Eurasian Journal of Educational Research
www.ejer.com.tr

The Effect of Self-Regulated Learning Strategies on Academic Achievement: A Meta-Analysis Study[*]

Binnur ERGEN[1] Sedat KANADLI[2]

ARTICLE INFO	ABSTRACT
	Problem Statement: Self-regulated learning strategies (cognitive, metacognitive, resource management, and motivational strategies) influence students' academic achievement, conceptual understanding, and motivation. Reviewing the national literature about self-regulated learning strategies, studies have indicated both significant and insignificant effects on academic achievement; however, no meta-analysis studies have been carried out. **Purpose of Study:** The aim of this study is to calculate the common effect size of empirical and relational studies conducted in Turkey between 2005-2014 that investigated the effect

of (or relationship with) self-regulated learning strategies on academic achievement, and to determine whether the common effect size shows a significant difference in terms of course type, self-regulated learning strategy type, school level, and study design. **Method:** A meta-analytical review method was employed to combine the outcome of independent empirical or relational studies. The studies included in this review were collected from the CoHE National Thesis Archive, ULAKBIM, Google Academic, ERIC, and EBSCO databases. A total of 47 studies were assessed in accordance with the inclusion criteria, and 21 studies were included in this study. Cohen's d coefficient was calculated for the effect size in this study. **Findings and Results:** As the heterogeneity among the effect sizes of the studies was high (Q > χ^2, $p < .05$), the common effect size was calculated in accordance with the random effects model. As a result of the meta-analysis, it was determined that self-regulated learning strategies had a "large" effect (d = 0.859) on academic achievement. Moreover, the calculated common effect size showed no significant difference according to the type of self-regulated learning strategy, course type, study design, and school level. **Recommendation:** As self-regulated learning strategies exhibit a substantial effect on students' academic achievement, it is recommended that preservice and in-service teachers should learn how to implement these strategies in their lessons to increase their students' performance. For this purpose, professional development programs should be designed for teachers.

Introduction

Technology and knowledge are rapidly improving in today's world. It is important that students acquire knowledge and skills by taking responsibility of self-learning in order to become individuals who learn to learn. They are aware of what and how they have learned, and their deficiency of knowledge and skills while learning to learn, which enables them to self-regulate. As a result, individuals' academic success increases (Zimmerman, 1990) and they acquire skills needed to be a lifelong learner. In this regard, self-regulation is defined as individual-controlled emotions, ideas, and behaviours exhibited to reach particular goals and that occur at different levels and features in each developmental period (Zimmerman, 2001). In other words, self-regulation is a process of influencing, directing, and managing one's own behaviours (Senemoglu, 2005, 231).

Studies about self-regulation, a basic concept of the Social Cognitive Theory, have been undertaken by scholars such as Albert Bandura, Barry Zimmerman, Dale Schunk, Paul Pintrich, and Frank Pajares since the 1980s (Sakiz, 2014). This theory claims that a behaviour is developed not only through experiences, but also through observing and understanding the rewarded or punished behaviours of others as a model (Bandura, 1971). Such a model consists of processes of paying attention to the behaviour, keeping it in mind, willing to reflect on it, and ultimately, performing it (Bandura, 1986). Individuals can observe their own behaviours, compare the behaviours according to their own criteria, and regulate themselves within this period (Senemoglu, 2005, 233). Therefore, the increase in the number of the studies focusing on how students regulate themselves in academic environments has resulted in the concept of self-regulated learning (Dinsmore, Alexander & Loughlin, 2008).

Self-regulated learning is defined as an active and constructive process in which individuals set their own learning goals, regulate their cognition, motivation, and behaviours, and are directed and limited by their own goals and contextual features around (Pintrich, 2000). It helps them get to know themselves, become wise and determinant in their learning-oriented approaches (Zimmerman, 1990). Students getting to know themselves can be viewed as a process that is associated with metacognitive skills, acquiring knowledge with cognitive skills, and obtaining the ability to motivated themselves and manage their environment effectively. For this reason, self-regulated learning model is explained in four categories: cognitive, metacognitive, resource management, and motivational strategies (Pintrich & De Groot, 1990; Pintrich, 1999).

Cognitive strategies are associated with behaviours and cognitive processes students employ during their learning experiences to complete a task or achieve a purpose about an academic subject (Boekaerts, 1996). Cognitive strategies cover sub-strategies of rehearsal, elaboration, and organizational strategies (Pintrich, 2000). Metacognitive strategies involve predicting, planning, monitoring, and evaluation, which help individuals control and regulate their own cognitive processes (Lucangeli

& Cornoldi, 1997). Resource management strategies embody such strategies as controlling and managing one's time and study environment, effort, peer cooperation, and help-seeking (Pintrich, 1999). However, as it is important that students are motivated to apply these strategies, motivational strategies covering intrinsic values, self-efficacy, and test anxiety (Pintrich & De Groot, 1990) stand as the last dimension of self-regulated learning.

Regarding national and international literature about self-regulated learning, many studies have examined this concept in accordance with various variables. Various studies reveal that self-regulated learning enhances students' academic success (Atas, 2009; Camahalan, 2006; Cazan, 2014; Dikbas & Hasirci, 2008; Gulay, 2012; Rowe & Rafferty, 2013), while others argue it has no significant relationship with or effect on academic success (Haslaman & Askar, 2007; Shaine; 2015; Ustun, 2012). However, meta-analysis studies of self-regulated learning are seen only in international literature. Such meta-analysis studies have found that self-regulated learning strategies affect students' academic success (Dignath & Buttner, 2008; Hattie, Biggs & Purdie, 1996), reading comprehension (Chiu, 1998), and motivation (Dignath & Buttner, 2008) at a moderate level (d= 0.50-0.80).

