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Exploring the Relationship between Learning Strategies, Academic Disciplines, and Reading Comprehension Test Performance

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Abstract

This study scrutinized the relationship between utilizing language learning strategies, academic fields, and reading ability in reading comprehension test performance of Iranian postgraduate EAP students. The participants were 947 students, who answered a reading comprehension test and a learning strategy questionnaire successively in one session. The gathered data were subjected to a set of parametric statistical analyses, including descriptive statistics, one-way analysis of variance, Tukey HSD and Duncan tests. The findings manifested significant differences among the participants in different fields in employing overall, direct, and indirect strategies. A statistically positive relationship was found between the participants' reading ability and use of overall, cognitive, compensation, metacognitive, and affective strategies. The findings reflected that the actual ability of language learners was significantly influenced by some nonlinguistic factors,

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and the observed scores did not represent their true ability. The findings can provide an empirical evidence for Bachman's (1990) as well as Bachman and Palmer's (1996, 2010) conceptual frameworks of language use due to the impact of nonlinguistic factors on language ability of L2 learners in test-taking process. The findings can help language teachers improve instructional reading programs, decrease error of measurement, and narrow the gap between more successful and less successful learners in different fields of study.

Keywords: Reading strategies; Strategic competence; Strategic reading; Communicative competence

Introduction

Most of the studies on second language reading have manifested that language learners often rely upon different sets of competencies while reading comprehension (e.g., Brantmeier, 2002; Saricoban, 2002; Scarcella & Oxford, 1992; Singhal, 2001). A close relationship between a set of competencies assists language learners in accomplishing a multitude of reading tasks. Four common sets of the competences identified by Scarcella and Oxford are: grammatical competence, sociolinguistic competence, discourse competence, and strategic competence. Among the mentioned competences, strategic competence has gained in popularity since the development of cognitive psychology in 1970s, which has encouraged many researchers to explore the strategic aspects of learning and test taking (e.g., Carson & Longhini, 2002; Cohen & Dörnyei, 2002; Dreyer & Oxford, 1996; Ehrman & Oxford, 1989; Peacock & Ho, 2003; Phakiti, 2003, 2008; Su, 2005).

In their conceptual frameworks of language use, Bachman and Palmer (1996, 2010) identified strategic competence as the central component, linking individual characteristics of language users to the characteristics of language use settings. The frameworks depict a relationship between language ability, topical knowledge, affective schemata, on the one hand, and a relationship between the mentioned components and the characteristics of language use settings through strategic competence, on the other.

Unlike previous descriptions of strategic competence, focusing on compensatory and enhancement functions (e.g., Canale, 1983; Canale & Swain, 1980; Farech & Kasper, 1983), Bachman (1990) described strategic competence as

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an essential dimension of communicative language ability, providing the means for relating language competence to the features of the context in which language use takes place and to the language user's knowledge structures. In Bachman's view, strategic competence and linguistic competence act as two major components of language ability, the combination of which provides language learners with the ability to create and interpret discourse in terms of the context requirements. Bachman and Palmer (1996, 2010) identified strategic competence as a set of strategies functioning in higher executive processes enabling individuals to recognize what information outside a certain discourse is relevant to accomplish required communicative tasks.

Although strategy research ranks among the most popular topics in applied linguistics, drawing a logical conclusion about the nature of strategic processing in light of Bachman and Palmer's (1996, 2010) conceptual frameworks is not often straightforward. There may be some plausible explanations for this issue. There are many schools of thought that have not explained theoretical concept of strategic competence in second language communicative ability (e.g. O'Malley & Chamot, 1990; Oxford, 1990). Furthermore, most studies have been oriented towards test development, rather than validating strategic competence theory (see Cohen, 1998, 2007). Despite the strong theoretical basis of Bachman and Palmer's classical frameworks, the models have not received serious attention. Only a limited number of researchers have examined systematically the interaction between the components of the frameworks (e.g. Phakiti, 2003, 2008; Purpura, 1998). However, the frameworks definitely merit further consideration by more researchers to clarify the complex relationship between linguistic and nonlinguistic components in different areas of language use. The frameworks can act as effective working models helping language teachers improve efficiency of language courses, decrease error of measurement, and interpret test scores reasonably to make a sound judgment on the actual ability of language learners.

As improving reading comprehension is of primary importance in most of English language teaching curriculums at the universities in Iran, the present study is an attempt to explore the relationship between reading ability and strategic patterns of language use in reading comprehension test performance of Iranian university students. In addition, as reading comprehension is of the essence for postgraduate students, who have to obtain academic information from English sources, the participants of this study were recruited from MA students doing EAP

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courses in different academic fields at different universities in Iran. The findings can be significant as the differences in the strategic patterns of postgraduate students in different academic fields at different levels of reading proficiency have been rarely explored systematically. In addition, as reading comprehension is of crucial importance in many English teaching programs, the findings can provide useful information helping policy makers, curriculum planners, syllabus designers, language teachers, and test designers tailor effective strategic-based instructional programs to the particular needs of language learners. The findings can remind language teachers of different factors affecting test scores, particularly systematic factors such as language learning strategies that are often ignored in many English teaching programs. Consequently, the findings can encourage language teachers to pay systematic attention to linguistic as well as strategic aspects of language learning to interpret test scores reasonably and decrease error of measurement.

