Language Learning Strategy-Task Corollary: A Case of Jigsaw vs. Problem-solving Tasks

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ABSTRACT

This study aimed at investigating the relationship between language learning strategy use and performing jigsaw and problem-solving tasks. For this purpose, 53 students of a total 77 BA students majoring at ELT, English Literature, and English Translation were chosen through taking the Standardized Nelson English Proficiency Test. The homogeneous participants were randomly divided into two experimental groups: jigsaw and problem-solving. The jigsaw group practiced reading comprehension through jigsaw tasks while the problem-solving group did so through problem-solving tasks. Strategic behavior of each group was assessed through administrating the Strategy Inventory of Language Learning (SILL) prior to and after the treatment. The dataobtained undergone three main statistical analyses: independent sample t-test, paired samples t-test and MANOVA. Between group comparison indicated that the two groups were not much different regarding the strategy use implying that task type does not much affect strategy use. However, within group comparisons revealed that, although thestrategies as a unitary entity did not change as a result of the exposure to the task types, they showed changes in their use of various components of the strategies; metacognitive, social, and cognitive strategies were used most frequently by the members of both groups. Interestingly, the findings sustain the old but still attractive notion of Gestalt Psychology that 'the whole, is other than sum of the parts' (Kurt Koffka)'.

Key words

Language learning strategies; Strategy use; Jigsaw tasks; Problem-solving tasks

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1.INTRODUCTION

Due to the growing interest in language learning, language scholars have been attempting to find ways which can promote language learning. For many years the focus was on teaching methods and classroom techniques; however, in the late sixties, it became increasingly clear that improvement in teaching methods required a more direct understanding of the language learning process (Naiman,1978), which consists of both unconscious mental processes and consciously employed strategies as "steps taken by students to enhance their own learning" (Oxford, 1990, p.1). Moreover, learning strategies , according to her (1990, p.8) "are specific actions taken by learners to make learning easier, faster, more enjoyable, more self-directed, more effective, and more transferable to new situations".

Different classifications for (language) learning strategies (LLSs) have been proposed. According to Hsiao and Oxford (2002), Oxford's taxonomyis the most consistent with learners' strategy use.Oxford (1990) classified strategies as direct and indirect strategies. Direct strategies are those which directly involve the target language, subdivided into memory, cognitive, and compensation strategies. Indirect strategies do not directly involve using the language, but they support language learning. They are further divided into metacognitive, affective, and social strategies (Oxford, 1990).

Theoretically and empirically, strategy use and input processing, the latter one as the core of learning, are interwoven in cognitive theories. Anderson's information processing model approaches to second language learning consider learning as transition from declarative to procedural knowledge, which according to Mitchel and Myles (1998) happens through utilizing language learning strategies. In their view, language learning strategies are complex procedures that individuals apply to tasks; consequently, they may be represented as procedural knowledge which may be acquired through cognitive, associative, and autonomous stages of learning. "As with other procedural skills at the different stages of learning, the strategies may be conscious at the early stages and later be performed without the person's awareness" (O'Malley &Chamot, 1990, p.52). On the contrary, sociocultural and sociolinguistic theorists emphasize the social nature of interaction (Mitchel& Myles, 1998). They report that for Vygotsky skilled individuals are capable of autonomous functioning or self-regulation, as the central concept to his theory. According to Berk and Winsler (1995, cited in Oxford, 1999), self-regulation is the process of planning, guiding, and monitoring one's own attention and behavior which are known as metacognitive learning strategies. Oxford (1999) maintains that social interaction requires strategies such as asking questions, requesting assistance, and collaborating with others using language which are called social strategies. Affective, compensatory, and memory strategies are also believed by Oxford (1999) to be part of learner's self-regulation. So, learning strategies, though not explicitly stated, is an integrative part to Vygotsky's theory.Nevertheless, choice of language learning strategies, according to Oxford (1989), is subject to many variables including: language being learned, duration, degree of awareness, age, sex, affective variables such as motivation and attitude, personality characteristics, general personality type, learning style, aptitude, career orientation, national origin, language teaching methods, and task requirements. These factors have been touched upon in numerous researchesin relation to, e.g., level of proficiency (Ehrman and Oxford, 1988; Oxford and Ehrman, 1995; Dreyer and Oxford, 1996; Hong- Nam and Leavell, 2006), motivation (Oxford and Nyikos, 1989; Oxford and Ehrman, 1995; Taguchi, 2002; Ziahosseeini and Salehi, 2008), gender (Oxford and Nyikos, 1989; Oxford and Ehrman, 1995; Dreyer and Oxford, 1996; Bacon, 1992). Junsheng (2008) compared learners' strategy use in virtual and actual situations and found that strategy use depends on the nature of the task. Kaivanpanah, Yamouty and Karami (2012), who explored use of communication strategies in doing different task types, concluded that task type had a significant impact on the type of communication strategies employed.

Among many factors, task type has received much attention in second language instruction and in the era of strategic teaching. Task is defined by Ellis (2003, p.16) as "a work plan that requires learners to process language pragmatically in order to achieve an outcome……, it requires them to give primary attention to meaning and to make use of their own linguistic resources. A task is intended to result in language use that bears a resemblance, direct or indirect, to the language used in real world". Contribution of task to language skill acquisition and strategy use has been subject to various empirical research studies. For example, Oxford et al. (2004) examined reading strategies of 36 adult ESL learners in relation to incorporation of task and proficiency level. The results showed that there was no significant main effect in aggregated strategy use across tasks or between proficiency levels, which were also supported by Sotudenam and Azimfar's (2011) as well as Fazilatfar's (2010) studies.Khan (2010) conducted a study on the strategies used in performing three oral communication tasks, a picture story, an art description, and an information gap. Comparing the three tasks in terms of aggregated strategy use indicated that the participants had used the most number of strategies while doing the information-gap task. It was concluded that the higher strategy use on the information gap task was due to comparatively greater use of interactional and compensation strategies by the group.

Junsheng (2008) explored the interaction integration of senior secondary students' language learning strategies, styles and tasks in a school in Fujian, China. The evidence revealed that when the students were provided with virtual tasks in the questionnaire, cognitive strategies were those that were predominantly used. By contrast, when they elaborated on their strategic actions undertaken to perform actual tasks, cognitive and metacognitive strategies are seen to be vital in their learning. In brief, the students' strategy use depends on the nature of the tasks. When learning tasks shift from virtual tasks to actual tasks, the students' strategy use relies increasingly on the ongoing regulatory process.