There are many primary studies about self-regulated learning in Turkey, and their various findings conflict with one another. Therefore, these studies must be examined through a meta-analysis to reach a more definitive conclusion. The purpose of the study is to calculate the effect size of studies that have analysed the effect of self-regulated learning on academic success or its relationship with academic success in Turkey, and to reveal whether self-regulated learning strategies differentiate significantly according to study type, school level, study design, and design type. One of the aims of this meta-analysis is for future studies about self-regulated learning in Turkey to use this study as a reference.

The effect of self-regulated learning on academic achievement was examined in this study in terms of five categorical moderators: self-regulated learning strategy, study type, school level, research design, and course type. That the determination of the most effective type of self-regulated strategy, school level, and course on academic achievement are considered to be important for guiding practitioners (teachers or academicians). Similarly, revealing the impact of research design and study type on academic achievement is significant, as it will show researchers the type and design of research that should be executed. The answers to following questions were sought in this regard:

1. What is the effect of teaching based on self-regulated learning on academic achievement?
2. Does the effect of teaching based on self-regulated learning on academic achievement show a significant difference according to self-regulated learning strategies?
3. Does the effect of teaching based on self-regulated learning on academic achievement show a significant difference according to research design, course type, and school level?

Method

Research Design

A meta-analysis method was employed in this study to examine the effect of self-regulated learning on academic achievement. Meta-analysis refers to procedures used to combine the results obtained from individual studies and consists of following (Figure 1) stages (Cooper, 2010, 12):
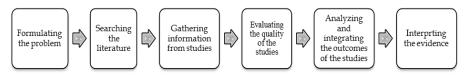

Figure 1. Steps of meta-analysis

Literature Search Procedure

The studies included in this research were obtained from the CoHE National Thesis Center (2015), ULAKBIM (2015), Google Academic (2015), ERIC (2015), and EBSCO (2015) databases. The database search was conducted between February 2015 and May 2015. While searching, these keywords were entered in both Turkish and English: "self-regulating learning", "self-regulated learning", "learning strategies", "learning strategies and academic success", "self-regulated learning and academic achievement", "metacognitive strategies", "metacognition", and "social cognitive theory". Relevant literature was scanned through references of the studies obtained. In total, 115 studies were attained about the literature concerning the effect of self-regulated learning on academic success and the relationship between them. After limiting the studies to those published between 2005-2014 and eliminating duplicated studies, 47 were left.

Study Inclusion and Exclusion Criteria

Quantitative studies published between 2005-2014 and about the effect of self-regulated learning on academic achievement were examined in the context of this study. Inclusion criteria were as follows: *(i)* Must be an article, thesis or assertion carried out in Turkey between 2005-2014 in an empirical and relational design. *(ii)* Must investigate the relationship of self-regulated learning with academic success or its effect on academic success. *(iii)* Empirical studies must have a sample size (N), means score ($\overline{X}$), and standard deviation, while relational studies must have sample size and Pearson correlation coefficient. *(iv)* Studies must employ parametric tests (t-test, F test, Pearson Correlation Coefficient, etc.).

Forty-seven studies examining the effect of self-regulated learning on academic success or its relationship with academic success were identified according to the criteria above. Some of these studies were eliminated, as six were conducted in a qualitative design, nine had limited access, and 11 were published as both a thesis

and an article. As a result, 21 studies (nine empirical and 12 relational) about self-regulated learning were identified to review. A flowchart showing the inclusion process of the studies obtained through the literature review into the meta-analysis is given in Figure 2:
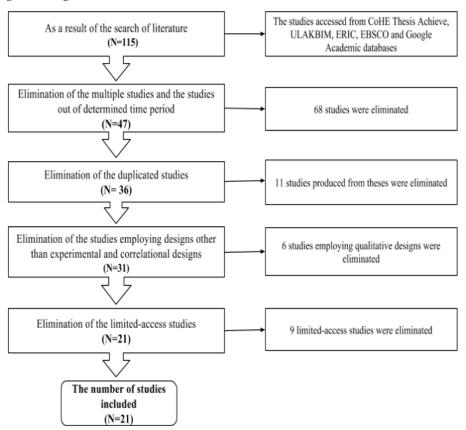

Figure 2. Flowchart of inclusion and exclusion of studies

Coding of Study Characteristics

The studies chosen according to inclusion criteria were coded in terms of their author, date, type, design, and course type. Type of study was coded according to whether it was *a thesis, article,* or *proceeding*, while study design was coded as *relational* (if examining the relationship between self-regulated learning and academic success) or *empirical* (if investigating the effect of self-regulated learning on academic success). Course types were placed in four categories: *Science, Language* (Turkish and English), *Social Sciences* (Social Sciences and Teaching Methodology), and *Mathematics*. Rehearsal, elaboration, organisation, and critical thinking were coded as *Cognitive Strategies*; predicting, planning, monitoring, and evaluation as *Metacognitive Strategies*; controlling and managing time and study environment, effort, peer cooperation, and help-seeking as *Resource Management Strategies*; value, expectation

and affective factors as *Motivational Strategies*. Since all the strategy types are employed together in some studies, they were coded as *Self-Regulated Strategies*.

Five studies (22.72%) were chosen at random and given to another coder to calculate inter-coder reliability. An equalisation rate over 80% is accepted as high enough (Miles & Huberman, 1994). After the coding process, inter-coder reliability was found to be 100%.

Data Analytic Strategy

In this study, Cohen's d effect size index defined as the standardised means difference was employed. Cohen's d is calculated by dividing the difference between raw means by standard deviation. According to Cohen (1988), the effect size is accepted as "no effect" if the d-value is up to 0.20, "low" between 0.20-0.50, "moderate" between 0.50-0.80, and "large" over 0.80.