Review of the Related Literature

Reading as a Strategic Process

Reading comprehension is a metacognitive process, in which many strategies are procedural, purposeful, and facilitative in nature (Alexander & Jetton, 2000). Readers with stronger metacognitive awareness are able to interpret a reading task more effectively in terms of context requirements. Effective readers select particular reading strategies in relation to reading purposes, task demands, and cognitive styles. They monitor the process of comprehension, evaluate the effects of selected strategies, and adjust the strategies when needed (Hudson, 2007). Cohen (2007) considered reading strategies as the mental processes readers consciously employ to accomplish reading tasks. Likewise, Gardner (1987) and Hudson (2007) regarded reading strategies as a series of actions a reader consciously employs to construct meaning in the process of reading comprehension.

Many researchers proposed that reading is an interactive meaning-making process, in which readers consciously capitalize on various available sources including a multitude of reading strategies to achieve a comprehension goal (e.g. Macaro, 2001; Macaro & Erler, 2008; Zhang, 2001, Zhang et al., 2008). Research on second language reading has manifested that second language readers generally draw on the same array of reading strategies in the process of reading comprehension. When individuals are reading, their reading processes range from

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lower level to higher level processing (Alderson, 2000). Lower level processing includes automatic recognition of word meanings, syntactic structures, and parts of speech requiring minimum of awareness (Segalowitz, 2003). However, optimal reading cannot be solely achieved through automaticity because conscious processing is also necessary. Readers often consciously control an extensive part of reading comprehension process through using reading strategies acting upon automatic process of reading (Cohen, 2005). Second language readers often encounter unfamiliar words, syntactic structures, and topics requiring conscious evaluation of alternative sources to overcome the difficulties. At this time, higher level strategic regulatory processing is activated to improve the speed and effectiveness of reading comprehension.

As the present study aims to explore the relationship between using learning strategies, reading ability, and academic disciplines in reading comprehension test performance, relevant empirical backgrounds are discussed.

Empirical Background

Relationship between Academic Disciplines and Use of Learning Strategies

The effect of academic major on the use of language learning strategies has been explored in the earlier studies (e.g., Gu, 2002; Oxford & Nyikos, 1989; Peacock, 2001; Peacock & Ho, 2003). The findings of most of the studies have demonstrated that the students majoring in the arts and humanities utilized a wider range of learning strategies than did the students majoring in basic sciences and engineering fields.

As an example, Oxford and Nyikos (1989) analyzed the differences in the use of learning strategies by 1200 EFL learners, majoring in Engineering, Computer Sciences, Physical Sciences, Social Sciences, Education, Humanities, and Business at a US university. The findings manifested that academic majors had significant effect on the frequency and type of language learning strategies utilized by language learners. The students of Social Sciences, Education, and Humanities used functional practice and resourceful independent strategies more frequently than did the students in the other fields.

Peacock (2001) explored the application of language learning strategies by 140 Science, Math, and Engineering students studying at City University of Hong

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Kong. The findings revealed that the students generally used cognitive and compensation strategies most frequently. Their academic major significantly affected the choice of certain language learning strategies. As an example, the students of Physics used cognitive strategies less frequently whereas the students of Mathematics used metacognitive strategies less frequently than did the other students.

In a more comprehensive study, Peacock and Ho (2003) scrutinized the use of 50 common language learning strategies by 1006 BA students majoring in eight academic disciplines at City University of Hong Kong. The academic disciplines were Building, Business, Computing, Engineering, English, Mathematics, Primary Education, and Sciences. The results indicated that overall strategies were used more frequently by the students majoring in English and less frequently by the students majoring in Computing. The students majoring in English differed significantly from the other students in using six subcategories of learning strategies. English students also used cognitive, metacognitive, and social strategies more frequently than did the other students.

Relationship between Level of Language Proficiency and Use of Learning Strategies

Language learning strategies play a crucial role in the process of learning a foreign language. Many researchers have equated in-depth language learning with adequate use of language learning strategies (e.g., Liu, 2004; Meschyan & Hernandez, 2002; Nisbet, et al., 2005). These researchers stressed a positive relationship between effective use of learning strategies and language ability of learners.

The positive relationship between use of language learning strategies and language ability of L2 learners has been justified by the researchers working on the strategic dimensions of reading comprehension in general settings of language use (e.g., Brantmeier, 2005; Coiro & Dobler, 2007; Dreyer & Oxford, 1996; El-Dib, 2004; Green & Oxford, 1995; Huang, et al., 2006; Ikeda & Takeuchi, 2006; Lan & Oxford, 2003; Ok, 2003; Shmais, 2003; Zhang, 2008; Zhang et al., 2008; Zhang & Wu, 2009). As an example, Zhang and Wu analyzed the frequency and type of learning strategies utilized by Chinese EFL learners through their reported description of reading comprehension process. The findings revealed a positive relationship between the learners' overall language proficiency and effective use of learning strategies. The findings also manifested that the learners with lower level

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of language proficiency considerably benefited from strategic-based reading instruction, which enabled them to think about their reading processes, identify their weaknesses, and take remedial measures.

Although many researchers have explored strategic dimensions of reading comprehension in general settings of language learning, the strategic processing of reading in EAP contexts have been rarely investigated systematically (e.g., Peacock, 2001; Peacock & Ho, 2003). The differences in the strategic patterns of EAP learners at different levels of language proficiency have been rarely explored systematically and are still matters for serious consideration. As improving academic reading ability is of primary importance in many EAP programs, particularly at the universities in Iran, systematic analysis of patterns of strategy use in comprehending reading texts is of considerable significance. The findings can help language teachers gain a better understanding of the strategic process of language learning and the differences among EAP learners with different language abilities in utilizing learning strategies. Although reading materials in EAP programs are usually designed based on specific linguistic and academic needs of the learners, little attention is devoted to designing particular strategic-based materials with regard to interdisciplinary differences. In practice, common strategic-based syllabuses are still used for teaching learning strategies to the students majoring in different academic disciplines at different levels of language proficiency. Due to lack of effective strategic-based instructional approaches, many EAP learners cannot benefit from the courses and suffer from deficient reading ability.

