502**	.392**	.206**
	Sig. (2-tailed)	.000	.000	.000	.002
	N	228	228	228	228

Compensation strategies	Pearson Correlation	.127	.078	.156[*]	.111
	Sig. (2-tailed)	.056	.239	.019	.093
	N	228	228	228	228
Metacognitive strategies	Pearson Correlation	.461[**]	.596[**]	.462[**]	.229[**]
	Sig. (2-tailed)	.000	.000	.000	.000
	N	228	228	228	228
Affective strategies	Pearson Correlation	.463[**]	.373[**]	.335[**]	.308[**]
	Sig. (2-tailed)	.000	.000	.000	.000
	N	228	228	228	228
Social strategies	Pearson Correlation	.439[**]	.410[**]	.292[**]	.208[**]
	Sig. (2-tailed)	.000	.000	.000	.002
	N	228	228	228	228
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

A quick look at the above matrix indicates that most of the strategy categories positively correlate with the motivational orientations at a medium level. Thus, the memory category is positively and significantly correlated with integrative, intrinsic and instrumental motivation at a medium level (r=.300; r=.311; r=.350, N=228, p<.0005 respectively); and exhibits a small yet significant correlation (r=.294, p<.0005) with extrinsic motivation. Cognitive strategies, on the other hand, highly correlate (r=.502, N=228, p<.0005) with intrinsic motivation, moderately correlate with integrative and instrumental motivation (r=.404; r=.392, N=228, p<.0005 respectively), and exhibit a small yet significant correlation with extrinsic motivation (r=.206, N=228, p<.002). Like cognitive strategies, metacognitive strategies are also highly correlated with intrinsic motivation (r=.596, N=228, p<.0005), moderately correlated with instrumental and integrative motivation (r=.462; r=.461, N=228, p<.0005 respectively); and display a small yet significant correlation with extrinsic motivation (r=.229, N=228, p<.0005). Compensation strategies' correlation with the four motivational orientations shows a totally different picture. Thus, while a weak and insignificant correlation exists between compensation strategies and integrative, intrinsic and extrinsic motivation (r=.127; r=.078; r=.111 respectively), a small but significant correlation (r=.156, N=228, p<.019) has been found with instrumental motivation. Finally, while affective strategies are moderately correlated with integrative, intrinsic, instrumental and extrinsic motivation (r=.463; r=.373; r=.335; r=.308, N=228, p<.0005 respectively); social strategies are moderately correlated with integrative and intrinsic motivation (r=.439; r=.410, N=228, p<.0005 respectively), and show a small but significant correlation level with instrumental and extrinsic motivation (r=.292, N=228, p<.0005; r=.208, N=228, p<.002 respectively)

To sum up, the correlation matrix displayed in table 7 shows that most of the four types of motivation correlate at a medium level with the six types of LLSs, except for intrinsic motivation which demonstrates a large correlation with cognitive and metacognitive strategies.

Besides, extrinsic motivation indicates a small correlation with all categories of LLSs except for affective strategies which moderately correlate with extrinsic motivation. Another pattern that emerges from the matrix is that the four motivation orientations show a small correlation with compensation strategies and a moderate correlation with affective strategies.

IV.   Discussion

The present study results show that Moroccan University EFL Science students are generally medium strategy users since their overall mean score of LLSs is 3.15 (SD=.46). This result is commensurate with similar studies carried out by other researchers in different contexts. Thus Alhaisoni's (2012) study indicated a medium frequency of LLS use (M=2.76, SD=1.23) for Saudi students; Su (2005) found that 419 Taiwanese vocational college students majoring in Applied Foreign Languages, used LLSs at a medium level (2.86). Similarly, Chand's (2014) research on a sample of 88 undergraduates Fiji students yielded an overall mean score which fell within the medium range of strategy use. On the other hand, Xu's (2011) study involving 284 Chinese graduates of non-English majors exhibited high use of overall LLSs (M=4.3).

One factor that may account for the participants' medium use of LLSs could be their limited exposure to English in real life situations allowing them few opportunities to interact directly with native speakers within English-speaking socio-cultural contexts. This indicates that the input they get from class or through exposure to different sources including the mass media (both broadcast and digital) is not sufficient to trigger the development of effective LLSs in the learning process in spite of their high motivation for learning English. Such results are indicative of the relevance of the learning strategy theory to the field of language learning. LLSs are supportive tools which allow students to be empowered in the learning process. They help them face the challenge of learning a foreign language, achieve autonomy and self-confidence and improve their linguistic proficiency. In this regard, Oxford (1990) states that "strategies are especially important for language learning because they are tools for active, self-directed involvement, which is essential for developing communicative competence. Appropriate language learning strategies result in improved proficiency and greater self-confidence" (p. 1).