After calculating the effect sizes of individual studies in the meta-analysis method, the effect sizes were combined through a statistical method and the common effect size was calculated. Two models are utilised in calculating common effect size: fixed and random effects models. Although it is disputable which model is to be used, there are two approaches: First one is a test of heterogeneity. This test reveals whether variance observed in effect sizes (Q) significantly differentiates from the variance arising from sampling error (χ^2) (Cooper, 2010, 85). Therefore, the Q-value must be found and compared to the degree of freedom value (df=n-1) in the χ^2 table. If Q < χ^2 (p>.05), the effect sizes of studies are interpreted as homogeneous and the combination process is applied according to the fixed effects model. If Q > χ^2 (p< .05), the effect size is interpreted as heterogeneous and the random effects model is employed.

Hedges and Pigott (2001) stated that the chi-square test (χ^2) lacks statistical power to measure variance between studies. For that reason, the model to be employed should be determined according to the inference that the researcher wants to conclude (Hedges & Vevea, 1998) and the sampling method of the studies (Borenstein, Hedges, Higgins & Rothstein, 2009, 86). In this study, the random effects model more appropriately fits the purpose of the researcher. Nevertheless, a heterogeneity test was executed, as primary studies were identified through a literature review and generalisation to the universe is an aim of this meta-analysis.

There are sub-groups independent of each other in the studies included in this study. In some of them, the combined effect of self-regulated learning on academic success was reported, while the effect of cognitive, metacognitive, motivational and resource management of self-regulated learning strategies was examined individually in others. Therefore, the studies must be utilised as analysis units instead of sub-groups. The effect size of a study is calculated by combining raw data of sub-groups reported individually (Borenstein et al., 2009, 219), and the common effect size is obtained by the help of combined effect sizes. Later, the studies reporting only the combined effect were excluded from the analysis. Furthermore, whether the common effect size showed a significant difference according to self-

regulated learning strategy types was examined by comparing sub-groups to each other. Moreover, a categorical moderator analysis was applied to reveal whether the common effect size of self-regulated learning on academic success showed a significant difference regarding study design, course type, and school level. Whether the moderator was significant was determined by the significance level of $Q_{between}$ value under the random effects model.

Moderator analysis, funnel plot, Rosenthal's Fail-safe N, and Egger's Regression Intercept tests were executed to reveal the existence of publication bias and its effect on the analysis. Comprehensive Meta-Analysis Software (CMA) 2.0 was utilised in data analysis.

Results

Characteristics of the Included Studies

The sample size of the empirical studies included in this study consists of 770 individuals, while 4583 individuals are included in the relational studies, which makes the total sample size 5353 people. Descriptive features of the studies included in the meta-analysis are given in Table 1.

Table 1

Frequency Distribution of Studies by Course Type, Study Type, Self-Regulated Learning Strategies, Research Design, and Investigated Variables

Variable	Frequency (N)	Percentage (%)
Course type		
Science	4	19.04
Mathematics	8	38.10
Social Sciences	6	28.57
Language	3	14.28
Study type		
Thesis	6	28.57
Article	14	66.67
Assertion	1	4.76
Self-regulated Learning Strategies		
Cognitive	11	40.74
Metacognitive	10	37.03
Resource Management	2	7.41
Motivational	4	14.81
Research design		
Relational design	12	57.14
Empirical design	9	42.86
School level		
Primary	4	19.05
Secondary	8	38.10
High school	1	4.76
Undergraduate	8	38.10

It is seen in Table 1 that 19.04% (*f*=4) of studies were conducted in Science, 38.10% (*f*=8) in Mathematics, 28.57% (*f*=6) in Social Sciences, and 14.28% (*f*=3) in Language courses. Concerning the study type, 28.57% of the studies (*f*=6) were thesis, 66.67% (*f*=15) were articles, and 4.76% (*f*=1) were assertions. With regard to the self-regulated learning strategies, 40.74% (*f*=11) of them were designed in line with cognitive strategies, 37.03% (*f*=10) with metacognitive strategies, 7.41% (*f*=2) with resource management, and 14.81% (*f*=3) with motivational strategies. It was reported that 42.86% (*f*=9) of these studies were empirical while 57.14% (*f*=12) were relational. With regard to the school type, 19.05% (*f*=4) were conducted in primary schools, 38.10% (*f*=8) in secondary schools, 4.76% (*f*=1) in high schools, and 38.10% (*f*=8) in undergraduate programs.

Heterogeneity Test

A heterogeneity test was applied to reveal whether the variance observed in the effect sizes of individual studies demonstrated a significant difference from the variance expected of sampling error, and to determine which model was to be used to combine effect sizes accordingly. Heterogeneity test results are shown in Table 2.

Table 2

Number, Standard Error, Heterogeneity, Effect Size, and Confidence Interval According to Effect Model of Studies

Model	N	Effect Size	Std. Error	95% Interval		Heterogeneity			
				Lower Limit	Upper Limit	Q	df	P	I²
Fixed Effect	21	0.751	0.017	0.718	0.784	740.77	20	0.00	97.3
Random Effect	21	0.859	0.114	0.636	1.083				

The heterogeneity test results were found to be significant ($p<0.05$), as seen in Table 2. The Q-value was calculated as 740.77, with 20 degrees of freedom (df). This value exceeds the critical value (31.410) of χ^2 with 24 df and confidence intervals of 95%. The I^2 index is 97.30%, which demonstrates a high amount of heterogeneity among the studies. These results reveal that the studies do not share a common effect size; namely, the variance observed in effect size of studies shows a significant difference from the variance of sampling error, and the studies are heterogeneous. As true effect sizes vary from study to study, they should be analysed according to the random effects model; the common effect is the mean of these effects (Borenstein et al., 2009, 76–77).