The Present Study

The present study attempts to examine interdisciplinary differences in utilizing language learning strategies among Iranian postgraduate EAP students at different levels of reading proficiency. The findings are compared and contrasted across 19 academic disciplines under three educational groups of Engineering, Basic Sciences, and Social Sciences. The findings are of significance because they can help syllabus designers and English teachers design effective strategic-based instructional programs based on particular needs of EAP learners bridging the linguistic and strategic gaps between more proficient and less proficient learners in different fields of study.

The questions addressed in this study are:

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One: Are there any significant differences among three educational groups of Engineering, Basic Sciences, and Social Sciences in using language learning strategies?

Two: Are there any significant differences among the participants in different academic disciplines in using language learning strategies?

Three: Is there any significant relationship between level of reading proficiency and use of language learning strategies by the participants?

To probe the research questions, the methodology and findings are discussed in the next sections.

Method

Participants

Initially, 1800 Iranian EAP students doing an MA in different academic disciplines participated in this study. Due to the participants' incomplete responses to the reading test and learning strategy questionnaire (research instruments), only the data recruited from 947 participants could be subjected to statistical analysis. Thus, the accessible sample consisted of 947 students majoring in 19 academic disciplines across three educational groups of Basic Sciences, Engineering, and Social Sciences. The participants were recruited from different branches of Islamic Azad University, including Mashhad, Neyshabur, Birjand, Isfahan, Tehran, Semnan, and Shiraz. The participants were also from Ferdowsi, Khayyam, Sajjad, and Payam e Noor universities of Mashhad. In addition, the participants were from national universities of Isfahan, Shiraz, Neyshabur, and Shahrud. The frequency and percentage of the participants across the academic disciplines and educational groups are manifested in Table 1.

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Table 1
Frequency and percentage of the participants across educational groups and academic disciplines

Educational Groups	Frequency	Percentage	Academic Disciplines	Frequency	Percentage
Basic Sciences	307	32.4	Chemistry	78	8.2
			Physics	30	3.2
			Mathematics	33	3.5
			Biology	130	13.7
Engineering	410	43.3	Geology	36	3.8
			Architecture	62	6.5
			Biomedical Engineering	31	3.3
			Civil Engineering	31	3.3
			Computer Engineering	47.0	4.9
			Information Technology Engineering	49	5.2
			Metallurgy Engineering	46	4.9
			Electrical Engineering	78	8.2
			Agricultural Engineering	32	3.4
			Mechanical Engineering	34	3.6
Social Sciences	230	24.3	Persian Literature	32	3.4
			Theology	31	3.3
			Accounting	50	5.3
			Management	86	9.1
			Political Sciences	31	3.3
			Total	947	100.0

The participants were classified under three levels of reading proficiency based on the standard deviations of their reading scores from the mean. Table 2 presents the frequency and percentage of the participants at three levels of reading proficiency.

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Table 2
Frequency and percentage of the participants

Levels of Reading Proficiency	Frequency	Percentage
Low	158	16.7
Intermediate	642	67.8
High	147	15.5
Total	974	100.0

Instrumentation

To probe the research questions, a reading comprehension test and a learning strategy questionnaire were employed in this study.

Reading Comprehension Test: A reading comprehension section of a TOEFL test (Longman, 2005), as an internationally valid proficiency test, was utilized in this study to measure the participants' reading comprehension ability. The test included five reading comprehension passages, followed by 50 multiple-choice items. Each test item carried one score. The test was piloted by a sample of 30 participants, who gave some feedback on the content and administration of the test. The reliability coefficient of the reading test, estimated against Kudar-Richardson Formula (KR-21), turned out to be 0.887. The time allotted to answer the test was 55 minutes.

Language Learning Strategy Questionnaire: The fifth version of Oxford's (1990) Strategy Inventory of Language Learning was utilized in this study to analyze the strategic patterns of the participants in comprehending reading texts. The questionnaire consisted of 50 English statements, contextualizing the use of six distinct subcategories of learning strategies, including memory, cognitive, compensation, metacognitive, social, and affective strategies. The first three subcategories of the strategies were classified under direct strategies, and the last three subcategories were classified under indirect strategies. The questionnaire was organized on a 5-point Likert scale, moving from never (1) to always (5).

Prior to actual administration of the questionnaire, it was piloted by a sample of 30 participants. The reliability coefficient of the entire questionnaire, estimated

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against Cronbach's alpha formula, turned out to be .889. The time allotted to complete the questionnaire was 20 minutes.

Procedures

The participants took the reading test and responded the learning strategy questionnaire successively in one session. Prior to taking the test and responding the questionnaire, the participants were fully briefed on the structures of the test and questionnaire. The participants were given 55 minutes to answer the reading test and 20 minutes to fill out the questionnaire.

Data Analysis

The statistical procedures used in the study were Cronbach's alpha, descriptive statistics, one-way analysis of variance, Tukey HSD and Duncan tests.

Results and Discussion

The findings of this study are reported and discussed in three subsections.