Use of learning strategies has been considered to be one of the crucial factors for successful language learning. The early studies of language learning strategies such as those by Rubin (1975), Stern (1975) and Naiman (1978) have alleged that good language learners are strategic ones. Rubin (1975) states that good language learners involve themselves actively in all aspects of language learning such as affective, linguistic, and environmental ones. However, their learning behavior might be subject to certain variables including the nature of the task (Oxford, 1990). Surprisingly, Nunan (1998) maintains that there are a number of language learning strategies underlying every task. These indicate some sort of link between tasks and language learning strategies.According to Ellis (2003)tasks are activities which are intended to result in language use that resembles the way language is used in real world. He states that tasks develop L2 proficiency through interaction as they include some kind of gap in information, opinion, or reasoning which stimulates the learners to use language in order to close the gap. Swain (1995, as cited in Beglar& Hunt, 2002) points out tasks provide learners with

input as well as the opportunity for meaningful use of language. It is believed that learners' cognitive processing will be engaged by this combination of contextualized input and output helping learners to process and reshape the input. Therefore, tasks are considered as valuable activities which promote language teaching (Ellis, 2003).

Similar to LLSs, tasks have also been classified differently depending on their nature in input processing. Pedagogically speaking, Richards (2001, p.162) suggests two broad categories of tasks including pedagogical and real world tasks. The former types "are based on second language acquisition theories and are designed to trigger second language learning processes and strategies. Real world tasks are designed to practice those activities that are found to be important in a needs analysis and that turn out to be important and useful in real life". In the same vein, Prabhu (1987) considers three types of pedagogical tasks: information-gap, reasoning-gap, and opinion-gap tasks. According to Willis (1996), there are six types of tasks: listing, ordering and sorting, comparing, problem-solving, sharing personal experiences, and creative tasks.

Richards (2001) considers five task types: jigsaw, information-gap, problem-solving, decision-making, and opinion-exchange tasks.Richards' classification seems to be more tangible pedagogically. However, two of them;jigsawand problem solving tasks are probably the most commonly used ones. The former, sometimes called split-information task (Willis&Willis, 2007), is an activity in which groups or individuals are expected to combine individual pieces of information, thereby they are involved in communication and collaborative work (Willis &Willis, 2007; Richards, 2001).In the latter category, however, learners are given a problem and a set of information. They have to communicate with each other in order to find a solution (Richards, 2001). Willis (1996) believes problem-solving tasks are challenging, engaging, and satisfying to solve. They require people's intellectual and reasoning power.

Pica et al. (1993, as cited in Smith, 2003) rank the task types based on their effect on second language learning: (1) jigsaw; (2) information-gap; (3) problem solving; (4) decision making; and (5) opinion exchange. Accordingly, jigsaw and problem solving tasks are considered as facilitative tasks for second language learning. Doughty and Pica (1986) compared a required information exchange task (jigsaw task) and an optional information exchange task in terms of the amount of modified interaction generated.Results indicated that more modification of interaction happened in doing the jigsaw task than did in doing the optional information exchange task. The researchers emphasized that a required information exchange task is necessary for the generation of conversational modifications of classroom interaction. Swain and Lapkin (2000) compared a jigsaw task and a dictogloss task in terms of the amount of focus on form. It was indicated that the students focused equally on form while doing both task types. What's more, the jigsaw task seemed to inspire greater linguistic creativity as the students used a greater range of vocabulary and language related episodes. Mengdus and Xialing (2010) used jigsaw technique to teach reading to a group of college students. They discovered that jigsaw technique is an effective way to promote students' participation and interest as well as a good technique to accomplish learning tasks in the EFL classroom.Kazemi (2012) compared the effect of traditional ways of teaching reading and using jigsaw to do so on students' reading comprehension achievement. The results indicated that jigsaw technique has a significant effect on students' reading achievement as the students' reading comprehension improved as a result of practicing jigsaw reading.Fredricks (1984) used a problem-solving task, a role play, and an authentic interaction in order to compare the language generated by the three tasks. The results showed that while doing the problem-solving task the students generated more communicative functions of language but narrower range of form and lexis. Poupore (2005) explored quality interaction and types of negotiation in problem- solving and jigsaw tasks. Based on the results of the study, Poupore considers problem- solving prediction tasks as being more beneficial than jigsaw tasks. He argues that the more open structure of the problem- solving tasks gives the learner more freedom to use a wider variety of language. Hussein et.al (2012) used a problem-solving approach to teach writing to a group of EFL students. The topic which was in form of a problem was discussed within group and even between groups before writing. Results indicated that the students writing improved in terms of content, grammar, and organization of ideas.

Addressing tasks empirically is rationalized both theoretically and pedagogically. Oxford et al. (2004) hold that including a task in second language learning strategy assessment is necessary because in this case learners will focus on the strategies they use to do the particular task. Cohen and Macaro (2007) emphasize the need for assessing the strategic behavior of the learners in the context of specific tasks. However, there seems to be a dearth of research in this particular area.Moreover, research on language learning strategies has mainly focused on the strategies of good language learner, strategy instruction, and factors affecting language learning strategy use. Among these factors, task requirements , contrary to some sporadic studies, has still received little attention. Additionally, probing learners' language learning strategy use in practicing reading comprehension through incorporating tasks in general and the jigsaw and problem-solving tasks in particular is wararnted. Sinceas the literature reviewed confirms, jigsaw and problem-solving tasks are valuable task types as they have required qualities for language leaning. They are both motivating and involve a great deal of negotiation of meaning. Therefore, using them in language classes will contribute to the students' progress in language learning; a claim requires more empirical supports. Rationalized in this way, this study tries to investigate the role of task types (jigsaw and problem solving) in LLS choice both individually and comparatively in a reading instruction class, which was realized in the following research questions addressed in the form of respective null hypotheses.

2.RESEARCH QUESTIONS

1. Does task type (jigsaw vs. problem- solving)have any statistically distinct effect on language learning strategy use both unitarily and componentially?
2. Does exposure to jigsaw tasks have any statistically distinct effect on language learning strategy use both unitarily and componentially?
3. Does exposure to problem-solving tasks have any statistically distinct effect on language learning strategy use both unitarily and componentially?

Note: the research questions were addressed as respective null hypotheses.

3. RESEARCH METHOD

3.1 Participants

Participants of the current study were 53 male and female students from Azad and ShahidBahonar universities of Kerman, Iran, majoring in English Literature, ELT, and English Translation. The mean age of the participants was 21, ranging from 18 to 36, who were selected through the Standardized Nelson English Proficiency Test (Version 300D) out of total population of 77 students. The students whose score fell within the range of one SD ± mean were selected as the participants of the study.

