



The Effect of Learning Strategies Used for Rehearsal on the Academic Success

Cemal Bıyıklı ¹, Nuri Doğan ²

Abstract

The aim of this study is to determine whether there are differences between groups that summarize, using concept-map, prepare questions, telling to another person and do not use any learning strategies in regard to the effects of learning strategies used for rehearsal on the Academic Success of students. In this study, pretest, posttest controlled grouped experimental design was used. The study was performed on 135 grade 5 students and five teachers at Ankara Tevfik Fikret Primary School in 2010-2011 academic year. The data was collected from a multiple-choice test including 20 questions at the beginning and end of the experimental study. As a result, a significant difference was found between the pretest and posttest marks of experimental groups and control groups. In comparison of pre-test and post-test results of experimental group and control group, the increase in the marks of experimental group was statistically significant as compared to increase in the marks of control group. Furthermore, the highest increase was observed in the group that summarized and using concept-map.

Keywords

Learning strategies
Studying
Summarizing
Using concept-map preparing
questions
Telling to another person

Article Info

Received: 04.29.2013
Accepted: 10.07.2015
Online Published: 11.14.2015

DOI: 10.15390/EB.2015.2728

Introduction

Recently, the concept of "learning to learn" has substantially gained importance in studies performed on education. The learning to learn is considered an essential skill to gain for an individual to identify the information needed by him/her and the ways to reach such information, and to use the reached information for meeting his/her needs (Başbay, 2008). This skill is one of the dimensions intended to develop in individuals during effective learning process. The learning to learn is to recognize own learning characteristics by students, be familiar with strategies used for learning, select and use suitable strategies (Başbay, 2008). This process is related to both learning styles of individuals and learning strategies used by them. The learning styles are usually individual and through them a student is aware of his/her characteristics for learning. The learning strategies are tools used for achieving the intent of learning and help students with learning by indicating how to learn and what methods to use (Güven, 2004).

In general, a strategy is defined as a method to follow for achieving something, or implementation of a plan developed to achieve a goal (Açıkgöz, 2009). There are methods to follow by individuals to achieve learning aimed by those individuals during learning process. These methods

¹ Ministry Of National Education, Ankara Tevfik Fikret Primary School, Turkey, cbiyikli@yahoo.com

² Hacettepe University, Faculty of Education, Department of Educational Science, Turkey, nuridogan2004@gmail.com

can be described by learning strategy. Weinstein and Mayer (1986), who have many studies on learning strategies, define learning strategies as behaviors or thoughts that are expected to have influence on processes of acquiring knowledge, encoding it into memory, and re-accessing it when necessary, which are all performed by students at learning. Derry and Murph (1986) defines the learning strategy as a combination of mental tactics gained by the individual during a specific learning situation in order to facilitate acquisition knowledge and skill. Woolfolk (1998) used the learning strategy as a kind of plan for achieving learning objectives. Yüksel and Koşar (2001) defines the learning strategy as plans used by the student for achieving learning objective. The learning strategy is each of techniques that facilitate self-learning of an individual (Özer, 2003). The learning strategies are behaviors that are aimed to influence our learning, and which we do intentionally or unintentionally in regard to cognitive processes we use during learning (Ellez, 2004). The learning strategies are thought and behaviors that are used by the student during learning and intended to encoding process of the students (Açıkgöz, 2009). The learning strategies are techniques that enable an individual to transfer stimuluses received by sense organs of individual during learning to the short- and long-term memory (Selçuk, 2007).

In review of definitions of learning strategy, what definitions have in common is the functioning of processes in the pattern to process information (Tay, 2002). From this point of view, the learning strategies can be defined as “a method to ease for a learner to transfer the information from sensory record to the short-term memory, to effectively process the information received by the short-term memory, to transfer from the short-term memory to the long-term memory, and to retrieve from the long-term memory” (Çalışkan, 2010). The learning strategies fall into five categories by inner processes in the theory of information process (Gagne, 1998). They can be listed as follows:

1. Attention Strategies: Underlining, examination questions, taking notes next to the text, reviewing heading, tables and diagrams
2. Strategies to Increase Storing in Short-Term Memory (Rehearsal Strategies): Reviewing at certain intervals, rereading, telling to another person, writing as it is.
3. Strategies to Enhance Encoding: Summarizing, taking notes, creating a concept-map or knowledge map, diagramming knowledge.
4. Strategies to Simplify Retrieval of Knowledge: Setting simulations, visualization, asking questions.
5. Monitoring Management Strategies: Being aware of own learning and thinking methods by individual, asking questions enabling effective self-learning, and self-control.