Relationship between Educational Groups and Use of Learning Strategies

To probe the first reseach question, concerning the significant differences among the participants of three educational groups in using language learning strategies, descriptive statistics were applied. The results are demonstrated in

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Table 3
Descriptive statistics for the use of learning strategies by three educational groups

Learning Strategies	Educational Groups	N	Mean	Std. Deviation
Overall Strategies	Basic Sciences	307	3.1303	.48951
	Engineering	410	3.0730	.43604
	Social Sciences	230	3.2151	.49808
	Total	947	3.1261	.47214
Direct Strategies	Basic Sciences	307	3.1648	.49202
	Engineering	410	3.1148	.45369
	Social Sciences	230	3.2655	.51859
		947	3.1676	.48574
Memory Strategies	Basic Sciences	307	3.1777	.57810
	Engineering	410	3.1046	.54796
	Social Sciences	230	3.3186	.58958
	Total	947	3.1802	.57376
Cognitive Strategies	Basic Sciences	307	3.1019	.53471
	Engineering	410	3.0704	.48773
	Social Sciences	230	3.2260	.59728
	Total	947	3.1184	.53441
Compensation Strategies	Basic Sciences	307	3.3058	.71662
	Engineering	410	3.2399	.70602
	Social Sciences	230	3.2815	.69851
	Total	947	3.2714	.70751
Indirect Strategies	Basic Sciences	307	3.0854	.58266
	Engineering	410	3.0195	.53838
	Social Sciences	230	3.1507	.59419
	Total	947	3.0727	.56864
Metacognitive Strategies	Basic Sciences	307	3.3935	.69943
	Engineering	410	3.2864	.62160
	Social Sciences	230	3.4886	.65586
	Total	947	3.3702	.66034
Affective Strategies	Basic Sciences	307	2.7348	.70764
	Engineering	410	2.6998	.67276
	Social Sciences	230	2.9679	.80216
	Total	947	2.7763	.72487
Social Strategies	Basic Sciences	307	2.9473	.77440
	Engineering	410	2.9122	.76306
	Social Sciences	230	2.8225	.80597
	Total	947	2.9018	.77795

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As revealed in Table 3, the mean score of the students of social sciences was the highest (M = 3.2151) whereas the mean score of the students of engineering was the lowest (M = 3.0730) in using overall strategies. The students of social sciences used direct as well as indirect strategies most frequently whereas the students of engineering used these strategies least frequently.

To probe the significant differences among the mean scores of three educational groups in using learning strategies, a one-way analysis of variance was applied. The results are presented in Table 4.

Table 4
One-way analysis of variance for the use of learning strategies by three educational groups

Learning Strategies		Sum of Squares	DF	Mean Square	F	Sig.
Overall Strategies	Between Groups	2.984	2	1.492	6.776	.001
	Within Groups	207.896	944	.220		
	Total	210.880	946			
Direct Strategies	Between Groups	3.351	2	1.675	7.193	.001
	Within Groups	219.848	944	.233		
	Total	223.199	946			
Memory Strategies	Between Groups	6.750	2	3.375	10.456	.000
	Within Groups	304.674	944	.323		
	Total	311.424	946			
Cognitive Strategies	Between Groups	3.693	2	1.846	6.540	.002
	Within Groups	266.477	944	.282		
	Total	270.170	946			
Compensation Strategies	Between Groups	.794	2	.397	.792	.453
	Within Groups	472.744	944	.501		
	Total	473.538	946			
Indirect Strategies	Between Groups	2.606	2	1.303	4.055	.018
	Within Groups	303.285	944	.321		
	Total	305.891	946			
Metacognitive Strategies	Between Groups	6.272	2	3.136	7.287	.001
	Within Groups	406.232	944	.430		
	Total	412.504	946			
Affective Strategies	Between Groups	11.370	2	5.685	11.049	.000
	Within Groups	485.696	944	.515		
	Total	497.066	946			
Social Strategies	Between Groups	2.124	2	1.062	1.758	.173
	Within Groups	570.404	944	.604		
	Total	572.529	946			

*The mean difference is significant at the 0.05 level.

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As manifested in Table 4, statistically significant differences were found among the mean scores of the participants in using overall strategies, F (2, 944) = 6.776, p = .001. Significant differences were also found among the mean scores of three educational groups in using direct strategies (2, 944) = 7.193, p = .001 as well as indirect strategies, F (2, 944) = 4.055, p = .018. The subsets of the mean scores of three educational groups in using overall strategies are presented in Table 5 through using Tukey HSD test.

Table 5

Tukey HSD test for the subsets of mean scores in using overall strategies

Educational Groups	N	Subset for alpha = 05	
		Mean Scores	Mean Scores
Engineering	410	3.0730	
Basic Sciences	307	3.1303	3.1303
Social Sciences	230		3.2151
Sig.		.296	.070

The mean difference is significant at the 0.05 level.

As presented in Table 5, the mean scores of engineering and basic sciences groups were not significantly different at p = .296. The mean scores of basic sciences and social sciences groups were not significantly different at p = .070. The mean scores of engineering and social sciences groups were significantly different at $p \leq .0.05$.

Figure 1 depicts the mean scores of using overall learning strategies by three educational groups.