3.2 Instrumentation

The instruments used in this study were the Standardized Nelson English Proficiency Test, the Strategy Inventory for Language Learning(SILL) (Oxford,1990), and jigsaw and problem-solving tasks.The Standardized Nelson English Proficiency Test which was used to choose a homogeneous group of participantsconsists of 50 items including reading, grammar, vocabulary, and pronunciation items.The Strategy Inventory for Language Learningconsists of six categories: memory strategies (9 items), cognitive strategies (14 items), compensation strategies (6 items), metacognitive strategies (9items), affective strategies (6 items), and social strategies (6 items). These SILL 50 items are evaluated on a five-point Likert scale from 1 to 5. The tasks employedwere jigsaw and problem-solving reading comprehension tasks. The problem-solving tasks were developed based on suggestions made by Willis (1996) in the form of giving advice to other people, predicting the end of a story, or choosing the best course of action to do something. In order to make sure that the texts used by both groups enjoyed the same level of difficulty, the readability of the texts was estimated usingGunnig-Fog formula.

3.3 Procedure

To collect the required data, a group of homogeneous participants was divided into two groups which differed in terms of the treatment they received. One group practiced reading comprehension through jigsaw tasks and the other through problem-solving tasks. In order to elicit the strategic behavior of the participants, the SILL was administered twice, before and after treatment.

4. DATA ANALYSIS

4.1 Reliability and Validity of SIIL and Nelson Test

Regardless of the already proven nature of the instruments in terms of reliability and validity, both of them were subjected to further validation process based on principal component analysis (i.e., varimaxrotation), indicating five factor loadings as the validity indices (Table 1) and KR-21 statistical formula showing the reliability ratios (Table 2).

Table 1.Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
Pretest	.977				
PreCogn	.863				
PreMemory	.766				
PreMetaC	.727				
PreAffect	.644		.371		-.305
PreSocial	.622				
PostCogn		.878			
Posttest		.877	.419		
PostMetaC		.864			
PostSocial		.709			
PostAffect			.837		
PostMemory		.364	.732		
PostComp				.805	
PreComp	.540			.654	
Proficiency					.915

Table.2Reliability Indices

	N	Mean	Variance	KR-21
Pretest	50	166.60	613.184	0.91
Posttest	50	170.20	343.633	0.85
PreMemory	50	31.36	35.288	0.68
PreCogn	50	34.10	33.670	0.69
PreComp	50	30.00	70.635	0.71
PreMetaC	50	36.16	49.293	0.81
PreAffect	50	31.23	46.010	0.76
PreSocial	50	35.60	70.721	0.87
PostMemory	50	32.53	29.128	0.62
PostCogn	50	33.87	26.366	0.60
PostComp	50	32.67	28.345	0.61
PostMetaC	50	37.09	29.926	0.69
PostAffect	50	31.07	48.272	0.77
PostSocial	50	36.47	58.349	0.85
Proficiency	50	24.91	43.321	.72
Valid N (listwise)	50			

4.2 Results
4.2.1 Homogeneity Measures
Table 3 displays the descriptive statistics of the participants selected for the study:

Table.3 Descriptive Statistics

		class1	class 2	class 3
N	Valid	15	20	18
	Missing	38	33	35
Mean		24.0000	24.2500	24.2778
Std. Error of Mean		.81064	.87622	.73122
Median		23.0000	24.5000	24.5000
Mode		22.00	25.00[a]	20.00
Std. Deviation		3.13961	3.91858	3.10229
Variance		9.857	15.355	9.624
Range		12.00	13.00	9.00
Minimum		20.00	18.00	20.00
Maximum		32.00	31.00	29.00

Table.4 Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
class1	.225	15	.050	.889	15	.074
class 2	.145	15	.200[*]	.934	15	.311
class 3	.134	15	.200[*]	.920	15	.193

a. Lilliefors Significance Correction
*This is a lower bound of the true significance.

Based on the level of significance displayed in table 4, the distribution of the scores is normal.

Table.5 Test of Homogeneity of Variances of Scores

Levene Statistic	df1	df2	Sig.
1.025	2	50	.366

As sig=0.366>0.05 the variance of the scores in the three classes are the same.
4.2.2 Testing Normality Assumptions
The data collected in this study enjoyed normal distributions. As displayed in table 6 the values of skewdness and kurtosis were lower than their critical values (c.r.).

Table.6 Assessment of Normality; Components of Language Learning Strategies

Variable	min	max	Skew	c.r.	kurtosis	c.r.
Pre. Memory	18.889	45.556	.135	.389	-.122	-.175
Pre. Cognition	15.714	47.143	-.723	-2.087	1.368	1.974
Pre. Compensation	13.333	50.000	-.025	-.072	-.362	-.523
Pre. Metacognitive	17.778	50.000	-.455	-1.312	-.187	-.271
Pre. Affective	18.333	45.000	.120	.347	-.719	-1.037
Pre. Social	16.667	50.000	-.361	-1.042	-.280	-.403
Post. Memory	22.222	44.444	.143	.412	-.110	-.159
Post. Cognitive	21.429	43.571	-.497	-1.436	.059	.085
Post. Compensation	20.000	45.000	-.197	-.567	-.116	-.167
Post. Metacognitive	23.333	48.889	-.136	-.392	.023	.034
Post. Affective	11.667	46.667	-.072	-.209	.145	.209
Post. Social	18.333	48.333	-.320	-.924	-.695	-1.003

Besides, the components of the total pretest and posttest enjoyed normal distributions (Table 7), since they lie between ±1.96

Table.7 Assessment of Normality; Pretest and Posttest of Language Learning Strategies

Variable	min	max	skew	c.r.	kurtosis	c.r.
Posttest	127.000	207.000	-.370	-1.067	.161	.233
Pretest	93.000	218.000	-.258	-.744	.600	.866

4.2.3 Investigation of the First Research Question

The first research question addressing the task types (jigsaw vs. problem-solving) to find out if it has any statistically distinct effect on language learning strategy(LLS) types, was probed twice for investigating the effect of two different treatments on language learning strategies as a unitary construct first and then on its components.

4.2.3.1 Learning strategies as a unitary construct

An independent t-test was run to compare jigsaw and problem-solving groups on the posttest of LLS. As displayed in table 8, the jigsaw group (M = 171.42, SE = 3.81) showed a slightly higher mean score than the problem-solving group did (M = 169.08, SD = 3.66) on posttest of language learning strategies (LLS).

Table.8 LLS in Posttest

Group	N	Mean	Std. Deviation	Std. Error Mean
Jigsaw	24	171.42	18.696	3.816
Problem-Solving	26	169.08	18.687	3.665

The results of the independent t-test (t (48) = .44, P > .05, R = .064 representing a weak effect size) (Table.9) indicated that there was not any significant difference between the two groups' mean scores on the posttest of the LLS. The null-hypothesis was not rejected.