Similar to the above results, the main patterns that emerged from the ranking of LLSs by category belong to the medium range. Thus, compensation strategies rank at the top followed by cognitive and metacognitive strategies, then social and memory strategies, and last affective strategies. A somewhat similar pattern emerges in Abu Radwan's (2011) study in which 128 Omani students reported metacognitive strategies as the highest, followed by compensation, cognitive, social and affective strategies as medium, and finally memory strategies as the lowest. Another study whose findings are close to those of this research is the one conducted by Lai (2009) on a sample of 418 EFL Taiwanese learners who used LLSs at a medium level with compensation strategies as the most frequent and affective strategies as the least frequent ones. The high frequency use of compensation strategies among Moroccan university EFL Science students is quite understandable. Students resort to compensation strategies such as gestures, synonyms, circumlocution, paraphrasing, or guessing the meaning of unknown words to fill in gaps in their communication due to deficiencies in their English proficiency. This preference for compensation strategies supports similar findings in studies carried out by Meshkat & Khanjani (2014), Lai (2009), Chen (2005) and Mochizuki (1999). Actually, these strategies are supportive tools EFL learners rely on to overcome their deficient communicative skills due to limited

exposure to English. Another factor which may explain this reliance on compensation strategies could be the learners' desire to use the new language in either comprehension or production despite their linguistic limitations.

Another interesting finding concerning LLSs is the participants' excessive use of cognitive strategies (e.g., practicing, analyzing, summarizing)which enable them to engage in manipulating and transforming the target language input, and provides evidence for the major role of these cognitive strategies in the learning process of a foreign language. Such strategies are deeply rooted in cognitive theories which view learning as an active and dynamic process in which learners process the input information in accordance with their background knowledge. Learning is based on thinking processes related to learning and remembering new information through organizing, elaborating and linking it with already existing one. This frequent use of cognitive strategies may also be due to the nature of the students' specialization in different fields of hard science which requires skills such as logical thinking, critical analysis, hypothesizing, problem solving, etc. Interestingly, students tend to make a simultaneous use of cognitive and metacognitive strategies as revealed by the results. The combination of both strategies is quite natural since metacognitive strategies are usually resorted to coordinate the learning process through organization, planning and regulation. Similar findings are reported by Peacock & Ho (2003) and Chang & Liu (2013) who discovered that participants in their respective studies also use cognitive and metacognitive strategies together, besides other learning strategies.

The Motivation factor turned out to play a greater role in the present study participants' English learning process. Results show a high degree of motivation with an overall mean score of 3.86 (SD=.49). This is in agreement with the results obtained by Domakani, Roohani & Akbari (2012) whose study on a sample of 152 Iranian EFL university students revealed a moderately high level of motivation and the use of LLSs at a medium level. Another slightly different study from the current one was carried out by Feng (2010) on 300 sophomores in Shandong Jianzhu University in China. Feng's study participants were motivated at a medium level (3.02) and their mean score of overall LLSs fell within the range of 2.50 and 3.40. Back to the present study, one reason that may explain the high degree of overall motivation exhibited by Moroccan students could be their awareness of the usefulness of learning English for both academic and professional purposes. One may assume that different learner needs and interests may result in different degrees of motivation and effort learners are willing to invest in the language learning process. In this regard, Cohen & Dornyei (2002) contend that "Motivation is often seen as the key learner variable because without it, nothing much happens. Indeed, most other learner variables presuppose the existence of at least some degree of motivation". (p. 172). Motivation thus seems to override all other factors underlying language learning.

Concerning the patterns of motivational orientations, they all belong to the high range except for one extrinsic motivation. Actually, the participants exhibited a high level of instrumental motivation, followed by intrinsic and integrative motivation, but only a moderate level of .extrinsic motivation. This result is somewhat similar to Yu's (2012) study in which 164 Chinese learners demonstrated a strong inclination towards instrumental and integrative motivation; and Domakani, Roohani & Akbari's (2012) study in which Iranian EFL students also exhibited a higher level of integrative and instrumental motivation. As mentioned earlier,

Moroccan students' motivational orientations may be accounted for by their awareness of the importance of developing their English proficiency for both research and career purposes. This makes them strive to learn the language in order to achieve these utilitarian goals. Likewise, their trend towards integrative motivation clearly expresses their desire to integrate with different foreign communities and be familiar with their cultures, which could only be achieved through a good level of English language proficiency. This integrative side of motivation is clearly reflected in the socio-educational model developed by Gardner (1985) who states that "languages are unlike any other subject taught in a classroom in that they involve the acquisition of skills or behaviour patterns which are characteristic of another cultural community" (p. 146)