From the theory of information process, one way to help information to be more easily processed in the short-term memory is to rehearse the learned information. Acquisition of the most long-lasting knowledge within the shortest time appears to be a requirement of this period rather than an objective of education. Considering that the successes can be achieved by effective study not by hard studying, students need to have habits of efficient studying (Küçükahmet, 1987).

In this study, because storing knowledge in the short-term memory, encoding and retrieving knowledge are considered important when rehearsing knowledge, examples were taken from these strategies. They are telling to another person from strategies to enhance storing in the short-term memory; summarizing and creating a concept-map from strategies to empower coding; and asking (preparing) questions from strategies to simplify retrieval of knowledge. The main reason for selecting these strategies was that researchers considered that they would control more easily whether such strategies were implemented during research time. From this consideration, five academicians, who have made research on the field, were interviewed and it was decided to use such strategies in line with their view. Definition of strategies addressed in the research is provided below.

Summarizing helps students to explain the meaning of information and to store the information in the long-term memory. Summarizing enables students to understand what they read, differentiate their significant thoughts from others, and express the knowledge in their own word. (Senemoğlu, 2010). A concept-map is a visual method that is widely used for learning and teaching activities (Kocalar, 2006). A concept-map is a diagram that helps, in a gradual manner, representing concepts and sub-concepts provided in a box, and the relationship between concepts (Novak, 2001). Preparing questions is a tool that allows an individual to think on the subject on which that individual studies. This tool allows giving meaning to and rehearsing what is learnt. The learning process becomes functional when it is supported by questions or includes student questions. Questions enable to create productive communication processes between teachers and students and to enhance learning. Asking questions is a process that is intended to involve students in learning process and includes mutual interaction (Cole and Chan, 1994). Telling to another person is that students tell the text with their own word, or tell the text with different expressions from the words in the text. This strategy allows students to establish inner links (Özer, 1998). In the process of telling to another person, the learning strategy allows students to structure information in their own way (Weinstein and Mayer, 1986).

It appears that learning strategies have usually positive effects on the academic success (Ning and Downing, 2011; Çalışkan, 2010; Cebesoy, 2009; Şensoy, 2008; Dikbaş, 2008; Taşdemir and Tay, 2007; Tunçer and Güven, 2007; Duban, 2006; Yıldız, 2003; Arslan, 2000; Hartley, 1998; Carns and Carns, 1991). In addition, learning strategies in this study including telling to another person in this study (Kıroğlu, 1995), asking questions (Fooks, Mora and Tracks, 1994; Tok, 2003; Chappella, Craft, Burnard and Cremin, 2008), creating a concept-map (Akay, 2010; Acar, 2009; Canbolat, 2008; Çağlayan, 2006; Güneş, Güneş and Çeliker, 2006; Çatalkaya, 2005; Kılıç and Sağlam, 2004; Öztürk, 2003; Duru and Gürdal, 2002; Okebukola, 1990) and summarizing (Görge, 1997; Foos, 1995; Kirby and Pedwell, 1991) have positive effects on the academic success.

In the literature, research on using learning strategies when studying is generally focused on identifying learning strategies used by students when studying (Hamurcu, 2002; Hamurcu and Özyılmaz, 2002; Uyar, 2008). The number of experimental studies that investigated the effect of learning strategies used for studying on the academic success is only a few. A study by Kaydu (2004) on this matter found that learning strategies used for studying had positive effects on the academic success; and the research by Çiftçi (1998) showed that learning strategies used by students accounted for their mathematical success with a rate as low as .06, rehearsal and interpretation strategies accounted for mathematical success with a significant rate; and executive cognition strategy accounted for mathematical success with an insignificant rate.

The research results indicate that the academic success of students, who can successfully implement learning strategies and direct their own learning process, will be higher. It was presented by the researches above that being acquainted with what to do by students for learning in the learning process has an influence on the success and any other dependent variables. Results of previous research and in-class practices demonstrate that we need to analyze and investigate well the learning strategies.

The experimental studies performed to find what strategies were effective on learning strategies focused on only one strategy or method and paid attention to very specific areas (Sünbül, 1998). Therefore, it is considered necessary to investigate the effect of each strategy on the academic success instead of addressing learning strategies within a general scope; and how strategies differ in influencing the academic success.