Table.9 Independent T-test of Posttest LLS Used by Groups

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	.051	.822	.442	48	.660	2.340	5.291	-8.298	12.978
Equal variances not assumed			.442	47.677	.660	2.340	5.291	-8.301	12.980

It should be noted that the assumption of homogeneity of variances was met (Levene's F = .051, P > .05). That is why the first row of table 9, i.e. "Equal variances not assumed" was reported.
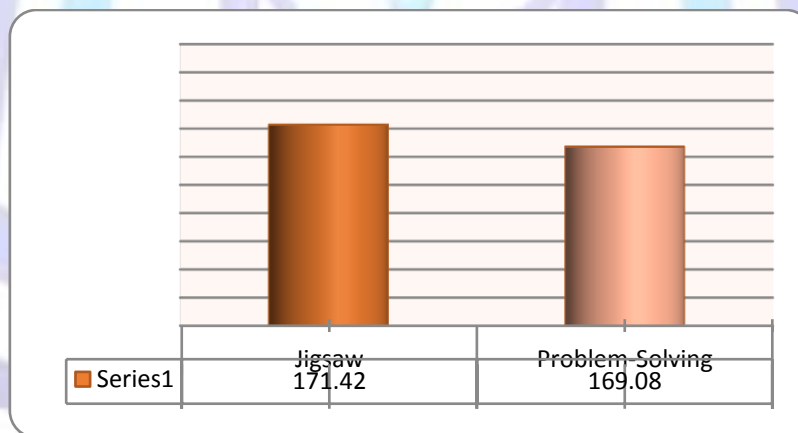
Graph 1. Posttest LLS Used by Groups

4.2.3.2 Components of LLSs

A multivariate ANOVA (MANOVA) was run to investigate the effect of jigsaw and problem-solving methods on the components of LLS. Before reporting the main results, it should be noted that the assumption of homogeneity of variances – as tested through the Levene's F-values – and the assumption of homogeneity of covariance – as tested through the Box's test – were met. As displayed in table 10, the probabilities associated with the Levene's F-values were all higher than .05. Thus, the assumption of homogeneity of variances was met.

Table 10.Levene's Test of Equality of Error Variances

	F	df1	df2	Sig.
Post. Memory	.099	1	48	.755
Post. Cognition	.054	1	48	.818
Post. Compensation	.089	1	48	.767
Post. Metacognitive	.005	1	48	.943
Post. Affective	.364	1	48	.549
Post. Social	2.563	1	48	.116

Besides enjoying homogenous variances, the groups enjoyed homogenous covariance matrices as the Box's M-value of 19.91 was not significant (P > .05) (Table 11). Thus, the assumption of homogeneity of covariance matrices was also met.

Table11. Box's Test of Equality of Covariance Matrices

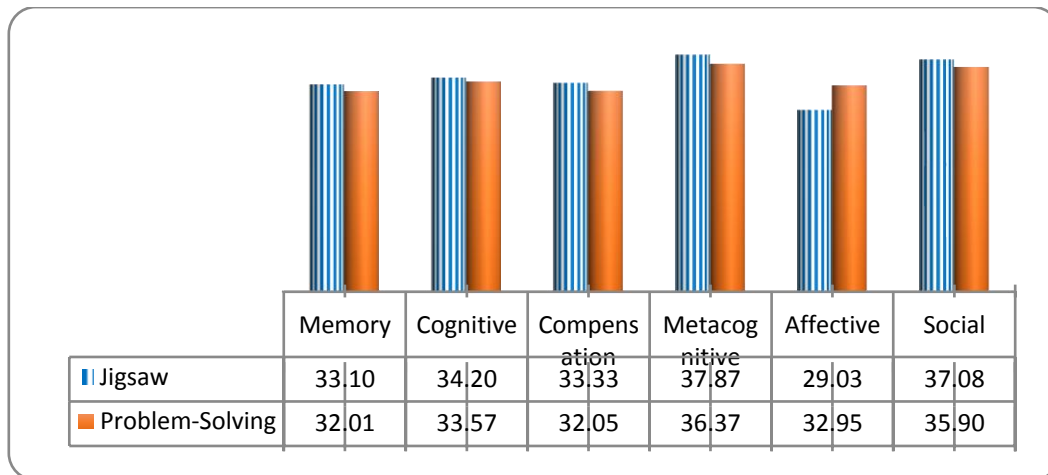| Box's M	19.910
F	.820
df1	21
df2	8352.637
Sig.	.698

Table12. Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Group	Post. Memory	14.918	1	14.918	.507	.480	.010
	Post. Cognition	4.875	1	4.875	.182	.672	.004
	Post. Compensation	20.513	1	20.513	.720	.401	.015
	Post. Metacognitive	28.187	1	28.187	.941	.337	.019
	Post. Affective	191.865	1	191.865	4.237	.045	.081
	Post. Social	17.551	1	17.551	.296	.589	.006
Error	Post. Memory	1412.342	48	29.424			
	Post. Cognition	1287.054	48	26.814			
	Post. Compensation	1368.376	48	28.508			
	Post. Metacognitive	1438.208	48	29.963			
	Post. Affective	2173.469	48	45.281			
	Post. Social	2841.560	48	59.199			
Total	Post. Memory	54348.148	50				
	Post. Cognition	58655.612	50				
	Post. Compensation	54744.444	50				
	Post. Metacognitive	70245.679	50				
	Post. Affective	50622.222	50				
	Post. Social	69350.000	50				

The only significant difference observed between jigsaw (M= 29.02) and problem-solving (M=32.49) groups' means was on posttest of affective strategies (F (1, 48) = 4.32, P < .05, Partial η^2 = .081, representing a moderate effect size).

Table 13. Descriptive Statistics; Components of LLS

Dependent Variable	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Post. Memory	Jigsaw	33.102	1.107	30.876	35.328
	Problem-Solving	32.009	1.064	29.870	34.147
Post. Cognitive	Jigsaw	34.196	1.057	32.071	36.322
	Problem-Solving	33.571	1.016	31.530	35.613
Post. Compensation	Jigsaw	33.333	1.090	31.142	35.525
	Problem-Solving	32.051	1.047	29.946	34.157
Post. Metacognitive	Jigsaw	37.870	1.117	35.624	40.117
	Problem-Solving	36.368	1.074	34.209	38.526
Post. Affective	Jigsaw	29.028	1.374	26.266	31.790
	Problem-Solving	32.949	1.320	30.295	35.602
Post. Social	Jigsaw	37.083	1.571	33.926	40.241
	Problem-Solving	35.897	1.509	32.864	38.931

	Memory	Cognitive	Compensation	Metacognitive	Affective	Social
Jigsaw	33.10	34.20	33.33	37.87	29.03	37.08
Problem-Solving	32.01	33.57	32.05	36.37	32.95	35.90

Graph 2. Components of LLS

So, when language learning strategies are treated as discrete construct composed of various sub-strategies, different picture is revealed indicating that in certain areas (i.e. affective strategies), though not in majority of the cases, task type affects the use of language learning strategies.

