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The Relationship between Cognitive and Metacognitive Strategies, Age, and Level of Education

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ABSTRACT

The present research investigated the use of cognitive and metacognitive strategies by 60 young and 90 adult learners of different levels of education across different fields of study. The intermediate level young participants included junior-high and senior-high school learners between the ages of 14 and 17. The high-intermediate adult participants were university students from the fields of social sciences, humanities, and languages. The results of the Pearson product moment correlation indicated that there was a moderate, positive, and significant correlation between strategy types and reading performances. The results of a one-way ANOVA showed that the preferences for the cognitive and metacognitive strategies differed across levels of education. The findings offer implications for the classroom suggesting that foreign language learning involves more than the acquisition of the target language, as learners' develop cognitively, socially, and linguistically at the same time.

INTRODUCTION

The concept of learning strategies commands a central position in second language acquisition research. Despite the extent of research done in the area of incorporating language learning strategies into classroom practice, there are still some problems because there is no clear idea of their theoretical foundation. Rees-Miller (1993) identified this issue regarding the nature of cognitive strategies: "It is questionable whether they can be specified in terms of observable, specific, universal behaviors that could be taught to or assessed in students" (p. 681). Dörnyei and Skehan (2003) also illustrated this well:

> Nobody has examined the theoretical soundness of the concept of "learning strategy" critically, particularly in view of the fact that the definitions and conceptualizations offered in the L2 literature were rather inconsistent and elusive. (p. 608)

The fact that language learning strategies have been defined from various perspectives also introduces numerous problems in consolidating them. O'Malley and Chamot (1987), for instance, referred to strategies on the basis of information-processing theories of cognition, thereby approaching the concept from a cognitive perspective. Oxford (1990), however, defined

strategies as "the steps taken by the learner" (p. 1) which embraces both the behavioral and mental steps. Bachman and Palmer (1996) have referred to strategic competence as one of the components of communicative competence.

The ambiguity and vagueness underpinning the nature of language learning strategies leads to controversy regarding the various ways of perceiving them in different tasks under different conditions. Some scholars have related effective strategy use to the level of proficiency (Green & Oxford, 1995; Purpura, 1998; Fan, 2003; Oxford, Cho, Leung, & Kim, 2004), others have identified the effectiveness of conscious strategies in language teaching (Carrell, 1985; Dörnyei & Malderez, 1997; Griffiths & Parr, 2001; Griffiths, 2007), and still others believe that strategies can be used either consciously or subconsciously (Chamot, 2005).

Thus, there seems to be a number of unresolved issues and questions that undermine the theoretical basis of learner strategy research. These problems all relate to the shaky foundation of the construct labeled a *learner strategy*, or to the lack of a consensus as to the unit of analysis for learner-strategy research (Macaro, 2006). These controversies in the field have led to a number of studies which have been aimed at reaching a consensus on the reality of strategies in different areas. One of the areas that has attracted much of the attention of researchers in the investigation of the role of strategies is reading skill. Learners tend to apply a variety of strategies while reading in order to make sense of the text. Cognitive (e.g., making predictions, translating, summarizing, linking with prior knowledge or experience, applying grammar rules, and guessing meaning from contexts) and metacognitive (e.g., self-management or self-regulation, planning, and monitoring strategies) strategies are the two most important strategies that are required to achieve an understanding of the text in the sense that learners need to not only notice their thinking, but also to plan and evaluate their processes. Cognitive and metacognitive strategies, then, help learners read independently and remember what they have read.

LITERATURE REVIEW

Language learning strategies have long been associated with effective language learning (O'Malley & Chamot, 1987; Green & Oxford, 1995; Cohen, 1998; Hsiao & Oxford, 2002). Chamot (2005) identified the importance of strategies considering two reasons: First, strategies, when used by learners, help teachers get insights into the metacognitive, cognitive, social, and affective processes involved in language learning. Second, strategies help teachers understand the knowledge base of learners toward helping the less successful in learning new strategies. In a recent paper on the important assumptions that teachers need to take into account in teaching language learning strategies, Swan (2008) has suggested that teachers need to involve problem-oriented strategies in their classrooms which require conscious attention, and which are not employed automatically with all learners without teaching (p. 265).