It is the student who should assume responsibility for effective learning during learning process, and students should be familiar with learning strategies to be successful both at their school life and throughout their lifetime (Erdem, 2005). In this sense, students that do not have skill for productive studying will have a lower level of success at their career as well as at school because they

do not receive a recompense for their effort and time that they spend to learn (Türkoğlu, Doğanay and Yıldırım, 2000). The consideration that “students should use learning strategies and get into habit of this” when rehearsing constitute the basis of this study.

Because the literature includes only few number of studies that compare the effects of learning strategies used for rehearsal, this study is considered to make substantial contribution to the literature. Furthermore, it is believed that this study will be elucidative to have a comparative review on the effects of other learning strategies not used in this research and rehearsal on the academic success.

Based on the explanations provide above, the aim of this study is to determine whether there are differences between groups that summarize, using concept-map, prepare questions, lecture to another person and do not use any learning strategies in regard to the effects of learning strategies used for rehearsal on the academic success of students. In line with this aim, the question of this research is stated as follows:

- Would there be any significant differences between the post-test marks of experimental groups that use learning strategies for rehearsal and the post-test marks of the control group that uses no rehearsal?

Methods

Type of Research

The research was designed from experimental design to quasi-experimental design. The quasi-experimental design is a model with a high applicability to research in the field of education when it is not possible to control all of the variables (Cohen, Manion and Morrison, 2007). This research used pre-test / post-test unbalanced control group among quasi-experimental designs.

The independent variable of the research was to rehearse at home what was learnt in class by students using learning strategies (summarizing, creating a concept-map, preparing questions, or telling to another person). The dependent variable was the academic success of students. Duties and responsibilities of students and families at home during a course, environments in which subjects are rehearsed, time, control points, outputs from rehearsal process, sources and tools & materials needed, and other supporting activities were control variables. Table 1 shows the schematic representation of the model.

Table 1. Schematic Representation of the Model

Group	Pre-test	Use	Post-test
G ₁	O _{1,1}	X	O _{1,2}
G ₂	O _{1,1}	X	O _{1,2}
G ₃	O _{1,1}	X	O _{1,2}
G ₄	O _{1,1}	X	O _{1,2}
G ₅	O _{1,1}		O _{1,2}

G₁: Experimental G₂: Experimental G₃: Experimental G₄: Experimental G₅: Control Group
(Preparing questions) (Summarizing) (Telling to another person) (Concept mapping)

X: Use of learning strategies when rehearsing subjects at home

O_{1,1} – O_{1,2}: Pre-test and post-test marks from Academic Success Test on Electricity Course

As seen in Table 1, as required by pretest-posttest unbalanced control grouped quasi-experimental design, experimental and control groups were designed; groups were randomly assigned to determine what group would be experimental or control; the Academic Success Test on Electricity Chapter was administrated simultaneously on each group; of four groups, one group was lectured about summarizing, one group was lectured about creating concept-map, one group was lectured about asking (preparing) questions and one group was lectured about telling to another person by a specialist who was specialized in learning strategies; and students were instructed to use these learning strategies when rehearsing at home what they learnt in class. Teaching learning strategies and using them for rehearsing what is learnt in class were implemented as an empirical

process, the control group was not intervened in any way, and at the end of empirical process again both of the groups simultaneously took Academic Success Test on Electricity Chapter.

Study Group

This study was carried out at science and technology course for grade 5 students at Ankara Tevfik Fikret Primary School during the second term of 2010-2011 academic year because of physical, administrative and application convenience provided to the researcher in terms of field of application. The sample characteristics are as follows: the study groups included 5th grade students that received MEB (Ministry of National Education) programs, and course hours were same as the weekly course hours of all other schools except for the foreign language (French); courses were delivered between 8.30 am and 16.15 pm; there were eight classes with forty minutes each; and the students did not have to take a placement examination (either achievement or ability).

This study was limited to 5th grade students of five classes in the second term of 2010–2011 academic year at Ankara Tevfik Fikret Primary School as the study group, to the content of Electricity course contained in the science and technology course for grade five in the second term as the area of subject, to 6 weeks as the time, to learning strategies including summarizing, preparing questions and telling to another person, and to the effect of these learning strategies on the academic success. In addition, uncontrolled variables and their same effect on the experimental and control groups' students were the premise of the study.

The students in the study group were randomly assigned to 5 groups of 27 each, and a variance analysis was performed to see whether there statistically significant differences between academic successes at grade four. After determining that no significant differences existed between grade point average of grade four students in five groups, experimental groups and control group were identified by drawing method. Table 2 shows the distribution of participants by gender in the experimental groups and control groups. The chi-square test was performed to determine whether the difference was significant in frequencies of female and male students in the experimental groups and control groups, and it was found that the difference was not significant ($X^2 = .119$; degrees of freedom = 4; $p = .998$).