4.2.4 Investigation of the Second Research Question

The second research question, concerned with the effect of exposure to jigsaw tasks on the use of language learning strategies by Iranian EFL learners, was addressed twice probing the effect of jigsaw tasks on language learning strategies as a unitary construct first and then on its components.

4.2.4.1 Learning strategies as a unitary construct (jigsaw group)

A paired-samples t-test was run to compare jigsaw group's means on pretest and posttest of language learning strategies as a unitary construct. As displayed in table 14, the jigsaw group showed a higher mean on the posttest of LLSs (M = 171.42, SE = 3.81) than did on the pretest (M = 163.58, SD = 4.10).

Table14. Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Posttest	171.42	24	18.696	3.816
Pretest	163.58	24	20.106	4.104

The results of the paired-samples t-test (t (23) = 1.64, P > .05, R = .32 representing a moderate effect size) (table 15) indicated that there was not any statistically significant difference between the jigsaw group's means on the pretest and posttest of language learning strategies indicating that the hypothesis was not rejected. However, there is some moderate degree of difference between the two means.

Table15. Paired-Samples T-test Pretest and Posttest of LLS (Jigsaw Group)

Paired Differences					T	Df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
			Lower	Upper			
7.833	23.360	4.768	-2.031	17.698	1.643	23	.114
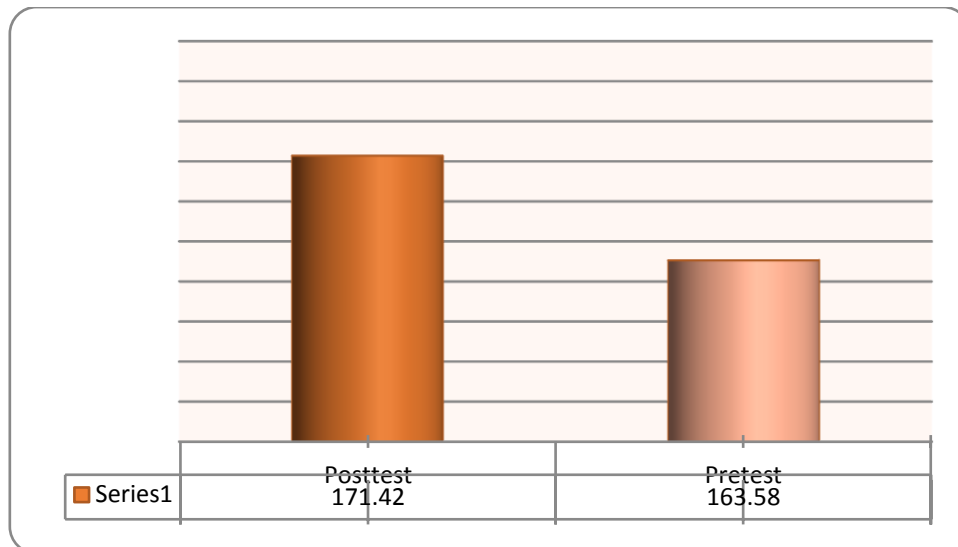
Graph 3. Pretest and Posttest of LLS (Jigsaw Group)

4.2.4.2 Components of LLSs

A repeated measures ANOVA was run to compare jigsaw group's means on pretest and posttest of component of LLS. Based on the results displayed in tables 16 and 17, it can be concluded that there was a significant difference between the jigsaw group's overall means on pretest (M = 32.47) and posttest (M = 34.10) (F (1, 23) = 2.87, P > .05, Partial η^2 = .11, representing a moderate to large effect size). Although the F-value of 2.87 was not significant, the effect size value of .11 indicated that the jigsaw group had a moderate to large improvement from the pretest to posttest. Then, the null-hypothesis was rejected.

Table16.Multivariate Tests; Pretests and posttests of Components of LLS (Jigsaw Group)

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Strategy	Pillai's Trace	.635	6.617	5	19	.001	.635
	Wilks' Lambda	.365	6.617	5	19	.001	.635
	Hotelling's Trace	1.741	6.617	5	19	.001	.635
	Roy's Largest Root	1.741	6.617	5	19	.001	.635
Time	Pillai's Trace	.111	2.881	1	23	.103	.111
	Wilks' Lambda	.889	2.881	1	23	.103	.111
	Hotelling's Trace	.125	2.881	1	23	.103	.111
	Roy's Largest Root	.125	2.881	1	23	.103	.111
Strategy * Time	Pillai's Trace	.430	2.872	5	19	.043	.430
	Wilks' Lambda	.570	2.872	5	19	.043	.430
	Hotelling's Trace	.756	2.872	5	19	.043	.430
	Roy's Largest Root	.756	2.872	5	19	.043	.430

Table17. Descriptive Statistics; Pretest and posttest of LLS (Jigsaw Group)

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Pretest	32.474	.847	30.722	34.227
Posttest	34.102	.753	32.545	35.659

Based on the results displayed in tables 18 and 19, it can be concluded that there were significant differences between the jigsaw group's means on the components of LLSs; disregarding the time variable (F (5, 19) = 6.61, P < .05, Partial η^2 = .63, representing a large effect size).

As displayed in table 16, the jigsaw group showed the highest means on metacognitive (M = 36.75), social (M = 36.35) and cognitive (M = 33.88). They showed almost the same means on memory (M = 31.75), compensation (M = 30.93) and affective (M = 30.03).