Classification of Language Learning Strategies

Language learning strategies have been classified by many linguists. Cohen and Dörnyei (2002, pp. 171-190) made three general distinctions which they thought to be helpful in understanding the nature of strategies: language learning strategies refer to the conscious and semi-conscious thoughts and behaviors used by learners with the explicit goal of improving their

knowledge and understanding of a target language. Second, language-use strategies refer to using the language that has been learned, which involves the following subcategories:

- Retrieval: to call up language material from storage.
- Rehearsal: to practice target language structures.
- Communication: to extend the students' communicative means beyond the constraints of target-language proficiency.
- Cover: to create an appearance of language ability so as not to look unprepared.

The third category of strategies in the general distinction made by Cohen and Dörnyei is *self-motivating strategies*, "which learners can use to increase or protect their existing motivation" (pp. 178-179).

One of the most comprehensive and detailed classifications is that of O'Malley and Chamot (1987). O'Malley and Chamot have made a three-way categorization:

1. Metacognitive strategies: These involve executive processes in planning for learning, monitoring one's comprehension and production, and evaluating how well one has achieved a learning objective.
2. Cognitive strategies: The learner interacts with the material to be learned by manipulating it mentally (as in making mental images or relating new information to previously acquired concepts *or* skills) or physically (as in grouping items to be learned in meaningful categories or taking notes on or making summaries of important information to be remembered).
3. Social-affective strategies: The learner either interacts with another person in order to assist learning, as in cooperation or asking questions for clarification, or uses some kind of affective control to assist learning. (pp. 241-242)

Another categorization is that of Oxford (1990) that was primarily based on the model proposed by O'Malley and Chamot (1987). The difference was that Oxford introduced and added certain other strategies to her model, namely, memory and compensation strategies. Oxford and Burry-Stock (1995) introduced these components as the following:

1. Memory strategies, such as grouping, imagery, rhyming, and structured reviewing.
2. Cognitive strategies, such as reasoning, analyzing, summarizing (all reflective of deep processing), as well as general practicing.
3. Compensation strategies (to compensate for limited knowledge), such as guessing meanings from the context in reading, and listening and using synonyms and gestures to convey meaning when the precise expression is not known.
4. Metacognitive strategies, such as paying attention, consciously searching for practice opportunities, planning for language tasks, self-evaluating one's progress, and monitoring error.
5. Affective (emotional, motivation-related) strategies, such as anxiety reduction, self-encouragement, and self-reward.
6. Social strategies, such as asking questions, cooperating with native speakers of the language, and becoming culturally aware. (p. 5)

Age and Stages of Learning or Schooling

Research on strategies has focused on two broad areas: learning strategies and communication strategies. In learning strategies the learner makes attempts to establish competence in the target language, whereas in a communication strategy the difficulty of the moment is to be solved. Looking at learning strategies from the linguistic perspective, a contradiction can be identified. The universal hypothesis claims that second language acquisition happens naturally, without mental effort on the learner's part. Consequently, learning strategies reflect what happens in cases of instructed SLA, or, in Krashen's (1985) terminology, while learning (not acquiring subconsciously) the target language. On the other hand, research on communication strategies does not take acquisition into consideration, but aims to find out how learners manage to solve their problems in certain situations.

Development of learning strategies in children has not been widely researched, as this is a relatively new area of inquiry. But in studies conducted so far, researchers have examined the use of strategies by young or adult learners and reached different conclusions regarding whether younger learners adopt different sets of strategies in comparison to older learners (Chamot & El-Dinary, 1999; Wharton, 2000; Nikolov, 2005, 2006). Gu, Hu, and Zhang (2005) investigated the use of strategies by primary school learners, and pointed to the difficulties associated with this research (such as learners' difficulties in verbalizing their mental processes while performing a language task) and thus leading to the existence of only a few empirical studies.

In my experience, the younger the learners, the less learning strategies they use, as they tend to rely on naturalistic processes of acquisition. As schooling progresses, children develop their learning skills, and the use of learning strategies increases. Some of the strategies are borrowed from other subject areas, and they cannot be regarded as specific language learning strategies. Other strategies are closely related to FLL, and can be identified as language learning strategies.