Table 2. Distribution of Students by Gender in the Experimental and Control Groups

Group	Gender	n	%
Control	F	14	52
	M	13	48
Experimental Group I (Asking questions)	F	15	55
	M	12	45
Experimental Group II (Summarizing)	F	14	52
	M	13	48
Experimental Group III (Telling to another person)	F	14	52
	M	13	48
Experimental Group IV (Concept-map)	F	14	52
	M	13	48

In order to determine whether the groups in the study were equal, the year-end grade point average of grade four for science and technology course was tested and compared using one-way variance analysis. Table 3 shows the results of one-way variance analysis performed on study groups.

Table 3. Results of One-Way Variance Analysis to Determine the Year-End Grade Point Average of Grade Four for Science and Technology in Groups

Source of Variance	Sum of Squares	SD	Average of Squares	F	p
Intergroup	8.148	4	2.037	.074	.99
Intragroup	3575.185	130	27.501		
Total	3583.333	134			

Based on analysis results, there were no statistically significant differences in the grade point average of grade four for science and technology course between study groups ($F_{4-130}=.074$, $p >.05$). Based on this result, it appears that the grade point averages of grade four for science and technology course were statistically equal in the experimental groups and control group of the research, thus it is evident that groups were equal in the success of science and technology course before the experiment.

In addition, an Academic Success Test for Electricity Course was applied on groups to determine whether the groups were equal, and in order to determine whether average of pretest marks were differed they were tested and compared using one-way variance analysis. Table 4 shows the results of one-way variance analysis performed for pretest results of study groups.

Table 4. Results of One-Way Variance Analysis for Pretest Marks of Groups

Source of Variance	Sum of Squares	SD	Average of Squares	F	p	Significant Difference
Intergroup	143.452	4	35.863	5.316	.001	Control - summarizing
Intragroup	876.963	130	6.746			
Total	1020.415	134				

Based on analysis results, minimum one difference of average of pretest marks of study groups for Academic Success Test for Electricity Course indicates that there were statistically significant differences between groups ($F_{4-130}=5.32$, $p \leq .001$). Scheffe's test was used, a paired comparison test, to determine between which groups a difference existed. According to results of Scheffe's test performed to find between which groups a difference existed in pretest marks, there was a significant difference between the average of the control group ($\bar{X} = 10.24$) and the average of the group ($\bar{X} = 7.29$) that rehearsed by summarizing at home what they learnt in class. Based on this finding, it can be said that the average of pretest marks for the control group was higher than the average of pretest marks of the group that summarized. However, because the difference was in favor of the control group and in case the average of posttest marks would be in favor of experimental groups, it was concluded to be useful proceeding with the research since it would empower the research question of the researcher. Furthermore, the decision to continue the research was supported by the ability to statistically control such difference using covariance analysis technique.

Empirical Process

Each of four classes in the experimental group was taught a different learning strategy. The randomization method was used to assign learning strategies to experimental groups. The class master taught the learning strategies to be applied as empirical process in the classroom. In two course hours, the students in these classes were taught by the class master of each class the learning strategies, how to use them, and for what they were used; and examples of strategies were provided in the class. Activities to teach strategies were prepared with a specialist who was experienced in the field. Students in these classes did, at home, daily rehearse of the subjects discussed at science and technology course using the learning strategies learnt. Whether students used learning strategies when they daily rehearsed the subjects at home was checked by reviewing their notebook of groups that summarized, creating a concept-map and preparing questions; and by having a weekly interview with parents of the group that used telling to another person learning strategy. The students in the control group were not taught any learning strategies, and no homework was given to them regarding science and technology course. The review of curriculums and interviews with class masters attended the class showed that the students were not familiar with, and did not use, learning strategies used for the empiric process. The students in groups with empiric process applied were advised to use only the learning method taught to them when they did, at home, rehearsal of subjects that they learnt at class. Following the initial explanation, the teacher involved in application motivated students to use only the learning method that they learnt in the process. For example, examples of concept-map drawn on notebooks, summaries and questions were shared with relevant classrooms in order to encourage students to use only what they learnt. In addition, presence of one of the researchers at school where

empiric process was carried out made students think that they did not have enough time to use a strategy other than the strategy taught to them as presented by observations of that researcher.