Table18.Descriptive Statistics; Components of LLS (Jigsaw Group)

Strategy	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Memory	31.759	.992	29.708	33.811
Cognitive	33.884	.774	32.283	35.484
Compensation	30.938	1.237	28.378	33.497
Metacognitive	36.759	.950	34.795	38.724
Affective	30.035	1.142	27.672	32.397
Social	36.354	1.364	33.532	39.177

Table 19 displays the results of the post-hoc comparison tests. Based on these results, it can be concluded that there were significant differences between the following two means;

A: Metacognitive (M = 36.75) and Memory (M = 31.75) (MD = 5, P < .05).
B: Metacognitive (M = 36.75) and Compensation (M = 30.93) (MD = 5.82, P < .05).
C: Metacognitive (M = 36.75) and Affective (M = 30.03) (MD = 6.72, P < .05).
D: Social (M = 36.35) and Memory (M = 31.75) (MD = 1.59, P < .05).
E: Social (M = 36.35) and Affective (M = 30.03) (MD = 6.31, P < .05).
F: Cognitive (M = 33.88) and Affective (M = 30.03) (MD = 3.84, P < .05

Table19.Post-Hoc Comparison Tests; Components of LLS (Jigsaw Group)

(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig.[b]
Memory	Cognitive	-2.125	1.014	.712
	Compensation	.822	1.586	1.000
	Metacognitive	*-5.000*[*]	*1.291*	*.012*
	Affective	1.725	1.017	1.000
	Social	*-4.595**	*1.242*	*.018*
Cognitive	Memory	2.125	1.014	.712
	Compensation	2.946	1.195	.324
	Metacognitive	-2.875	1.003	.130
	Affective	*3.849**	*1.121*	*.034*
	Social	-2.470	1.071	.456
Compensation	Memory	-.822	1.586	1.000
	Cognitive	-2.946	1.195	.324
	Metacognitive	*-5.822**	*1.733*	*.041*
	Affective	.903	1.760	1.000
	Social	-5.417	1.956	.163
Metacognitive	*Memory*	*5.000**	*1.291*	*.012*
	Cognitive	2.875	1.003	.130
	Compensation	*5.822**	*1.733*	*.041*
	Affective	*6.725**	*1.312*	*.001*
	Social	.405	1.469	1.000
Affective	Memory	-1.725	1.017	1.000
	Cognitive	*-3.849**	*1.121*	*.034*
	Compensation	-.903	1.760	1.000
	Metacognitive	*-6.725**	*1.312*	*.001*
	Social	*-6.319**	*1.349*	*.002*
Social	*Memory*	*4.595**	*1.242*	*.018*
	Cognitive	2.470	1.071	.456
	Compensation	5.417	1.956	.163
	Metacognitive	-.405	1.469	1.000
	Affective	*6.319**	*1.349*	*.002*

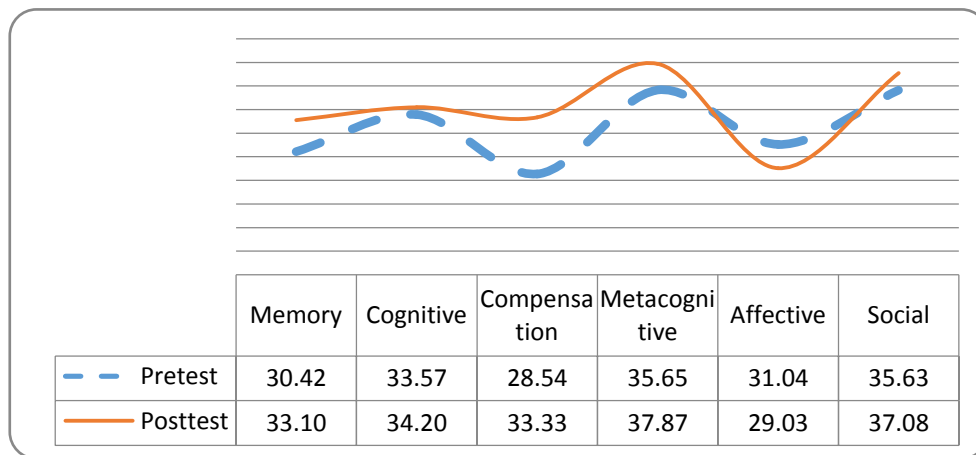*. The mean difference is significant at the .05 level. (Highlighted, underlined and italicized)
Note. *Each comparison was reported twice. The negative sign means that the first mean was smaller.*
Based on the results displayed in tables 17 and 20, it can be concluded that there was significant and large interaction between time and components of language learning strategies (F (5, 19) = 2.87, P < .05, Partial η^2 = .43, representing a large effect size). Bar Graph 6 displays the jigsaw group's means on components of pretests and posttests of language learning strategies.

Table 20.Descriptive Statistics; Time*Components (Jigsaw Group)

Strategy	Time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Memory	Pretest	30.417	1.260	27.811	33.023
	Posttest	33.102	1.213	30.592	35.611
Cognitive	Pretest	33.571	.912	31.685	35.458
	Posttest	34.196	1.036	32.054	36.339
Compensation	Pretest	28.542	1.982	24.442	32.642
	Posttest	33.333	1.161	30.931	35.736
Metacognitive	Pretest	35.648	1.217	33.131	38.165
	Posttest	37.870	1.125	35.543	40.198
Affective	Pretest	31.042	1.422	28.101	33.983
	Posttest	29.028	1.505	25.915	32.140
Social	Pretest	35.625	1.557	32.405	38.845
	Posttest	37.083	1.744	33.475	40.691

	Memory	Cognitive	Compensation	Metacognitive	Affective	Social
Pretest	30.42	33.57	28.54	35.65	31.04	35.63
Posttest	33.10	34.20	33.33	37.87	29.03	37.08

Graph 4. Components of Pretests and Posttests of LLS (Jigsaw Group)

Therefore, when language learning strategies are treated as a unitary construct regardless of the components, the task type (i.e jigsaw) does not affectlearners' frequency of strategy use. However, when the components of language learning strategies are scrutinized, some changes in the strategic behavior of learners are revealed. It is notable that metacognitive, social, and cognitive strategies were used the most frequently by the learners.

4.2.5 Investigation of the third research Question

The third research question, concerned with the effect of exposure to problem-solving tasks on the use of language learning strategies by Iranian EFL learners, was addressed twice probing the effect of problem-solving tasks on language learning strategies as a unitary construct first and then on its components.

4.2.5.1Language learning strategies as a unitary construct (problem-solving group)

A paired-samples t-test was run to compare problem-solving group's means on pretest and posttest of total language learning strategies. As displayed in table 21, the problem-solving group showed almost the same means on the posttest of language learning strategies (M = 169.08, SE = 3.66) than the pretest (M = 169.38, SD = 5.59) on posttest of language learning strategies.

Table 21. Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Posttest	169.08	26	18.687	3.665
Pretest	169.38	26	28.515	5.592

The results of the paired-samples t-test (t (25) = .058, P > .05, R = .012 representing a weak effect size) (table 22) indicated that there was not any significant difference between the problem-solving group's mean scores on pretests and posttest of language learning strategies. The null-hypothesiswas not rejected.