Subject Domain

It has been suggested that subject domain also contributes to the FLL process and that learners' use of strategies is affected by it. The real difficulty results from the difference between learners' needs and purposes at the time of learning the language and their future task needs in relation to the subject they study. One of the most influential studies in relation to career and strategy use is that of Politzer and McGroarty (1985): They found that learners of specialization (engineering/science vs. social science/humanities) outperformed in the use of strategies. Another study demonstrating the effect of career has come from Peacock and Ho (2003). Among the learners of eight disciplines (building and construction, business, computer studies, engineering, English, math, primary education, science), learners of English demonstrated the highest frequency of strategy use, especially cognitive, metacognitive, and social strategies.

RESEARCH METHODOLOGY

Research Questions

In line with the different studies conducted in this area and in order to understand the use of cognitive and metacognitive strategies by the learners' of different ages and educational levels across disciplines, the following three research questions were proposed:

1. Is there any relationship between age (young vs. adult learners) and the use of cognitive and metacognitive strategies?
2. Is there any difference between the learners' level of education and the use of cognitive and metacognitive strategies?
3. Is there any difference between the learners' field of study and the use of cognitive and metacognitive strategies?

Participants

The participants of this study were two main groups: adult and young learners. The adult learners were 30 language students at the University of Tehran, and 60 non-language learners (30 from humanities studies at Azad University and 30 from social sciences at the University of Tehran) between the ages of 20 and 30. The young learners were 30 males at Abouzar Junior-High School, and 30 females at Shahid Samiee Senior-High School, all between the ages of 14 and 17. (For the purpose of consistency, the two schools were government schools.) All of the participants were native speakers of Persian learning English as a foreign language.

The adult participants were all in the high-intermediate levels of English, and the young participants were all intermediate. The language proficiency test used for determining the level of proficiency of learners was the paper-based version of the Test of English as a Foreign Language (TOEFL Preparation Kit, 2003). The test did not include the listening comprehension questions, because the scope of this study did not include testing the participants' level of listening comprehension. The results of the test at each level are presented at in Table 1.

Table 1. TOEFL Test Results

	Mean	Standard Deviation
Intermediate	31.95	2.22
High-intermediate	46.12	2.20

Instrumentation

Three instruments were used in this study to elicit data on learners' language learning strategies and their reading-comprehension performance.

The Strategy Inventory for Language Learning (SILL)

The instrument that was used for eliciting data on learners' strategies is version seven of the Strategy Inventory for Language Learning (SILL). This version of SILL (1989) is a questionnaire developed to assess the frequency of strategy use by non-native speakers (ESL/EFL, 50 items) which consists of the following subscales (strategies): memory, cognitive, compensation, metacognitive, affective, and social strategies (Oxford & Burry-Stock, 1995). In the present study only the cognitive and metacognitive sections were administered to the learners. These sections were translated into Persian in order to prevent difficulties rising from misunderstanding the language of the questionnaire. The SILL returned a single score for cognitive and a single score for metacognitive strategy use, with a higher score indicating greater

use. The reliability of the SILL questionnaire was computed using the Cronbach Alpha method which turned out to be 0.82, indicating a high reliability coefficient.

Reading Tests

Two types of reading-comprehension tests were administered to the participants in this study with regard to their age. The TOEFL test was administered to the adult university learners because they were assumed to have the required capacity to understand the TOEFL passages. The reading comprehension questions required the learners to provide answers to the questions related to the text. There were a variety of questions, including main-idea questions, detail questions, and implied-detail questions. The young participants in this study, however, were given the KET (Key English Test, 2006) which was more appropriate for their proficiency level. The KET test included two reading-comprehension passages, three matching questions, and one fill-in-the-blank question. The reliability of both the TOEFL and the KET was computed using the Cronbach Alpha method. The reliability of the TOEFL turned out to be 0.75 and the reliability of the KET was 0.78.

Procedure

The data on the performance of the learners in the reading comprehension test along with their strategy preferences were collected in one session in which participants were given instruction on how to answer the questions. Immediately after the completion of the comprehension test, they were asked to report their employed cognitive and metacognitive strategies in the Strategy Inventory for Language Learning (SILL). They were asked to chose the answers that were most related to them which ranged from *never* or *almost never true of me,* to *usually not true of me*, *somewhat true of me*, *usually true of me*, and *always* or *almost always true of me*. Learners were required to complete the SILL questionnaire in ten minutes.