Instrument

In the research, the researcher developed an Academic Success Test for Electricity Chapter of Science and Technology Course to collect data. Critical gains from electricity chapter of grade five were identified when developing the test. During the process of identifying critical gains, five class masters, three science and technology teachers, one specialist in developing programs and one specialist in assessment and evaluation were asked to identify which gains were critical in the science and technology program. The opinion of specialists on each of the gains was digitized by giving 3 points for "Suitable" option, 2 points for "Somewhat Suitable" option, and 1 point for "Not Suitable". The Scope Validity Ratio was calculated by proportioned the number of specialist provided a positive response (Suitable) (N_G) for each gain to the half of total number of specialist (N) minus one (Lawshe, 1975). This is expressed in a formula as follows:

$$KGO = \frac{N_G}{\frac{N}{2}} - 1$$

36 multiple-choice test items were prepared for 18 critical gains identified by calculating scope validity ratio and scope validity indexes. The trial form prepared was administrated on 302 grade five primary school students, who were taught the electricity chapter in 2009-2010, in 3 different schools of Ankara. The items were analyzed based on the data obtained, and items with an item selectivity power below 0.30 were excluded from the test and the number of items in the test was reduced to 20. 20 questions were enough to see that each of critical gains could be assessed by minimum one question. KR-20 coefficient was .85 as calculated by data of trial application of the form created with trial application of Academic Success Test for Electricity Chapter of Science and Technology Course; KR-20 coefficient was .83 as calculated in experimental groups and control group of this study. Considering these values, the items contained in the test appeared to be consistent.

Data Analysis

In analysis of data, the t test for paired groups was used to determine whether a significant difference existed in average marks of pretest and posttest within control and experimental groups.

As there was a difference in favor of the control group in the results of variance analysis performed to compare the averages of pretest marks carried out to determine whether study groups were equal, the covariance analysis was performed to compare the averages of posttest marks. But, before proceeding with analysis process, it was analyzed whether covariance analysis and t test conditions were met. For this purpose, first average of pretest and posttest marks, standard deviation, skewness, kurtosis and Shapiro-Wilks statistics were calculated to determine whether data was normal. Shapiro Wilks statistics performed for pretest and posttest marks of all groups were .01, which was not significant. The confidence interval with 95% of probability calculated for kurtosis and skewness coefficients contained the value of 0. Based on these calculations, pretest and posttest marks did not significantly deviated from normal distribution. In the analysis performed for equivalence of slope of regression lines for pretest-posttest marks of groups, the interaction of group variable with pretest variable was statistically insignificant ($F = 2.26$; $sd = 4$; $p = .66$). Thus, it can be stated that slope of regression lines for pretest-posttest of groups was statistically equal. On the other hand, dispersion graphics for pretest and posttest marks of each group were reviewed and it was found that there was a linear relationship between the pretest and posttest marks; the correlation between two variables was positive and ranged from .54 to .72. Finally, Levene statistics were calculated for homogeneity of group variances, as a result the group variances were homogeneous ($F = 1.08$; $sd_1 = 4$; $sd_2 = 130$; $p = .37$). Based on these results, it is decided that t test and covariance analysis conditions were met.

Findings

Table 5 shows t test results for dependent groups performed to determine whether there were significant differences between the averages of pretest and posttest marks of the groups that rehearsed what was learnt from the electricity chapter of science and technology course of grade five at primary school through using learning strategies including concept-map, preparing questions, summarizing and telling to another person and the group that did not any rehearsal, depending on the sub-problem of the research.

Table 5. T Test Results Performed for Significance of Difference between the Averages of Pretest and Posttest Marks of Experimental Groups and Control Group

Groups	Assessment	N	Average	Standard. Deviation	Degree of Freedom	t	p
Experiment 1	Pretest	27	8.59	2.59	26	-11.43	.000
Preparing Qs.	Posttest	27	12.37	2.42			
Experiment 2	Pretest	27	7.29	2.82	26	-17.78	.000
Summarizing	Posttest	27	15.29	1.61			
Experiment 3	Pretest	27	9.22	1.92	26	-18.02	.000
Telling to another person	Posttest	27	13.11	2.17			
Experiment 4	Pretest	27	8.29	2.44	26	-15.5	.000
Using concept-map	Posttest	27	14.92	2.3			
Control	Pretest	27	10.24	3.05	26	-7.17	.000
	Posttest	27	13.22	3.25			