When the effect sizes of the 21 studies included in this review were combined in accordance with the random effects model, the common effect size was calculated as (d) 0.859 with 0.114 standard error and 95% confidence intervals of 1.083 and 0.636. The value of effect size falls within the "large" interval, according to Cohen's (1988) classification.

Forest Plot

Forest plot is one of the most useful tools to summarise meta-analysis results by visualizing them (Israel and Richter, 2011). The forest plot of the meta-analysis results of the 21 studies included in this review is given below:

Study name	Subgroup within study	Statistics for each study							Std diff in means and 95% CI
		Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	
Akca, 2013	Combined	0,516	0,066	0,004	0,386	0,646	7,787	0,000	
Atas, 2009	Combined	0,787	0,288	0,083	0,223	1,351	2,733	0,006	
Bas, 2011	Combined	1,215	0,281	0,079	0,664	1,766	4,324	0,000	
Caliskan & Sunbul, 2011	Combined	0,375	0,180	0,032	0,022	0,728	2,083	0,037	
Canca, 2005	Combined	0,682	0,093	0,009	0,498	0,865	7,294	0,000	
Duru et al., 2014	Combined	0,774	0,110	0,012	0,558	0,990	7,036	0,000	
Ergoz, 2008	Combined	0,151	0,059	0,004	0,034	0,267	2,534	0,011	
Gulay, 2012	Combined	0,383	0,312	0,097	-0,229	0,995	1,228	0,220	
Haslaman & Askar, 2007	Combined	3,096	0,137	0,019	2,827	3,365	22,599	0,000	
Memis & Arican, 2013	Combined	2,124	0,149	0,022	1,832	2,416	14,255	0,000	
Onemli & Yondem, 2012	Combined	0,523	0,294	0,086	-0,053	1,099	1,779	0,075	
Polat & Uslu, 2012	Combined	1,053	0,302	0,091	0,461	1,645	3,487	0,000	
Sapanci, 2012	Combined	0,488	0,118	0,014	0,257	0,719	4,136	0,000	
Tay, 2007	Combined	1,300	0,284	0,081	0,743	1,857	4,577	0,000	
Tekbiyik et al., 2013	Combined	0,614	0,051	0,003	0,514	0,715	11,953	0,000	
Tonguc, 2013	Combined	1,092	0,031	0,001	1,031	1,153	35,061	0,000	
Tuncer & Guven, 2007	Combined	0,919	0,332	0,110	0,268	1,570	2,768	0,006	
Uredi & Uredi, 2005	Combined	0,730	0,048	0,002	0,637	0,823	15,330	0,000	
Uredi, 2012	Combined	0,593	0,050	0,002	0,496	0,691	11,916	0,000	
Ustun, 2012	Combined	0,188	0,059	0,003	0,072	0,304	3,188	0,001	
Vardar & Arsal, 2014	Combined	0,546	0,275	0,076	0,007	1,085	1,985	0,047	
		0,859	0,114	0,013	0,636	1,083	7,550	0,000	

Figure 3. Forest plot of meta-analysis results

When standardised means differences of control and experimental groups are calculated in addition to effect sizes in a 95% confidence interval, the result is seen to be in favour of the experimental group. As a result, 19 of the 21 studies have a significant effect size, while 2 do not. Upon classifying these studies in regard to Cohen's (1988) effect classification, the effect size was found to be "low" in five studies, "moderate" in nine studies, and "large" in seven studies.

Moderator Analysis

Moderator analysis was applied to reveal whether the effect of self-regulated learning on academic achievement showed a significant difference in terms of self-regulated learning strategy, course type, school level, and research design. The results of the moderator analysis can be seen in Table 3.

Table 3

Moderator Analysis

Moderator Name	k	Effect Size	95% CI.		Heterogeneity		
			Lower Lim.	Upper Lim.	Q_b	df	p
Self-regulation strategy	27	0.701	0.548	0.854	2.994	3	0.393
Cognitive	11	0.673	0.432	0.915			
Metacognitive	10	0.897	0.548	1.245			
Management	2	0.818	0.435	1.201			
Motivational	4	0.515	0.204	0.826			
Course type	21	0.639	0.562	0.715	4.182	3	0.242
Language	3	0.682	0.190	1.173			
Science	4	0.618	0.521	0.714			
Mathematics	8	1.098	0.646	1.551			
Social Sciences	6	0.635	0.502	0.769			
School level	20	0.762	0.535	0.990	1.159	2	0.560
Primary	4	1.077	0.159	1.994			
Secondary	8	0.693	0.432	0.955			
Undergraduate	8	0.944	0.408	1.479			
Study design	21	0.825	0.640	1.011	0.521	1	0.470
Experimental	9	0.767	0.522	1.011			
Relational	12	0.905	0.619	1.191			

It is seen in Table 3 that there is no significant difference in the effect size of groups formed according to self-regulation strategy, course type, school level, and study design ($Q_b < \chi^2$; p>.05). In other words, the effect of self-regulated learning on academic success does not vary significantly neither according to cognitive, metacognitive, resource management, and motivational strategies, nor according to the courses in which self-regulated learning occurs, be they science, social sciences, mathematics, or language courses. Similarly, the common effect size of the studies shows no significant difference according to whether they are relational or empirical or conducted in primary schools, secondary schools, or undergraduate programs.