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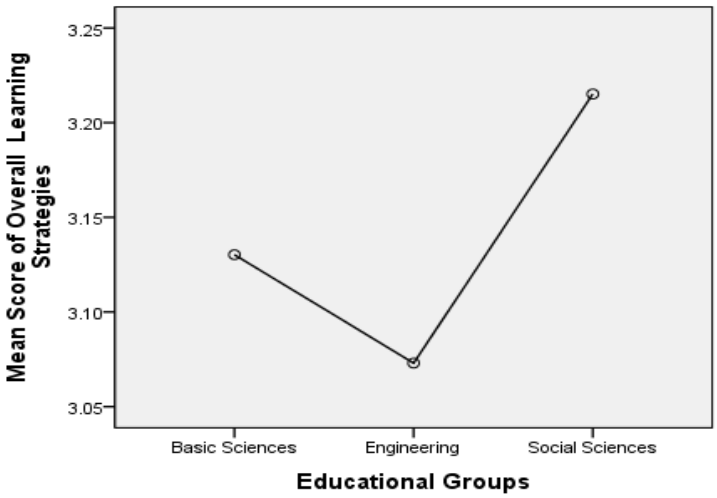

Figure 1: Relationship between educational groups and use of overall learning startegies

As illustrated in Figure 1, the mean score of the studens of social sciences was the highest wheras the mean score of the students of engineering was the lowest in using overal learning strategies. The mean score of the students of basic sciences was in-between.

The more frequent use of learning strategies by the students of social sciences has been confirmed in earlier studies (e.g. Oxford & Nyikos, 1989), discussed in the literature review in this study.

As the findings manifested, the students of social sciences used memory, cognitive, metacognitive, and affective strategies more frequently than did the students of basic sciences and engineering to comprehend English texts. In comparison, the students of basic sciences used compensation and social strategies more frequently. The strategic patterns of the students of basic sciences and engineering were very similar, but different from the strategic patterns of the students of social sciences. The similarity between the strategic patterns of the students of engineering and basic sciences may be due to similar academic genres of their reading materials. The academic texts used in basic sciences and

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engineering curricula include many distinguishing non-linguistic characteristics such as chemical formulas, mathematical equations, virtual recreations, symbols, graphs, tables, figures, diagrams, and other graphic representations. The use of hybrid genres or multimodal texts in basic sciences and engineering programs can greatly facilitate the process of comprehending academic materials. In contrast, the academic texts used in social sciences curricula contain a few pictorial aids, and most of the content information is delivered by language. Consequently, as the findings of this study reflected, the students of social sciences preferred to employ a variety of compensatory learning strategies to smooth the way for better comprehension.

Relationship between Academic Disciplines and Use of Learning Strategies

To probe the significant differences among the participants of different academic disciplines in using learning strategies, the main concern of the second research question, descriptive statistics were utilized. The results are demonstrated in Table 6.

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Table 6
Descriptive statistics for the use of learning strategies by the prticipants of 19 academic disciplines

Academic Disciplines	Number	Mean	Std. Deviation
Chemistry	78	3.1386	.47032
Physics	30	3.0083	.39623
Mathematics	33	3.2400	.48047
Biology	130	3.1513	.51356
Geology	36	3.0372	.51015
Architecture	62	2.9792	.43810
Biomedical Engineering,	31	3.0787	.33486
Civil Engineering	31	2.9187	.44147
Computer Engineering	47	2.9879	.42081
Metallurgy Engineering	46	3.1635	.39089
Information Technology Engineering	49	2.9451	.49085
Agricultural Engineering	32	3.2763	.36219
Electrical Engineering	78	3.1150	.45661
Mechanical Engineering	34	3.2715	.37074
Persian Literature	32	3.2344	.44780
Theology	31	3.5897	.57987
Accounting	50	2.9704	.43884
Management	86	3.2258	.46107
Political Sciences	31	3.1858	.43236
Total	947	3.1261	.47214

As presented in Table 6, the students of theology (M = 3.5897) got the highest mean score whereas the students of civil engineering (M = 2.9187) got the lowest mean score in using learning strategies. To probe the significant differences among the mean scores of the participants in using learning strategies as well as the subcategories of the strategies, a one-way analysis of variance was utilized. The results are demonstrated in Table 7.

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Table 7
One-way analysis of variance for the use of learning strategies by the participants of 19 academic disciplines

Learning Strategies	Sum of Squares		DF	Mean Square	F	Sig.
Overall Learning Strategies	Between Groups	17.196	18	.955	4.577	.000
	Within Groups	193.684	928	.209		
	Total	210.880	946			
Direct Strategies	Between Groups	18.960	18	1.053	4.786	.000
	Within Groups	204.239	928	.220		
	Total	223.199	946			
Memory Strategies	Between Groups	23.620	18	1.312	4.231	.000
	Within Groups	287.803	928	.310		
	Total	311.424	946			
Cognitive Strategies	Between Groups	21.780	18	1.210	4.521	.000
	Within Groups	248.390	928	.268		
	Total	270.170	946			
Compensation Strategies	Between Groups	20.367	18	1.131	2.317	.001
	Within Groups	453.171	928	.488		
	Total	473.538	946			
Indirect Strategies	Between Groups	19.741	18	1.097	3.557	.000
	Within Groups	286.150	928	.308		
	Total	305.891	946			
Metacognitive Strategies	Between Groups	21.280	18	1.182	2.804	.000
	Within Groups	391.224	928	.422		
	Total	412.504	946			
Affective Strategies	Between Groups	47.632	18	2.646	5.464	.000
	Within Groups	449.434	928	.484		
	Total	497.066	946			
Social Strategies	Between Groups	23.089	18	1.283	2.167	.003
	Within Groups	549.439	928	.592		
	Total	572.529	946			

*The mean difference is significant at the 0.05 level.