$p \leq .001$

Daily rehearsal by students in experimental groups of what was learnt from science and technology course at home using learning strategies including preparing questions ($t_{(26)}=-11.43$, pretest: $\bar{X} = 8.59$, posttest: $\bar{X}=12.37$); summarizing ($t_{(26)}=-17.78$, pretest: $\bar{X} = 7.29$, posttest: $\bar{X}=15.29$); telling to another person ($t_{(26)}=-18.02$, pretest: $\bar{X} = 9.22$, posttest: $\bar{X}=13.11$); using concept-mapping ($t_{(26)}=-15.5$, pretest: $\bar{X} = 8.29$, posttest: $\bar{X}=14.92$) resulted in a statistically significant increase in their academic success point. There was also a statistically significant increase in academic success point of students in the control group ($t_{(26)}=-7.17$, pretest: $\bar{X} = 10.24$, posttest: $\bar{X}=13.22$).

Since there was a difference between pretest marks of groups, it was considered necessary to hold constant of external factor-dependent group values and to analyze whether there was a significant relationship with the empirical process used. To test this significance, the average of pretest marks of groups needed to be corrected (Büyüköztürk, 2002). Therefore, the covariance analysis technique was used to find an answer to sub-question of the research. Table 6 shows the posttest marks corrected by pretest marks of groups.

Table 6. Corrected Posttest Averages of Groups

Applications	N	Average	Corrected Average
Experimental Group 1 (Preparing Questions)	27	12.37	12.48
Experimental Group 2 (Summarizing)	27	15.29	16.25
Experimental Group 3 (Telling to another person)	27	13.11	12.81
Experimental Group 4 (Using concept-map)	27	14.92	15.23
Control Group (without rehearsal)	27	13.22	12.14

According to Table 6, the average of pretest marks was calculated to be $\bar{X}=12.37$ in the group preparing questions, $\bar{X}= 15.29$ in the group summarizing, $\bar{X}=13.11$ in the group telling to another person, $\bar{X}= 14.92$ in the group creating a concept-map, and $\bar{X}= 13.22$ in the control group. In this

calculation, the average of control group was higher than the average of groups preparing questions and telling to another person. However, variances can be observed in posttest marks when pretest marks of groups were checked. The average of corrected marks for the posttest was calculated to be \bar{X} = 12.48 in the group preparing questions, \bar{X} = 16.25 in the group summarizing, \bar{X} = 12.81 in the group telling to another person, \bar{X} = 15.23 in the group using concept-map, and \bar{X} = 12.14 in the control group. Table 7 shows the results of ANCOVA performed to see whether the difference was significant in the averages of corrected posttest marks of groups.

Table 7. Covariance (ANCOVA) Analysis Results for Differences in the Averages of Posttest Marks Corrected by Pretest Marks

Source of Variance	Sum of Squares	SD	Average of Squares	F	Significance Level (p)
Pretest	373.329	1	373.329	126.144	.000
Groups	327.469	4	81.867	27.662	.000
Error	381.782	129	2.960		
Total	926.770	135			

In Table 7, a significant difference can be seen between the averages of corrected posttest marks of experimental and control groups ($F_{(4,129)}=27.662$, $p \leq .001$). Accordingly, there was a significant difference in favor of experimental groups between the average of posttest marks ($\bar{X}=13.92$) of experimental groups and the control group ($\bar{X}=13.22$) according to results of Bonferroni test performed between the corrected posttest marks of groups. It appears that the difference resulted from the groups summarizing and creating a concept-map in particular. The effect size calculated for the difference of group averages was $\eta^2=.35$. Because this value is greater than .14, the effect size is considered high (Gay and Airasian, 2000).

Discussion

Based on the research findings, learning strategies has higher effects on the variance in academic success point of students in the experimental groups that rehearsed daily at home what was learnt in class than on the variance in academic success point of students in the control group that did not rehearse daily at home what was learnt in class. This finding is highly consistent with the literature. Cebesoy (2009) performed a study to investigate the effect of using interpretation and organizing strategies in teaching of science on the academic success of students, their attitude towards science and technology course and learning concepts, and found that academic success of students in experimental groups using interpretation and organizing strategies was higher than that of control group. Dikbaş (2008) found that the level of use of learning strategies by students increased the academic success and also made positive contribution to students' attitude towards classes. Carns and Carns (1991) deduced that learning strategies improved academic success as they demonstrated with their study on grade 4 students at primary school.