The above results thus seem to confirm the hypothesis formulated at the outset of this study concerning the relationship between motivation and the use of LLSs. The Pearson's r Product-moment correlation shows that there is a linear and positive relationship between overall motivation and overall LLSs. Moreover, the findings also indicate generally moderate relationships between the four types of motivation and the six categories of LLSs. Two plausible explanations may account for this finding. First, given their high level of motivation, Moroccan university EFL Science students are more likely to invest the time and effort required to engage in strategy use since learning strategies are regarded as effort-driven behaviors. This explanation is supported by MacIntyre & Noels' (1996) conclusion that "students who feel more highly motivated will be more likely expend the effort needed to engage in strategy use" (p. 383). Second, this category of students, given the nature of their academic majors, may already have developed some learning strategies, hence their awareness that they are effective learning tools and readiness to learn more LLSs for the sake of improving their English learning. A number of previous studies have yielded similar results. For example, Chang & Liu (2013) examined the use of LLSs in relation to motivation by 163 EFL freshmen university students, and discovered that highly motivated students made significantly greater use of overall LLSs. Wu (2013) at Fooyin University in Taiwan revealed that motivation is of paramount effect on the use of vocabulary learning strategies; Feng's (2010) findings revealed a high correlation between overall motivation and overall strategy use. In the same vein, the studies carried out by Xu (2011) and Yu (2012) in the EFL Chinese context reached results which are consistent with those reported above.

As for the correlation between individual types of motivation and individual categories of LLSs among the present study participants, intrinsic motivation was found to correlate with all the strategy categories except for compensation strategies. This corroborates the findings provided by Ziahosseini & Salehi (2008) which revealed a positive correlation between intrinsic motivation and all categories of strategies except for the compensation category. The same conclusion is further confirmed by Ellis' (2001) research in which he maintained that intrinsically motivated language learners usually employ a variety of LLSs. Accordingly, intrinsic motivation seems to correlate with different types of strategies, especially the cognitive and metacognitive category. This is the case in the present study in which that students who are inherently interested in learning English use metacognitive strategies such as planning, organizing and evaluating the learning process; cognitive strategies related to "identification, grouping, retention and storage of language material, as well as strategies of retrieval, rehearsal and comprehension or production of words, phrases and other elements of the L2more frequently than other types of strategies (Schmitt, 2002).This finding is supported by Pintrich's (1999) who

contends that the use of metacognitive strategies to control learning is closely linked to motivation in general and self-regulated learning more particularly.

In connection with the above conclusion, the lack of correlation between intrinsic motivation and compensation strategies in the current study may be due to students' preference for higher order strategies such as cognitive and metacognitive ones which require deep analysis and engage them in a deeper thinking process. Besides, intrinsically motivated students may avoid compensating for their deficient English proficiency taking it as their duty to develop their language ability by facing the challenge of applying their linguistic input. These are risk takers who dare communicate in the target language to test their ability to convey the messages by their own means. On the other hand, extrinsic motivation results indicate a low but significant correlation with memory, cognitive and metacognitive strategies; a medium level correlation with affective and social strategies; but no correlation with compensation strategies. These results are similar to those concerning the relation between intrinsic motivation and LLSs, except that the correlation level is lower in the case of extrinsic motivation. This may be due to students' interest in learning English for its own sake rather than for any external factors.

Sadeghi (2013) conducted a similar study to explore the relationship between English learning strategies and motivational orientations. He found that only intrinsic orientation could predict LLSs use, in contrast to extrinsic orientation which failed to significantly correlate with LLSs. These findings support those of the present one concerning intrinsic orientation, but contrast in results concerning extrinsic orientation, since the present study indicated a significant yet low correlation between extrinsic motivation and LLSs. Nikoopour et al.'s study (2012) also examined the relationship between intrinsic/extrinsic motivation and LLSs use among 72 Iranian EFL upper-intermediate learners. They demonstrated that intrinsic motivation correlated positively with both metacognitive and cognitive strategies, moderately with memory and social strategies, and at a low level with compensation and affective strategies, while extrinsic motivation displayed weak negative correlations with LLSs.