As manifested in Table 7, statistically significant differences were found among the mean scores of the participants in using overall learning strategies, F (18, 928) = 4.577, p = .000. Significant differences were found among the participants' mean

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scores in using direct strategies F (18, 928) = 4.786, p = .000 as well as indirect strategies, F (18, 928) = 3.557, p = .000.

The subsets of the participants' mean scores in using overall learning strategies are presented in Table 8 through using Duncan test.

Table 8
Duncan test for the subsets of the mean scores in using overall learningstrategies

Academic Disciplines	Number	Subset for alpha = .05						
		1	2	3	4	5	6	7
Civil Engineering	31	2.9187						
Information Technology	49	2.9451	2.9451					
Accounting	50	2.9704	2.9704	2.9704				
Architecture	62	2.9792	2.9792	2.9792				
Computer Engineering	47	2.9879	2.9879	2.9879				
Physics	30	3.0083	3.0083	3.0083	3.0083			
Geology	36	3.0372	3.0372	3.0372	3.0372	3.0372		
Biomedical Engineering	31	3.0787	3.0787	3.0787	3.0787	3.0787	3.0787	
Electrical Engineering	78	3.1150	3.1150	3.1150	3.1150	3.1150	3.1150	
Chemistry	78	3.1386	3.1386	3.1386	3.1386	3.1386	3.1386	
Biology	130	3.1513	3.1513	3.1513	3.1513	3.1513	3.1513	
Metallurgy	46		3.1635	3.1513	3.1513	3.1513	3.1513	
Political Sciences	31			3.1858	3.1858	3.1858	3.1858	
Management	86				3.2258	3.2258	3.2258	
Persian Literature	32				3.2344	3.2344	3.2344	
Mathematics	33				3.2400	3.2400	3.2400	
Mechanical Engineering	34					3.2715	3.2715	
Agricultural Engineering	32						3.2763	
Theology	31							3.5897
Sig.		.053	.071	.075	.054	.051	.105	1.000

*Means for homogenous subsets are displayed.

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As presented in Table 8, the mean scores of different academic discipline groups were divided into seven subsets. The students of theology got the highest mean score, differing significantly from the mean scores of the students in the other academic disciplines at $p < .05$.

Figure 2 illustrates the relation between the participants' academic disciplines and use of overall learning strategies.

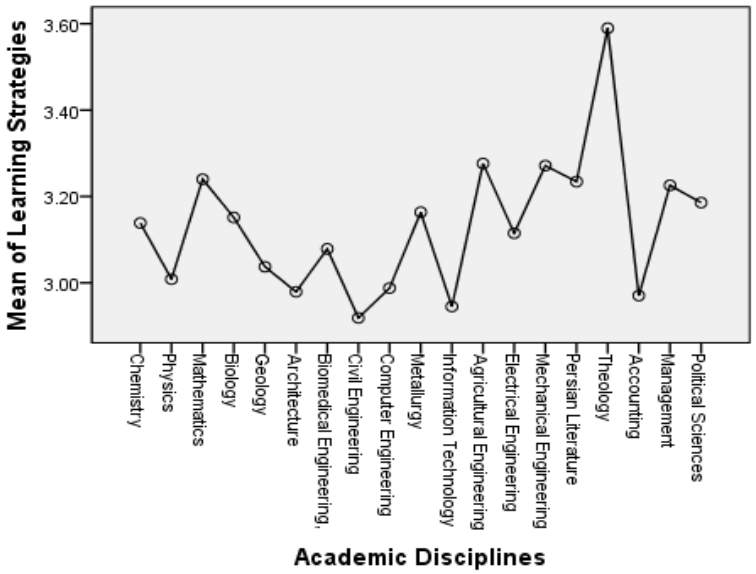

Figure 2: Relation between academic disciplines and use of overall learning strategies

As illustrated in Figure 2, the students of theology got the highest mean score whereas the students of civil engineering got the lowest mean score in utilizing overall learning strategies. The figure also depicts the differences among the participants of different academic disciplines in using overall learning strategies.

As the findings reflected, the type and frequency of utilizing learning strategies varied according to the participants' fields of study. As an example, the most frequent use of overall learning strategies by the students of theology and political

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sciences suggests that their rational, analytical, and philosophical approaches to deal with problems may encourage them to follow particular strategic patterns for processing reading comprehension passages as well as answering relevant questions. Detailed analysis of the findings also reflected that the students of social sciences read the texts and questions more interactively than did the students of basic sciences and engineering. The students of social sciences had lower reading ability, which might encourage them to employ available sources and strategies to narrow the linguistic gap.

The findings of this study provide an empirical support for earlier studies reporting a relationship between academic majors and use of language learning strategies (e.g., Dreyer & Oxford, 1996; Gu, 2002; Peacock, 2001; Peacock & Ho, 2003). The findings reflected statistically significant differences among the participants of different academic disciplines in employing language learning strategies to comprehend equal reading comprehension passages, which implies that the participants' academic disciplines can exert an influence on their topical knowledge and the way reading comprehension passages are cognitively processed. Thus, the findings can pertain to Bachman's (1990) as well as Bachman and Palmer's (1996, 2010) conceptual frameworks of language use, depicting an interaction between topical knowledge and strategic components of language use in a test-taking setting.