Publication Bias

One of the ways to determine the existence of publication bias is that the common effect size of the studies does not show a significant difference according to study type (thesis vs. article). For this purpose, a moderator analysis was executed; it was found that the effect of self-regulated learning strategies on academic success

demonstrates no significant difference regarding publication status under the random effects model (Q_b=0.271, p>0.05). Another way to determine whether there is publication bias is via a funnel plot. When there is no publication bias, the effect sizes of studies included in the analysis will range around the common effect size symmetrically in the funnel plot, while they are expected to pile up very close to each other at the centre or bottom in case of publication bias, depending on the number of lacking studies (Borenstein et al., 2013, 273). A funnel plot for this study is given in Figure 4.
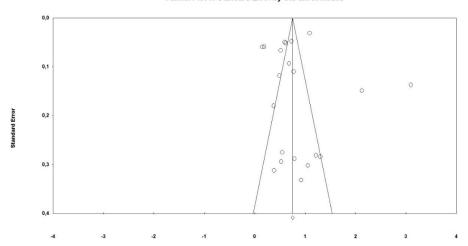

Figure 4. Funnel plot of publication bias

As seen in the funnel plot above, the effect sizes of the studies are generally dispersed at the centre and around the common effect size asymmetrically, which shows a possible existence of publication bias. However, the interpretation of the funnel plot is of the utmost subjectivity (Borenstein et al., 2009, 283). So Egger's Regression Intercept test and Rosenthal's Fail-safe N test were employed to evaluate the amount and impact of publication bias on the results.

If the intercept value (B0) obtained from Egger's regression intercept test does not deviate significantly from zero (p> 0.05), it proves the absence of publication bias, whereas it shows the possible existence of publication bias if the intercept value (B0) significantly deviates from zero (p< 0.05) (Card, 2012, 267). As a result of Egger's regression intercept test, the intercept value (B0) was computed as 0.6996 and the two-tailed p-value as 0.7576. According to these results, it can be interpreted that the common effect size does not result from publication bias since the intercept value did not significantly (p > 0.05) deviate from zero.

Rosenthal's Fail-safe N test (Borenstein et al., 2009, 284) was performed to evaluate whether the observed effect size was strong or if the common effect size resulted from publication bias. This test calculates how many studies with the mean effect of zero need to be added to the analysis to make the p-value non-significant

(Rosenthal, 1979). According to Rosenthal (1979), if 5k+10 (k is the number of the studies) of the studies included in the analysis are needed, the common effect can be said not to result from publication bias. As a result of Rosenthal's Fail-safe N, it was found that 7331 studies with a mean effect of zero would be needed to nullify the common effect size. Considering the number of studies included in the analysis was 21, the threshold of Rosenthal (1979) was computed to be 115 (5*21+10). As the sum of the studies to be added exceedingly outnumbers this threshold, the common effect size can be claimed not to be the outcome of publication bias.

Discussion and Conclusion

In this study as a result of the meta-analysis, a heterogeneity test showed that the individual studies were heterogeneous at a high level *(p < 0.05, I^2 = 97.30%)*. As effect size varies from study to study, the common effect size should be analysed in regard to the random effects model. The common effect size under the random effects model was calculated as 0.859. The result reveals that the effect of the educational environment designed according to self-regulated learning on academic achievement is "large" *(d=0.859)*.

The finding that self-regulated learning strategies have a "large" effect on academic achievement shows parallelism with the findings from meta-analysis studies by Hattie, Biggs, and Purdie (1996), Chiu (1998), and Dignath and Buttner (2008). The common effect size in those studies is "moderate", while it is "large" in this study. This can be because relational studies are included in this meta-analysis study in addition to empirical ones. Though there is no significant difference in the common effect size of the studies regarding study designs (empirical vs. relational), the common effect size of empirical studies was found to be "moderate" *(d=0.767)*, while it was "large" *(d=0.905)* in relational ones. The result that the common effect size of relational studies is higher than empirical ones can be thought to be the reason for the "large" interval.

It was found in this study that the common effect size of self-regulated learning shows no significant difference according to self-regulated learning strategies (cognitive, metacognitive, motivational and resource management) *(Q_b=2.994, p>.05)*. The common effect size of resource management and metacognitive strategies is "large", while the common effect size of cognitive and motivational strategies is "moderate". Metacognitive strategies help individuals to control and regulate their own cognitive processes (Lucangeli & Cornoldi, 1997); however, resource management strategies enable individuals to manage and monitor their learning environment (Pintrich, 1999). Consequently, individuals make use of their own cognition effectively via metacognitive strategies and benefit from their environment more through resource management strategies to achieve their goals, which will probably increase their academic achievement more than other strategies.

Another result of this meta-analysis review is that the effect of self-regulated learning on academic achievement does not show any significant difference according to course type *(p>0.05)*. It was found that the effect of self-regulated learning on academic achievement in mathematics is "large", while it is "moderate"

in science, language, and social sciences. The finding as to mathematics corresponds to Dignath and Buttner's (2008) findings; however, unlike this study, Dignath and Buttner (2008) found the common effect size of reading/writing (language) to be "low". Regarding this finding, it can be alleged that self-regulated learning enhances academic success in mathematics more than other courses.

Finally, the effect of self-regulated learning on academic success shows no significant difference in terms of school level. As a result of the meta-analysis, the effect size for primary and undergraduate was found to be "large", while it was "moderate" for secondary school. Accordingly, Chiu (1998) revealed that providing students who exhibit low-level skills with strategy teaching would contribute more to their achievement, in comparison with other students. Therefore, the reason for the high effect size in primary school may be because it requires low-level skills compared to other school levels. The fact that there is no significant difference between school levels shows it would be useful to teach these strategies to all age levels.

Recommendations

It was revealed in this study that metacognitive and resource management strategies have the highest effect size and, thus, it is important that teachers employ metacognitive strategies in learning environments to the increase academic achievement of their students. For this purpose, teachers can be provided with professional development programs about creating self-regulated learning environments as well as requesting teacher candidates to work on improving these skills. Although these programs are useful for all branch teachers, they are especially important for classroom teachers/teacher candidates, as these strategies increase academic success in primary school more than other school levels. In this way, the students educated by these teachers can be lifelong learners, as they will acquire these skills early.