The current study findings reveal a positive and significant correlation between instrumental and integrative motivation and the six categories of LLSs except for compensation strategies which correlate at a small but significant level with instrumental motivation. This is consistent with Manfred's (2007) study which was limited to the investigation of the relationship between motivation and metacognitive strategies. He found that the learners' use of metacognitive strategies was positively related to their levels of motivation, with the integrative type having a stronger relationship with strategy use than the instrumental type. Bonney, Cortina, Smith-Darden & Fiori (2008) also investigated the predictive power of integrative and intrinsic motivation in explaining the use of LLSs among a population of 694 students from 36 foreign language classrooms in a high school in the U.S.A. They found that integrative motivation is the best predictor of LLSs use in general, and of compensation, cognitive and collaborative social strategies in particular; and that intrinsic motivation did not correlate with any of the LLSs. This finding is partially in agreement with the present study except for compensation strategies which correlate neither with integrative nor intrinsic motivation. Three other studies whose findings show similarities with the present one are Feng's (2010) study in which instrumental motivation correlated with the six categories of LLSs; Sadighi & Zarafshan (2006) study conducted on a sample of 126 Iranian freshmen and seniors majoring in English Translation and Teaching

English which concluded that integratively motivated students used more strategies than instrumentally motivated ones; and Yu's (2012) study in which both integrative and instrumental motivation correlated with the six categories of LLSs, with integrative orientation revealing a stronger relation than the instrumental one.

To conclude this discussion, Moroccan university EFL Science students have been shown to be both intrinsically and integratively motivated. This is an interesting finding which is quite understandable as these two dimensions of motivation might overlap. In other words, in intrinsic motivation, students are moved to learn from within – there is no external force acting on them; while in integrative motivation, students are moved to learn due to a strong desire, which can be psychologically driven without any outside force, to identify with the target language community.Different reasons may explain this integrative orientation and its significant correlation with LLSs. For instance, and as mentioned earlier, even though Moroccan students are not in direct contact with the target language community in their immediate environment, they might still be tempted to identify with cultural and intellectual values associated with the English language. As argued by Dörnyei (2011), integrative orientation can involve the affective and interpersonal disposition of the students and their desire to interact without completely identifying themselves with the target culture. Another factor which might as well explain the correlation between integrative motivation and LLSs is the role of technological advancement which provides learners with rich sources of information that serve to bridge the gap between cultures, trigger openness on other ways of life and thinking and facilitate exchange between groups of different cultures. Finally, it is interesting to note that not only are Moroccan university EFL Science students intrinsically and integratively oriented, but instrumentally oriented as well. Students with instrumental motivation tend to have clear learning objectives. Learning English for them is a means to an end, and in order to achieve their instrumental goals, they try to use all types of strategies that they believe can scaffold their learning process. This might be one of the reasons why compensation strategies correlate with instrumental motivation in the present study, unlike the other types of motivation.

The above studies reveal both similarities and differences with the present one. Research thus has yielded mixed results concerning the issue at hand. This is not surprising given the complex nature of the two major concepts investigated by the study which contributes largely to the complexity of their relationship. This may raise the age-old chicken-and-egg question as to whether it is motivation which leads to the use of LLSs or the use of LLSs which enhances learners' motivation. This is reflected in Oxford and Nyikos' statement that "Not only does high motivation lead to significant use of language learning strategies…but high strategy use probably leads to high motivation as well" (1989, p. 295).

V.   Implications and Conclusions
This piece of research aimed at exploring the relationship between language learning strategies employed by Moroccan EFL Science students and their learning motivation. The quantitative analysis of collected data yielded findings which show that the students participating in the survey are medium strategy users and highly motivated English learners. The study results have also revealed a strong and positive correlation between their strategy use and motivation for English learning

Building on these findings, some pedagogical and research implications can be drawn. First, concerning pedagogical implications, strategy training seems to be imperative since students exhibited some degree of awareness of their learning strategies and their usefulness. Therefore, training them in strategy practice can be beneficial in making them aware of the most effective way of using those strategies to enhance their learning process and improve their English proficiency level. In fact, students majoring in non-English specialties need more scaffolding and training into how to apply strategies to learn English. Furthermore, motivation, as the study results indicate, is vital in language learning in general and in enhancing strategy use in particular. Thus, teachers need to boost their students' motivation level and strategy use by creating a positive learning environment in which students are provided with appealing language learning tasks and strategy training that enhance their enthusiasm for English classes. On the other hand, to help teachers respond to their students' needs, curriculum developers and textbook designers should base their materials on the language learning strategy theory. For example, they may design textbooks which include a variety of tasks that require students to use a wide range of motivational language learning strategies.

The present study findings suggest some research implications as well. One such implication is the need for an experimental research study to pin down exactly what types of LLSs are actually used, and whether training students in those strategies will yield beneficial results. Also, more variables such as learning styles, personality traits or language proficiency level need to be included in order to identify other factors that may influence the use of strategies. In addition, more research should be conducted on LLSs in Moroccan EFL context which combines both learners' and teachers' perceptions of LLS use with a focus on the learning strategies used by students and how they match the teaching strategies used by teachers. There is even a need for a research study to develop a strategy training model that can fit Moroccan students since the learning context is constrained by different socio-cultural factors. Moreover, the data collection methods should be varied to include interviews, verbal reports, think-aloud techniques…etc so that more unobservable strategies can be captured.

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