Detailed analyses reflected that the interdisciplinary differences found in the strategic patterns of the participants might be due to reader-related and text-related factors. The participants were different in their thinking patterns, learning styles, motivation, learning needs, attitude, aptitude, previous language learning experiences, background knowledge, and many other reader-related factors. Text-related factors also exerted significant influence on the strategic processing of reading comprehension passages. As discussed earlier, the genres of engineering and basic sciences texts are different from the genre of social sciences texts, which inevitably affects the frequency and type of using learning strategies by the students in different academic fields.

Relationship between Reading ability and Use of language Learning Strategies

To probe the third research question, concerning the relationship between the participants' level of reading proficiency and use of language learning strategies, the descriptive statistics were utilized. The results are demonstrated in Table 9.

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Table 9
Descriptive statistics for use of learning strategies by 3 groups of reading proficiency

Reading Strategies	Level of Reading Proficiency	N	Mean	Std. Deviation
Overall Learning Strategies	Low	158	3.1106	.47161
	Intermediate	642	3.1537	.49151
	High	147	3.1640	.45252
	Total	947	3.1261	.47214
Direct Strategies	Low	158	3.2067	.48161
	Intermediate	642	3.1512	.48863
	High	147	3.1973	.47684
	Total	947	3.1676	.48574
Memory Strategies	Low	158	3.2625	.58775
	Intermediate	642	3.1714	.57002
	High	147	3.1303	.56996
	Total	947	3.1802	.57376
Cognitive Strategies	Low	158	3.1463	.49486
	Intermediate	642	3.1000	.54837
	High	147	3.1687	.51188
	Total	947	3.1184	.53441
Compensation Strategies	Low	158	3.2727	.66850
	Intermediate	642	3.2488	.72528
	High	147	3.3685	.66455
	Total	947	3.2714	.70751
Indirect Strategies	Low	158	3.0851	.60862
	Intermediate	642	3.0586	.55817
	High	147	3.1212	.57057
	Total	947	3.0727	.56864
Meta cognitive Strategies	Low	158	3.4022	.67370
	Intermediate	642	3.3389	.66310
	High	147	3.4728	.62515
	Total	947	3.3702	.66034
Affective Strategies	Low	158	2.8422	.77012
	Intermediate	642	2.7654	.71942
	High	147	2.7529	.69907
	Total	947	2.7763	.72487
Social Strategies	Low	158	2.8399	.80955
	Intermediate	642	2.9093	.74430
	High	147	2.9356	.88257
	Total	947	2.9018	.77795

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As manifested in Table 9, the high proficiency group got the highest mean score (*M* = 3.1640), which was close to the mean score of the intermediate proficiency group (*M* = 3.1537), whereas the low proficiency group got the lowest mean score (*M* = 3.1106) in using overall learning strategies. As for the subcategories of direct strategies, memory strategies (*M* = 3.2625) were used more frequently by the low proficiency group whereas cognitive (*M* = 3.1687) and compensation strategies (*M* = 3.3685) were used more frequently by the high proficiency group. As for the subcategories of indirect strategies, affective strategies (*M* = 2.8422) were used more frequently by the low proficiency group whereas metacognitive (*M* = 3.4728) and social strategies (*M* = 3.9356) were used more frequently by the high proficiency group. To probe the significant differences among the mean scores of three groups of reading proficiency in using learning strategies, a one-way analysis of variance was used. The results are demonstrated in Table 10.

Table 10

One-way analysis of variance for using learning strategies by three groups of reading proficiency

Learning Strategies		Sum of Squares	Df	Mean Square	F	Sig.
Overall Learning Strategies	Between groups	.485	2	.243	1.089	.337
	Within groups	210.395	944	.223		
	Total	210.880	946			
Direct Strategies	Between groups	.544	2	.272	1.152	.316
	Within groups	222.655	944	.236		
	Total	223.199	946			
Memory Strategies	Between groups	1.484	2	.742	2.260	.105
	Within groups	309.940	944	.328		
	Total	311.424	946			
Cognitive Strategies	Between groups	.712	2	.356	1.247	.288
	Within groups	369.458	944	.285		
	Total	270.170	946			
Compensation Strategies	Between groups	1.714	2	.857	1.714	.181
	Within groups	471.824	944	.500		
	Total	473.538	946			
Indirect Strategies	Between groups	.499	2	.249	.771	.463
	Within groups	305.392	944	.324		
	Total	305.891	946			
Metacognitive Strategies	Between groups	2.339	2	1.169	2.691	.068
	Within groups	410.165	944	.434		
	Total	412.504	946			
Affective Strategies	Between groups	.842	2	.421	.801	.449
	Within groups	496.224	944	.526		
	Total	497.066	946			
Social Strategies	Between groups	.810	2	.405	.669	.513
	Within groups	571.719	944	.606		
	Total	572.529	946			

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As manifested in Table 10, no significant differences were found among the mean scores of three proficiency groups in using overall learning strategies, F (2, 944) =1.089, p = .337. No significant differences were found among the mean scores of three proficiency groups in using the subcategories of learning strategies.

Figure 3 demonstrates the relation between level of reading proficiency and mean score of using overall learning strategies.