This meta-analysis study revealed that empirical design was employed, at the very least, in studies of self-regulated learning, and that these studies are conducted in language courses. Therefore, further studies may contribute to literature if they are carried out in language courses with an empirical design. In addition, it may be useful for researchers to conduct a meta-analysis study about self-regulated learning to investigate the effect of self-regulated learning on dependent variables such as attitude towards course, retention, self-efficacy, and high-level thinking skills.

Limitations

While calculating the effect of self-regulated learning on academic success, firstly, the sub-strategies of each strategy reported in some of the studies were combined amongst one another and their effect size was calculated. Later, these effect sizes were combined and the common effect size of the study was determined. However, while some of the studies reported the effect of the sub-strategies of each self-regulated learning strategy, some reported the effect of the self-regulated learning strategies, and others reported the effect of self-regulated learning. For instance, the

individual effect of cognitive or metacognitive strategies of self-regulated learning was mentioned in several studies. Therefore, it can be said that this situation can influence the common effect size of self-regulated learning on academic success.

References

(The studies with asterisk indicate that the studies are included in this review).

*Akca, F. (2013). An investigation into the academic success of prospective teachers in terms of learning strategies, learning styles and the locus of control. *Journal of Education and Learning*, *2*(1), 134–146. DOI: http://dx.doi.org/10.5539/jel.v2n1p134

*Atas, I. (2009). *Oz-duzenleyici ogrenme stratejileri kullaniminin ilkogretim okulu 4.sinif ogrencilerinin matematik dersindeki oz-yeterlik algisina ve basarisina etkisi* [The effect of self- regulated learning education strategies on the fourth grade primary students' perception of self-efficacy and success on maths lesson] (Unpublished Master's Dissertation), Gazi University, Ankara. Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi

*Bas, G.(2012). The effect of teaching learning strategies in an English lesson on students' achievement, attitudes, and metacognitive awareness. *Journal of Theoretical Educational Science*, *5*(1), 49–71.

Bandura, A. (1971). *Social learning theory.* New York: General Learning Press.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Boekaerts, M. (1996). Self-regulated learning at the junction of cognition and motivation. *European Psychologist*, *1*(2), 100–112.

Borenstein, M., Hedges, L.V., Higgins, J.P.T., & Rothstein, H.R. (2009). *Introduction to meta-analysis*. John Wiley & Sons, Ltd.

Card, N.A. (2012). *Applied meta-analysis for social science research*. New York, London: Guilford Press.

*Canca, D. (2005). *Cinsiyete gore universite ogrencilerinin kullandiklari bilissel ve bilisustu oz duzenleme stratejileri ile akademik basarilari arasindaki iliskinin incelenmesi* [Research of the relationship between university students' cognitive and metacognitive self-regulation strategies and their mathematics achievement according to gender] (Unpublished Master's dissertation), Yildiz Technical University, Istanbul. Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi

Camahalan, F. M. G. (2006). Effects of self-regulated learning on mathematics achievement of selected Southeast Asian children. *Journal of Instructional Psychology*, 33(3), 194–205.

Cazan, A. (April 2014*). Self-regulated learning and academic achievement in the context of online learning environments*. The 10th International Scientific Conference e-Learning and Software for Education, Bucharest.

Chiu, C. W. T. (April 1998). *Synthesizing metacognitive interventions: What training characteristics can improve reading performance?* Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd Ed.). Hillsdale, NJ: Erlbaum. Cox

Cooper, H. (2010). *Research synthesis and meta-analysis (A Step by Step Approach) 4th edition*. Thousand Oaks: SAGE Publication.

*Caliskan, M., & Sunbul M.A. (2011). The effects of learning strategies instruction on metacognitive knowledge, using metacognitive skills and academic achievement (Primary Education Sixth Grade Turkish Course Sample) *Educational Sciences: Theory & Practice, 11*(1), 133–153.

Dikbas, Y., & Hasirci, O. (2008).The effects of teaching and using of learning strategies on achievement, retention and attitude of the students. *Journal of Kırsehir Education Faculty (JKEF)**, 9*(2), 69–76.

Dignath, C., & Buttner, G. (2008). Components of fostering self-regulated learning among students. A meta-analysis on intervention studies at primary and secondary school level. *Metacognition Learning, 3,* 231–264.

Dinsmore, D. L., Alexander, P. A., & Loughlin, S. M. (2008). Focusing the conceptual lens on metacognition, self-regulation, and self-regulated learning. *Educational Psychology Review*, *20*, 391–409. DOI: http://10.1007/s10648-008-9083-6

*Duru, E., Duru, S., & Balkis, M. (2014) Analysis of relationships among burnout, academic achievement, and self-regulation. *Educational Sciences: Theory & Practice, 14*(4), 1263–1284. DOI: http://10.12738/estp.2014.4.2050

*Ergoz, G. (2008). *Oz- duzenleyici ogrenmenin ve guduleyici inanclarin matematik basarisi icinde arastirilmasi* [Investigation of self-regulated learning and motivational beliefs in mathematics achievement*]* (Unpublished Master's Dissertation). Middle East Technical University, Ankara. Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi

*Gulay, A. (2012). *Oz-duzenleyici ogrenmenin 5.sinif ogrencilerinin akademik basarisina ve bilimsel surec becerilerine etkisi* [Effect of self-regulated learning on 5th grade students' academic achievement and scientific process skills] (Unpublished Master's Dissertation) Recep Tayip Erdogan University, Rize. Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi

*Haslaman, T., Askar, P. (2007). Investigating the relationship between self-regulated learning strategies and achievement in a programming course. *Hacettepe University Journal of Education, 32*(2007), 110–122.