In this research, three reasons may be put forth why learning strategies had a significant effect on the academic success of students in experimental groups who did daily rehearsal at home of what they learnt in class using learning strategies. The first reason would be that rehearsal through learning strategies enabled visualization of activities of that day; knowledge was not exactly rehearsed by means of such strategies, and strategies presented students' own meaning and way of thinking. So, this led to taking the critical steps of permanent learning, thus to increase in the academic success. Studies in the literature support this reason. Yıldız (2003) performed a study to investigate academic success of the experimental group that was taught learning strategies and the control group that received traditional education for the science and technology course and retention of what was learnt and found a significant difference between the academic success of groups and the retaining knowledge in mind in favor of the experimental group that was taught learning strategies. Duban (2006) investigated the effect of learning strategies taught to grade 5 primary school students about

science and technology course on the students' academic success and level of retention, and reached at similar results to results of Yıldız (2003).

The second reason why learning strategies had a significant effect on the academic success of students in experimental groups who used learning strategies would be the motivation as a result of adding a new method to learning style of students. Students were encouraged to use learning strategies at home and explained that if they used learning strategies they would comprehend the subject better to increase their awareness. Students' rehearsal of subjects using learning strategies might have influenced to enhance their desire to learn. The learning strategies were affected by affective characteristics of students such as interest and attitude. Students that have a positive attitude towards learning process appear to use more learning strategies than others do (Butler, 1999; Ho, 1998; Najjar, 1997; Purdie and Oliver, 1999). In addition, the research results presented that attitude of students, who were taught learning strategies, improved positively (Carroll and Leander, 2001; Huffman and Spires, 1992; Keller, 1990). The Hawthorne effect is considered to have had an effect on the study, which is often encountered in experimental research and means that subjects, who are aware of being observed during a research, are affected by the environment and draw away from their natural behavior. Therefore, groups in which empirical process was carried out and the control group were not told that a study was being performed, and a particular care was taken for students not to feel that they were the part of a research process.

The use of learning strategies by students is affected by academic characteristics and related affective characteristics of students. Research conducted on different areas and at different learning levels detected that successful learners used more learning strategies than unsuccessful learners (Jimenez, Garcia and Pearson, 1996; Medo, 2000; Phakiti, 2003). This can be considered to positively reflect on academic personality of successful students, which would make significant contribution to the academic success of students.

Another reason would be constructivism approach which forms the basis of teaching and using learning strategies. The constructivism addresses to learning as a holistic approach. Regardless of how teaching-learning process is designed, students need to use a variety of learning strategies during their activities and to overcome their predefined tasks. In this sense, the learning strategies have an important function for accomplishing defined educational activities and achieving effective learning (Vural, 2011). Students should learn to learn in effective learning. Learning to learn also includes to learn learning strategies (Özer, 2001). The ability of individuals to be aware of how they learn, access the knowledge, interpret and use the accessed knowledge, and present new knowledge in the light of existing knowledge is enabled by learning to learn, brief expression and learning the learning strategies (Tunçer and Güven, 2007).

Based on the research data and according to the average of corrected pretest marks, it is seen that the group that summarized had the highest mark which is followed by the group that using concept-map, the group that told to another person, the group that prepared questions and the group that did no rehearsal (control group) respectively. In other words, the marks of the group (control) after correcting that did not rehearsed exceeded the average of two groups before correcting that rehearsed (by preparing questions and telling to another person) had the lowest mark. Based on this, it is evident that the academic success of groups that did daily rehearsal by using learning strategies is higher than the academic success of the group that did no rehearsal. This difference can be interpreted as operationally addressing the learning strategies used.

The findings section of the research mentions that experimental groups that used particularly summarizing and concept-map from the data provided above had higher marks than others did. The reason why the average of marks of the group that summarized was higher might be that students shortened the information as far as possible in their own way when they were summarizing, and this shortened information retained in the mind more easily. The literature has studies that support the findings of this study. Belet (2005) found a significant difference between the experimental group

using summarizing and using concept-map and the control group using traditional educational methods in favor of the experimental group. Research shows that summarizing increases recall and comprehension (Anderson and Armbruster, 1984; Brown and Palincsar, 1985; Pressley et al., 1989; cited by Senemoğlu, 2010). Erden and Demirel (1993) detected that one of the strategies used by students was summarizing in their study to identify learning strategies used by primary school students when they studied. In this study they also found a significant relationship between the summarizing strategy used by students and their success. In addition, the literature has results that are different from the results of this research. Anniss (1985) concluded that summarizing partially influenced the text reading and studying at synthesis and evaluation level in their research performed to investigate the effects of studying by summarizing on the success of students.