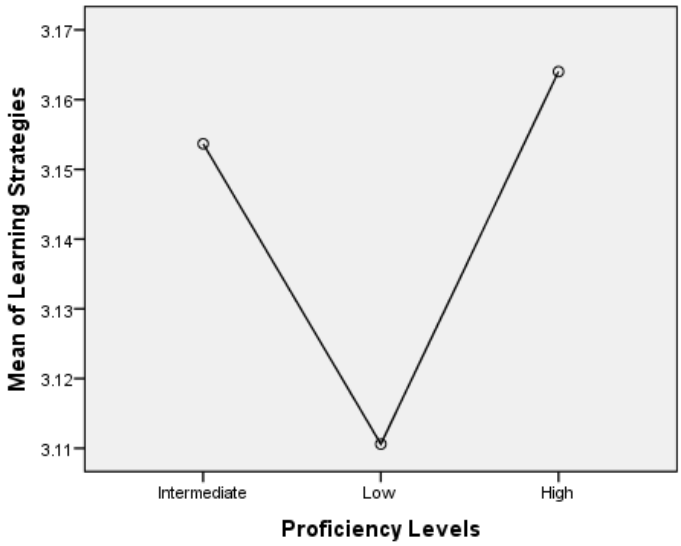

Figure 3: Relation between reading proficiency and use of overall learning strategies

As depicted in Figure 3, the mean scores of the high and intermediate proficiency groups were close together and higher than the mean score of the low proficiency group in using overall learning strategies.

The findings of this study support the viewpoints of the earlier researchers stressing the positive relationship between reading ability and use of learning strategies (e.g., Liu, 2004; Meschyan & Hernandez, 2002; Nisbet et al., 2005). The use of a wider range of language learning strategies by more proficient language learners has been discussed in the literature review.

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As the findings of this study reflected, more proficient language learners utilized learning strategies more frequently than did less proficient language learners. The positive relationship found between the participants' reading comprehension test performance and use of learning strategies revealed the positive relationship between linguistic and strategic components in the process of test taking, stressed by Bachman (1990) as well as Bachman and Palmer (1996, 2010). The findings suggest that the gap between more successful and less successful language learners can be filled through effective strategic-based instructional programs, tailored to the particular needs of language learners in different academic disciplines with different reading ability levels. Thus, language teachers should give systematic attention to linguistic and strategic aspects of language learning rather than paying excessive attention to either side. The findings also reflected that the actual ability of language learners is dependent on linguistic and nonlinguistic factors such as strategic processing, educational groups, and academic disciplines. Consequently, language learners' observed scores cannot reflect their true scores, and language teachers should make a sound judgment about their students' actual ability through paying careful attention to nonlinguistic factors too.

As Alderson (2000) believed, second language reading comprehension is highly complex, dynamic, and multi-dimensional process due to multiple interactions among many different factors, ranging from readers' dependent factors to contextual factors. Given all this, teaching reading is highly demanding, which requires a thorough understanding of components of reading, teaching methodology, characteristics of learners, and the context in which teaching of reading takes place. Thus, despite advancement in L2 reading research, many questions remain unanswered.

This study was an attempt to scrutinize the probable significant relationship between reading ability, academic disciplines, and patterns of strategy use in reading comprehension test performance of postgraduate EAP learners in many universities in Iran. In fact, the study explored the interaction among some L2 readers' dependent factors and contextual factors, including reading proficiency, educational groups, academic disciplines, and strategic processing in a reading comprehension test taking setting. The findings can provide language teachers with useful information on the way language is cognitively processed as well as some influential linguistic and nonlinguistic factors.

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Conclusion

McNamara (1996) introduced three basic dimensions, conceptualizing the nature of second language communicative ability. They are the factors constituting knowledge of a language; non-linguistic factors, including strategic processing and affective schemata; and the way actual real-time instances of language use are seen in the light of the preceding dimensions. In Bachman's (1990) framework of the components affecting test performance, communicative language ability is hypothesized as the major contributor to test performance among the other contributors such as test method facets, individual characteristics, and random factors. Bachman (1990) identified language competence and strategic competence as two major components of language ability, the combination of which provides language learners with the ability or capacity to create and interpret discourse in testing or non-testing settings. Bachman considered strategic competence as the capacity relating language competence to the language users' knowledge structures and the features of the context in which communication takes place. In his view, strategic competence is a general ability enabling an individual to make the most effective use of available resources to carry out a given communicative task. It includes a wide range of learning and use strategies that make language performance possible in relation to linguistic, psychological, and social dimensions of language use. Purpura (1999) and McNamara and Roever (2006) also stressed the multidimensional nature of strategic competence concerned with metacognitive, cognitive, affective, and social aspects of language use.

With regard to Bachman's (1990) as well as Bachman and Palmer's (1996, 2010) conceptual frameworks of language use, the present study was an attempt to scrutinize the probable relationship between strategic processing and reading comprehension test performance of Iranian postgraduate EAP students. The relationship was explored in terms of the participants' reading proficiency, educational groups, and academic disciplines. The study explored the differences among the participants in using different types of learning strategies, focusing on multidimensional nature of strategic competence, stressed by earlier researchers (e.g., McNamara, 1996; McNamara & Roever, 2006; Purpura, 1999). The findings revealed a significant relationship between the participants' academic disciplines and frequency as well as type of language learning strategies used by the participants to process reading comprehension passages. As the students in different academic disciplines used different strategic patterns to process equal reading comprehension passages in the reading section of the TOEFL test, it can be

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inferred that the participants' academic disciplines might influence their topical knowledge. Thus, a relationship between the participants' reading test performance and topical knowledge can be deduced in this study. The findings also manifested a positive relationship between the participants' reading ability, frequency, and type of using language learning strategies.

The findings suggest that linguistic and strategic aspects of language use cannot be dissociated and should be taught simultaneously in instructional programs. Thus, language teachers should be qualified enough to adapt themselves to innovative teaching approaches drawing on the linguistic as well as strategic needs of language learners in different fields of study to improve the efficiency of instructional programs.

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