Hattie, J., Biggs, J., & Purdie, N. (1996). Effects of learning skills interventions on student learning: A meta-analysis. *Review of Educational Research, 66,* 99–136. DOI: http://10.3102/00346543066002099

Hedges, L. V., & Pigott, T. D. (2001). The power of statistical tests in meta-analysis. *Psychological Methods*, *6*, 203–217.

Hedges, L. V., & Vevea, J. L. (1998). Fixed- and random effects models in meta-analysis. *Psychological Methods*, *3*, 486–504. DOI: http://10.1037/1082-989X.3.4.486

Israel, H., & Richter, R.R. (2011). A guide to understanding meta-analysis. *Journal of Orthopedic & Sports Physical Therapy*, *41*(7), 496–504. DOI: http://10.2519/jospt.2011.3333.

*Kuyumcu Vardar, A., & Arsal Z. (2014). Oz-duzenleme stratejileri ogretiminin ogrencilerin Ingilizce basarilarina ve tutumlarina etkisi [The effect of self-regulated learning strategies instruction on students' English achievement and attitude]. *Journal of Mother Tongue Education*, *2*(3), 32–52.

Lucangeli, D., & Cornoldi, C. (1997). Mathematics and metacognition: What is the nature of the relationship? *Mathematical Cognition*, *2*, 121–139. DOI: http://10.1080/135467997387443

*Memis, A., & Arican, H. (2013). The analysis of 5th grade students' mathematical metacognition levels between the variables gender and achievement. *Karaelmas Journal of Educational Sciences, 1*(2013), 76–93.

Miles, MB. & Huberman, AM. (1994). *Qualitative Data Analysis (2nd edition)*. Thousand Oaks, CA: Sage Publications

*Onemli, M., & Yondem D. Z. (2012). The effect of psychoeducational group training depending on self-regulation on students' motivational strategies and academic achievement. *Educational Sciences: Theory & Practice*, *12*(1), 59–73.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*, 33–40. DOI: http://10.1037//0022-0663.82.1.33

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research*, *31*, 459–470. DOI: http://10.1016/S0883-0355(99)00015-4

Pintrich, P. R. (2000). Multiple goals, multiple pathways: The role of goal orientation in learning and achievement. *Journal of Educational Psychology*, *92*, 544–555.

*Polat, S., & Uslu, M. (2012). The effect of teaching based on metacognitive strategies on 5th grade students' achievement in science and technology course. *Usak University, The Journal of Social Sciences, 11*, 28–43.

Rowe, F., & Rafferty J. (2013). Instructional design interventions for supporting self-regulated learning: Enhancing academic outcomes in postsecondary e-Learning environments. *MERLOT Journal of Online Learning and Teaching, 9*(4), 590–601.

Rosenthal, R. (1979). The "file drawer problem" and tolerance for null results. *Psychological Bulletin*, *86*, 638–641.

Sakiz, G. (2014). *Oz-duzenleme- ogrenmeden ogretime oz-duzenleme davranislarinin gelisimi, stratejiler ve oneriler* [*Self-regulation- from learning to teaching the development of self-regulation behavior, strategies and suggestions]*. Ankara: Nobel Publishing.

*Sapanci, A. (2012).The relationship of student teachers' epistemological beliefs and metacognitive levels with their academic achievement. *Celal Bayar University the Journal of Social Sciences, 10*(1), 311–331.

*Tay, B. (2007). Ogrenme stratejilerinin hayat bilgisi ve sosyal bilgiler ogretimi dersinde akademik basariya etkisi [The effect of learning strategies on academic achievement in life science and social studies teaching courses]. *Journal of Education and Social Sciences, 173*, 88–102.

*Tekbiyik, A., Camadan, F., & Gulay, A. (2013). Self-regulated strategies as a predictor of academic achievement in science and technology course. *Turkish Studies, 8*(3), 567–582.

*Tonguc, D. (2013). Sekizinci sinif ogrencilerinin motivasyon duzeylerinin ve oz-duzenlemeye dayali ogrenme stratejilerinin matematik basarisini yordama gucu [The predictive power of motivation levels and self-regulated learning strategies on mathematics achievement of eight grade students] (Unpublished Master's Dissertation). Osman Gazi University, Eskisehir. Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi

*Tuncer, K.B., & Guven, B. (2007). Effects of learning strategies on academic achievement, students' recalling level and students' attitudes toward assigned courses. *YYU Journal of Education Faculty, 4*(2), 1–20.

*Uredi, I., & Uredi, L. (2005). The predictive power of 8th grade students' self-regulated strategies and motivational beliefs on mathematic achievement. *Mersin University Journal of the Faculty of Education*, *1*(2), 250–260.

*Uredi, I. (2012). An investigation of the relationship between pre-services teachers' self-regulated strategies, motivational beliefs and academic achievement. *Proceedings of International Conference on Educational Science*, *3*, 2014–2022.

*Ustun, A. (2012). *Cinsiyete gore ogrencilerin kullandiklari bilissel ve bilis ustu oz duzenleme stratejilerinin akademik basarilari uzerindeki etkileri* [The relationship between students' cognitive and metacognitive self-regulation strategies and their academic achievement according to gender] (Unpublished Master's Dissertation). 18 Mart University, Canakkale. Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi

Senemoglu, N. (2005). *Gelisim ogrenme ve ogretim* (12. Baskı) [Development, learning and teaching]. Ankara: Gazi Bookstore.

Shaine, M.H. (2015). The effect of self-regulated learning strategies and self-efficacy on academic achievement of primary school students. *Psychology and Behavioral Sciences*, *4*(3), 107–115.