The reason why the students in the group using concept-map learning strategy had a higher average of marks might be that mapping enables schematizing the knowledge as well as focusing on key thoughts. The research has reported that using concept-map for learning-teaching process improves the persistency of knowledge for students, causes developing positive attitude to science, enables meaningful learning and reasoning and to focus on key thoughts and gain concepts, increases performance at problem solving, eases to learn difficult and new concepts (Çağlayan, 2006; Ekmekçioğlu, 2007; Novak and Gowin, 1984; Güneş, Güneş and Çelikler, 2006; Kendirli, 2008).

The reason why preparing questions strategy increased the academic success might be that students considered questions and answers together when they prepared questions, which led them to establish a cause and effect relationship. Children keep asking questions in an attempt to build a cause and effect relationship between events they encounter when they are more attentive to the environment. By this way, children intensely interact with the environment and increase their knowledge about the world (Alisinanoğlu and Kesicioğlu, 2009). Furthermore, reduced anxiety of students during preparing questions can be considered another factor that enables increase in academic success. Warr and Downing (2000) concluded that there was a high correlation between the organizing strategies and the success and using strategies reduced the learning anxiety in their research titled "The relationship between learning strategies, learning anxiety and knowledge acquisition".

The findings of the research show that rehearsal by telling to another person had less effect on increasing academic success point of students for science and technology course than other learning strategies did. The reason why this strategy created less effect might be that students needed another person other than themselves during rehearsal process, which might have caused some difficulties in planning the process and in learning time. In telling to another person strategy, it is important that students study in harmony with family members. Children whose parents support their children's learning at home and take improving precautions appear to develop more positive attitude towards school and to have improved personal development and increased academic success (Gürşimşek, 2003). In addition, characteristics of families, peers and adults that provide aid to students during learning process shape their status of being familiar with and using learning strategies (Nisbett and Shucksmith, 1986).

According to results of review of the literature, there are many studies that learning strategies increase the academic success. In persistency dimension of academic success, the literature has a number of research that learning strategies make no differences in persistency. One research was performed by Arslan (1996). This research investigated the effect of teaching with underlined materials and full learning method, either together or individually, on the learning level, recall and academic personality, and found no differences between recall averages of groups. Similarly, Aytunga (1999) investigated the effect of taking notes in the class on the level of learning and recall by students and detected no significant difference in the level of recall by students. Görgen (1997) found no significant differences in teaching summarizing rules and creating a concept-map at the level of recalling the text between experimental groups and the control group. Furthermore, the literature has examples that learning strategies do not predict the academic success. The studies performed by

Sünbül, Afyon, Yağız and Aslan (2003) examined the effect of learning style and strategies of students on predicting the academic success at science class at grade 6, 7 and 8. As a result of the research, the tactile style and interpretation strategy appeared to highly predict the success, and visual and auditory styles and affective strategies did not create a significant effect.

Conclusions

Learning to learn by students is considered important as it enables long-term storage of knowledge. As mentioned before, the results of many research present that use of learning strategies enhances the academic success. In particular, summarizing and creating a concept-map might be more effective when they are rehearsing what was learnt. The learning strategies are important because both they enable students to learn on their own and enhance the academic success, and it is believed that learning strategies should be taught to students from grade one. As a result of this research, particularly summarizing and using concept-map appear to be more effective when students rehearse what they have learnt. Therefore, it is judged that the focus should be on teaching students how to summarize and how to create a concept- map. Especially, grade three, four and five students should be taught summarizing and concept-map; these learning methods should be demonstrated in classes, and students should be encouraged to use such methods when studying. Such activities that should be performed at primary schools are considered to provide support for students to gain academic confidence, who have learning difficulty, or who have failed to acquire correct and effective study habits for learning. In addition to this consideration, supporting learning strategies in the process of eliminating negative attitude and prejudice to a number of classes could create a favorable effect for outputs achieved at the end of the process.

As a result, the following recommendations can be made in line with findings above: The curriculums should include learning strategies; strategies should be gradually taught at the class level; and learning strategies should be consolidated with in-class applications. The students should be encouraged to use learning strategies when they do daily rehearsal at home of what they have learnt in class, and some part of homework should be prepared to serve such purpose. Primary school teachers in particular should taught learning strategies through in-service training and their awareness should be raised accordingly. This study was performed on one grade-five chapter of science and technology course. Based on this study, various studies can be performed on multiple chapters of different courses. Learning strategies that are different from learning strategies used in this study should be engaged to perform experimental studies for comparing learning strategies. Furthermore, another important suggestion would be to examine learning strategies at different class levels, in studies of different fields, and with different research methods and techniques in order to develop a scientific literature that can guide persons involved.

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