RESULTS

To achieve the objectives of this study, the following statistical procedures were conducted. For the first two research questions, the Pearson product moment correlation was used, and for questions two and three, the one-way ANOVA test was deployed.

Research Question #1: Is there any relationship between age (young vs. adult learners) and the use of cognitive and metacognitive strategies?

To find the answer to the first question of the study, a Pearson correlation coefficient was used. The correlation between the reading comprehension of the TOEFL test and the use of the cognitive strategies by the learners ($r = 0.369$) is significant at the 0.01 level ($p = 0.000 < 0.01$). The results of the analysis show that there is a moderate, positive, and significant relationship between the two variables of the study, that is, the reading performance of the adult learners in the TOEFL test is directly related to their use of cognitive strategies. A moderate, positive, and significant correlation of 0.380 ($p = 0.000 < 0.01$) was observed between the use of metacognitive strategies and adult learners' TOEFL scores.

Sixty young subjects performed on the reading-comprehension section of the KET test. The results indicate that there are moderate, positive, and significant correlations among strategy types and overall KET scores. Concerning reading comprehension in the KET and its relationship with cognitive strategies, there is a moderate, positive, and significant correlation ($r = 0.594$) at the level of 0.01 ($p = 0.000 < 0.01$). A similar result can be seen for the correlation between reading and metacognitive strategies ($r = 0.542$). The correlation is significant ($p = 0.000 < 0.01$).

Research Question #2: Is there any difference between the learners' level of education and the use of cognitive and metacognitive strategies?

The process of data analysis for the second research question began with computing the descriptive statistics of the participants of different levels of education on the use of cognitive and metacognitive strategies, the results of which are shown in Table 2.

Table 2. Descriptive Statistics for Cognitive and Metacognitive Strategy Use across Levels of Education

		n	Mean	Std. Deviation	Std. Error
Cognitive Strategy	Junior-High	30	2.6867	.75051	.13702
	Senior-High	30	2.4300	.72405	.13219
	University	90	3.1842	.84453	.06896
	Total	150	3.0054	.86280	.05954
Metacognitive Strategy	Junior-High	30	2.6833	.87181	.15917
	Senior-High	30	2.4967	.69752	.12735
	University	90	3.0855	.81382	.06645
	Total	150	2.9440	.83546	.05765

To examine whether differences exist between the students' strategy use and level of education, the results of SILL and the level of education of the subjects were statistically compared using a one-way ANOVA. This question investigated the possible differences between participants' use of strategies and their level of education. Table 3 presents the results of the use of strategies by all participants.

Table 3. ANOVA Results for Strategy Subcategory Differences across Levels of Education

		Sum of Squares	*df*	Mean Square	*F*	Sig.
Cognitive Strategies	Between Groups	17.776	2	8.888	9.490	.000
	Within Groups	137.809	147	.937		
	Total	155.585	149			
Metacognitive Strategies	Between Groups	11.046	2	5.523	6.022	.000
	Within Groups	134.835	147	.917		
	Total	145.881	149			

As Table 3 shows, preferences for cognitive strategy use differed significantly across the three levels of education ($F = 9.490$, $p = 0.000$), and metacognitive strategies had a significant effect in the same way ($F = 6.022$, $p = 0.000$). To discover whether there are differences among the means of groups with different levels of education, the test of Tukey was carried out. The results are shown in Table 4.

Table 4. Tukey Test Results for Cognitive Strategies

Level of Education	*n*	Subset for Alpha = 0.05	
		1	2
Junior-High	30	2.6867	
Senior-High	30	2.4300	
University	90		3.1842
Sig.		.331	1.000

As Table 4 shows, the junior- and senior-high school groups show up in the same column which means that the comparisons between the senior-high ($M = 2.43$, 95% confidence interval [CI]) and the junior-high school groups were not statistically significant at $p < 0.05$. However, the university group ($M = 3.1842$, 95% CI) appears in the second column which indicates that it is different from the other two groups in that it gave significantly higher preference ratings for the use of cognitive strategies than either of the high-school groups. To discover whether there are differences among the means of groups with different levels of education in the use of metacognitive strategies, the test of Tukey was carried out. These results are shown in Table 5.