Table 22. Paired-samples T-test, Pretest and Posttest of LLS (Problem-solving group)

Paired Differences					T	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
			Lower	Upper			
.308	27.258	5.346	-10.702	11.318	.058	25	.955
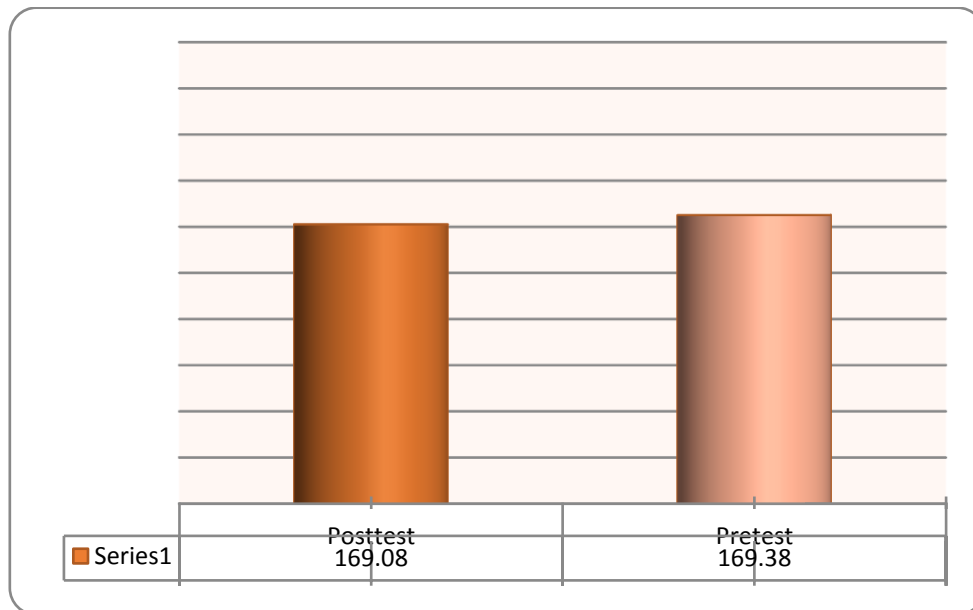
Graph 5. Pretest and Posttest of LLS (Problem-solving Group)

4.2.5.2 Components of language learning strategies (problem-solving group)

A repeated measures ANOVA was run to compare problem-solving group's means on pretest and posttest of component of Language Learning Strategies. Based on the results displayed in tables 23 and 24 it can be concluded that there was not any significant difference between the problem-solving group's overall means on pretest (M = 32.62) and posttest (M = 33.80) (F (1, 25) = .030, P > .05, Partial η^2 = .001 representing a weak effect size). Then, the null-hypothesis was not rejected.

Table 23.Multivariate Tests; Pretests and Posttests of Components of LLS (Problem-solving Group)

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Strategy	Pillai's Trace	.507	4.324	5.000	21.000	.007	.507
	Wilks' Lambda	.493	4.324	5.000	21.000	.007	.507
	Hotelling's Trace	1.030	4.324	5.000	21.000	.007	.507
	Roy's Largest Root	1.030	4.324	5.000	21.000	.007	.507
Time	Pillai's Trace	.001	.030	1.000	25.000	.863	.001
	Wilks' Lambda	.999	.030	1.000	25.000	.863	.001
	Hotelling's Trace	.001	.030	1.000	25.000	.863	.001
	Roy's Largest Root	.001	.030	1.000	25.000	.863	.001
Strategy * Time	Pillai's Trace	.127	.608	5.000	21.000	.694	.127
	Wilks' Lambda	.873	.608	5.000	21.000	.694	.127
	Hotelling's Trace	.145	.608	5.000	21.000	.694	.127
	Roy's Largest Root	.145	.608	5.000	21.000	.694	.127

Table 24.Descriptive Statistics; Pretest and Posttest of LLS (Problem-solving Group)

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Pretest	33.628	1.105	31.352	35.904
Posttest	33.807	.703	32.359	35.256

Based on the results displayed in tables 23-26, it can be concluded that there were significant differences between the problem-solving group's means on the components of LLS; disregarding the time variable (F (5, 21) = 4.32, P < .05, Partial η^2 = .50, representing a large effect size). As displayed in table 25, the problem-solving group showed the highest means on metacognitive strategies (M = 36.49), social strategies (M = 35.73) and cognitive strategies (M = 34.08). They showed almost the same means on memory strategies (M = 32.11), compensation strategies (M = 31.69) and affective strategies (M = 32.17).

Table 25. Descriptive Statistics; Components of LLS (Problem-solving Group)

Strategy	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Memory	32.115	.847	30.371	33.859
Cognitive	34.080	.944	32.135	36.024
Compensation	31.699	.935	29.772	33.625
Metacognitive	36.496	1.165	34.096	38.896
Affective	32.179	1.073	29.969	34.390
Social	35.737	1.319	33.020	38.454

Table 26 displays the results of the post-hoc comparison tests. Based on these results it can be concluded that there were significant differences between the following two means;

A: Metacognitive (M = 36.49) and Memory (M = 32.11) (MD = 4.38, P < .05).
B: Metacognitive (M = 36.49) and Compensation (M = 31.69) (MD = 4.79, P < .05).
C: Metacognitive (M = 36.49) and Cognitive (M = 34.08) (MD = 2.41, P < .05).

Table 26.Post-Hoc Comparison Tests; Components of LLS (Problem-solving Group)

(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig.[b]
Memory	Cognitive	-1.964	.889	.549
	Compensation	.417	.849	1.000
	__Metacognitive__	*__-4.380*__*	*__.987__*	*__.002__*
	Affective	-.064	1.074	1.000
	Social	-3.622	1.345	.187
Cognitive	Memory	1.964	.889	.549
	Compensation	2.381	.908	.221
	__Metacognitive__	*__-2.416*__*	*__.735__*	*__.045__*
	Affective	1.900	1.273	1.000
	Social	-1.658	.959	1.000
Compensation	Memory	-.417	.849	1.000
	Cognitive	-2.381	.908	.221
	__Metacognitive__	*__-4.797*__*	*__1.179__*	*__.006__*
	Affective	-.481	1.164	1.000
	Social	-4.038	1.297	.069
Metacognitive	*__Memory__*	*__4.380*__*	*__.987__*	*__.002__*
	__Cognitive__	*__2.416*__*	*__.735__*	*__.045__*
	__Compensation__	*__4.797*__*	*__1.179__*	*__.006__*
	Affective	4.316	1.414	.080
	Social	.759	1.241	1.000
Affective	Memory	.064	1.074	1.000
	Cognitive	-1.900	1.273	1.000
	Compensation	.481	1.164	1.000
	Metacognitive	-4.316	1.414	.080
	Social	-3.558	1.323	.189
Social	Memory	3.622	1.345	.187
	Cognitive	1.658	.959	1.000
	Compensation	4.038	1.297	.069
	Metacognitive	-.759	1.241	1.000
	Affective	3.558	1.323	.189

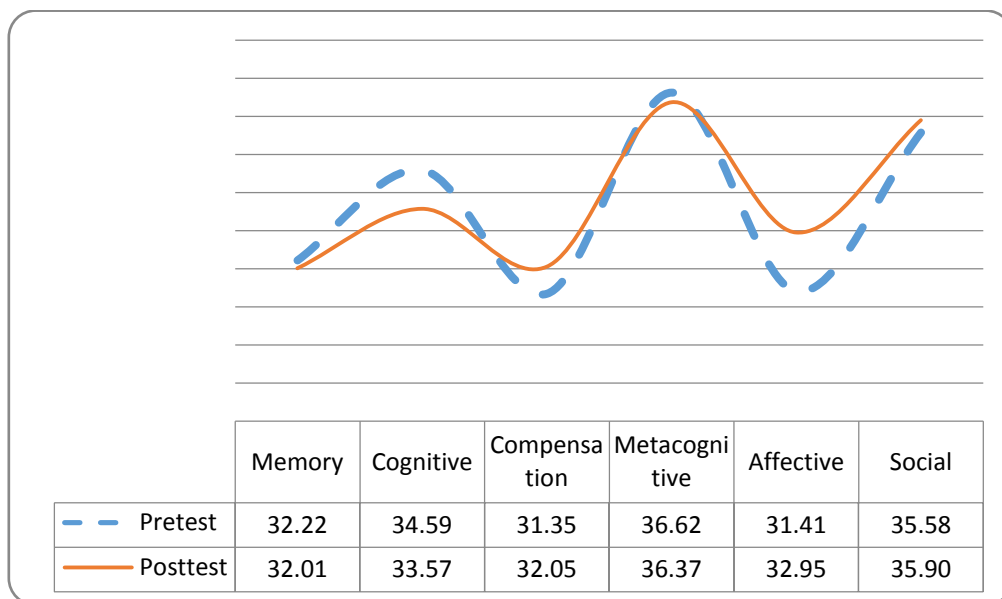*The mean difference is significant at the .05 level. (Highlighted, underlined and italicized).*

Note. ***Each comparison was reported twice. The negative sign means that the first mean was smaller.***
Based on the results displayed in tables 23-28, it can be concluded that there was a non-significant but moderate to large interaction between time and Components of language learning strategies (F (5, 21) = .608, P > .05, Partial η^2 = .12 representing a moderate to large effect size). Bar graph 7 displays the problem-solving group's means on components of pretests and posttests of language learning strategies.

Table 27.Descriptive Statistics; Time*Components (Problem-solving Group)

Strategy	Time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Memory	Pretest	32.222	1.118	29.920	34.525
	Posttest	32.009	.961	30.030	33.987
Cognitive	Pretest	34.588	1.346	31.816	37.360
	Posttest	33.571	1.034	31.442	35.701
Compensation	Pretest	31.346	1.356	28.554	34.138
	Posttest	32.051	.980	30.033	34.069
Metacognitive	Pretest	36.624	1.562	33.406	39.841
	Posttest	36.368	1.067	34.171	38.565
Affective	Pretest	31.410	1.323	28.686	34.134
	Posttest	32.949	1.192	30.493	35.404
Social	Pretest	35.577	1.809	31.851	39.303
	Posttest	35.897	1.337	33.143	38.652

		Memory	Cognitive	Compensation	Metacognitive	Affective	Social
– –	Pretest	32.22	34.59	31.35	36.62	31.41	35.58
——	Posttest	32.01	33.57	32.05	36.37	32.95	35.90

Graph 6. Components of Pretests and Posttests of LLS (Problem-solving Group)

Thus, regarding language learning strategies as a unitary construct, exposure to problem-solving tasks does not affect learners' strategy use (i.e. the total number of strategies used is not changed). Nevertheless, when the components of language learning strategies are examined, it is indicated that the task type affects learners' use of different strategy types. The highest means belongs to metacognitive, social, and cognitive strategies.

5.Discussion and Conclusion

Approaching the LLSs as a unitary entity, the findings showed that the two groups were not significantly different indicating that the task types do not much influence the overall strategy use. This is in line with Oxford et al.'s (2004) study in which total reported mean frequency of strategy use did not differ significantly across three task conditions. The same result was reached by Sotudenama and Azimfar (2012) as well as Fazilatfar (2010).However, this result is inconsistent with findings of the study done by Khan (2010) who concluded that overall strategy use varies across different task types. It is also inconsistent with Junsheng's (2008) and Kaivanpanah, Yamouty, and Karami's (2012) findings.This was also partially true with respect to thecomponentsof LLSs. The only significant difference between the two groups was in affective strategies. This is in line with Khan's (2010) study which found that only a few strategies differed across task types. Moreover, the participants in the jigsaw group favored metacognitive, social, and cognitive strategies. This is in line with Junsheng's (2010) study in which learners employed cognitive and metacognitive strategies to do actual classroom tasks. Learners' infrequent use of compensatory strategies is inconsistent with Smith's (2003) research in which participants reported use of this strategy type in doing a jigsaw task. However, the analysis done on the subcategories of learning strategies showed that the students' strategic behavior changed after exposure to problem-solving tasks. It isnotable that metacognitive, social, and cognitive strategies were most frequently used by the learners. Results indicated that both groups were similar in terms of the strategy types they used more frequently as also Smith (2003) reports in his study in which similar pattern of strategy use across different task types was reported.

It then may be safely concluded that, statistically speaking, task type does not play a significant role in LLS selection and use either as a unitary construct or when addressed componetially. However, componetially certain components appeared to have different pictures or realizations. This status quo may be attributed to the fact that in a jigsaw task a lot of negotiations happen which require the use of social strategies. The students may need to ask others for clarification, repetition, and other sorts of help. With regard to cognitive strategies, the students may have used skimming, scanning, and summarizing the information in the text in order to transfer the necessary information to other group members. As to the effects of problem solving tasks to LLS selection, metacognitive, social, and cognitive strategies were most frequently used. On the other hand, the problem-solving group outperformed on the posttest. This is justified on the nature of the task and the exposure of the members to more consciousness –raising statements in the questionnaire in the pretest stage.Generally, the insignificant results may imply that the target tasks are rested in the same psychological and underlying constructs in spite of their assumed format and structural differences. Perhaps if strategic behavior of learners is compared in doing non-communicative tasks with communicative ones more differences will be observed.

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