Table 5. Tukey Test Results for Metacognitive Strategies

Level of Education	*n*	*Subset for Alpha = 0.05*	
		1	2
Senior-High	30	2.4967	
Junior-High	30	2.6833	2.6833
University	90		3.0855
Sig.		.549	.065

As Table 5 shows, university learners were different from both the junior- and senior-high school learners in their use of the metacognitive strategies.

Research Question #3: Is there any difference between the learners' field of study and the use of cognitive and metacognitive strategies?

The descriptive statistics for the differences in the use of cognitive and metacognitive strategies across the fields of study of the participants are reported in Table 6. The higher the mean, the greater the use of strategies.

Table 6. Descriptive Statistics for Cognitive and Metacognitive Strategy Use across Fields of Study

		n	Mean	Std. Deviation	Std. Error
Cognitive Strategies	Humanities	30	3.3467	.66785	.12193
	Languages	30	3.3977	.74710	.13640
	Social Sciences	30	3.4133	.75555	.13794
	Total	90	3.3859	.71696	.07557
Metacognitive Strategies	Humanities	30	3.2967	.79675	.14547
	Languages	30	3.1877	.73307	.13384
	Social Sciences	30	3.3667	.81762	.14928

The one-way ANOVA procedure lent support to the use of descriptive statistics, and the results of the ANOVA test for the cognitive and metacognitive strategies are shown in Table 7 below.

Table 7. ANOVA Results for Strategy Subcategory Differences across Fields of Study

		Sum of Squares	*df*	Mean Square	*F*	Sig.
Cognitive Strategies	Between Groups	.073	2	.036	.069	.933
	Within Groups	45.676	87	.525		
	Total	45.749	89			
Metacognitive Strategies	Between Groups	.488	2	.244	.398	.673
	Within Groups	53.381	87	.614		
	Total	53.869	89			

As can be seen in Table 7, the field of study of the participants had no correspondence with the type of cognitive strategies ($F = 0.069$, $p = 0.933$). The same findings hold true for the use of metacognitive strategies ($F = 0.398$, $p = 0.673$). Therefore, the students' major course of study made for no significant difference in the choice of cognitive and metacognitive strategies, that is, all the subjects of different fields used the cognitive and metacognitive strategies equally.

DISCUSSION AND CONCLUSIONS

The data of this study clearly shows that the participants had a substantial awareness and control of their cognitive activities while reading. The information provided by the participants demonstrated that L2 academic reading at the university level was a complex process in which they consciously and actively invoked a repertoire of metacognitive strategies. They used these

strategies to plan, monitor or control, evaluate, and remediate their comprehension while reading. Cognitive strategies, too, were frequently applied by participants in interacting with the text. The study provides empirical support for other research findings that cognitive and metacognitive strategies are crucial for L2 academic reading and also reveals some new points. Although some of strategies may emerge in the classroom naturally, most need to be developed through conscious tasks and activities.

Regarding the first question, there was a significant relationship between the age of the learners and their use of language learning strategies. This relationship was significantly moderate, positive, and direct either between the scores of the KET taken by the young learners or between the reading-comprehension scores of the TOEFL test taken by the adult learners. However, the relationship between the use of strategies by young language learners and their reading comprehension is as moderate as the relationship between the use of strategies by adult learners and their reading comprehension. This almost equal strength might be the result of the nature of the reading-comprehension test that the young participants had performed. Despite the format of the TOEFL reading-comprehension test consisting of only multiple-choice items, the test of KET includes tests of different kinds such as matching items, multiple choice items, and fill-in-the-blank items.

With respect to the type of strategies used, the findings of the present research show differences according to the level of education. The findings of this research show that Iranian university students in all fields of study employed more strategies in their reading of the passages than the high school students. However, the differences between the use of strategies across levels of education is not very high.

The findings offer implications for the classroom: The role of the teacher is very special in FLL contexts, as cooperating with the teacher substitutes for the aspect of cooperating with native speakers in Oxford's model (1990, p. 21) and in the SLA theory proposed by Wong-Fillmore (1991). Young learners accept the teacher as a language model, but this relationship changes over time. Cooperation with peers should be most frequently encouraged by the teacher through pair and group work.

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