Yukselturk, E., & Bulut, S. (2009). Gender differences in self-regulated online learning environment. *Educational Technology & Society*, *12*(3), 12–22.

Zimmerman, B.J. (1990). Self-regulated learning and academic achievement: An overview. *Educational Psychologist, 25*(1), 3–17.

Zimmerman, B. J. (2001). Theories of self-regulated learning and academic achievement: an overview and analysis. In B. J. Zimmerman, & D. H. Schunk (Eds.), Self-regulated learning and academic achievement: theoretical perspectives (2nd ed.) (pp. 1–38). Mahwah, NJ: Erlbaum.

Öz Düzenlemeli Öğrenme Stratejilerinin Akademik Başarıya Etkisi: Bir Meta Analiz Çalışması

Özet

Problem durumu: Öğrenme sürecinde öğrencilerin kendi öğrenmelerinin sorumluluğunu almaları beklenmektedir. Bu sorumluluğu alan bireyler kendilerini, kendi belirledikleri ölçütlere göre değerlendirerek eksik bilgi ve becerilerini tamamlayabilirler. Öz düzenlemeli öğrenme olarak adlandırılan bu süreç öğrencilerin akademik başarılarının, kavramsal anlamalarının ve motivasyonlarının arttırılması ve yaşam boyu öğrenen bireyler olmaları açısından önemli görülmektedir. Bireyler kendilerini düzenlerken bilişsel, üst bilişsel, kaynakları yönetme ve motivasyonel olarak adlandırılan çeşitli stratejiler kullanmaktadırlar. Öz düzenlemeli öğrenme stratejileri ile ilgili ulusal alan yazın incelendiğinde, bu

stratejilerin kullanılmasının öğrencilerin akademik başarılarını arttırdığını belirten çalışmaların yanında akademik başarı üzerinde anlamlı bir etkisi ya da akademik başarıyla anlamlı bir ilişkisi olmadığını ortaya koyan çalışmalar görülmektedir. Bu nedenle Türkiye'de öz düzenleme ile ilgili olarak birçok bireysel çalışmanın olması ve bu çalışmalarda çelişkili sonuçların elde edilmesi, bu çalışmaların meta analiz yöntemiyle birleştirerek bir sonuca varma ihtiyacının doğurmuştur.

Amaç: Bu araştırmanın amacı öz-düzenlemeli öğrenmenin akademik başarı üzerindeki etkisini inceleyen ilişkisel ve deneysel çalışmaların meta-analizini yaparak genel etki büyüklüğünü hesaplamak ve akademik başarının öz düzenlemeli öğrenme stratejisine, ders türüne, çalışma türüne, öğretim kademesine ve çalışma desenine göre anlamlı fark gösterip göstermediğini belirlemektir.

Yöntem: Araştırmada öz-düzenlemeli öğrenmenin akademik başarıya etkisinin incelenmesi amacıyla meta-analiz yöntemi kullanılmıştır. Çalışmaların seçiminde Google Akademik arama motoru (2015), TÜBİTAK ULAKBİM DergiPark (2015), YÖK Ulusal Tez Merkezi (2015), ERIC (2015) ve EBSCO (2015) veri tabanları taranarak uygun çalışmalar toplanmıştır. Toplanan çalışmalar şu ölçütlere göre değerlendirilmiştir: *(i)* Türkiye'de 2005-2014 yılları arasında yapılan, deneysel ve ilişkisel desenlerle hazırlanmış makale, tez ya da bildiri olmalıdır. *(ii)* Öz-düzenleyici öğrenmenin akademik başarı ile ilişkisini ya da akademik başarıya etkisini araştırmalıdır. *(iii)* Deneysel çalışmaların örneklem sayısı (N), ortalaması ($\overline{X}$) ve standart sapması (SD); ilişkisel çalışmaların da örneklem büyüklüğü ve Pearson korelasyon katsayısı olmalıdır. *(iv)* Parametrik testleri kullanmalıdır (t testi, F testi vb.). Yapılan değerlendirme sonucunda içerme ölçütlerini karşılayan toplam 21 çalışma analize dâhil edilmiştir. Bu çalışmalar çalışmanın yazarı, çalışmanın tarihi, çalışmanın türü, çalışma deseni, çalışmanın yürütüldüğü ders ve öğretim kademesi ile çalışmada kullanılan öz düzenlemeli öğrenme stratejilerine göre kodlanmıştır. Yapılan kodlamanın derecelendirenler arası güvenirliği %100 olarak hesaplanmıştır. Bu araştırmada etki büyüklüğü indeksi olarak standartlaştırılmış ortalamalar farkı olan Cohen's d kullanılmıştır. Çalışmaların alanyazından toplanmış olması ve evrene genelleme yapılmak istenmesinde dolayı rastgele etkiler modeli uygun olmakla birlikte kullanılacak modelin belirlenmesinde heterojenlik testi yapılmıştır. Alanyazından toplanan çalışmaların kendi içinde alt gruplar içermesinden dolayı her bir çalışma analiz ünitesi olarak kabul edilmiş ve genel etki büyüklüğü buna göre hesaplanmıştır. Bununla birlikte hesaplanan genel etki büyüklüğünün çalışmanın türü, çalışma deseni, çalışmanın yürütüldüğü ders ve öğretim kademesi ile çalışmada kullanılan öz düzenlemeli öğrenme stratejilerine göre anlamlı farklılık gösterip göstermediğini belirlemek için moderatör analizi yapılmıştır. Yayın yanlılığının varlığını belirlemek ve analiz üzerindeki etkisini değerlendirmek için çalışmaların yayınlanma durumuna göre (tez vs. makale) moderatör analizi, huni diyagramı ile Rosenthal'ın Korumalı N'i, ve Egger'in Regresyon Kesişim testi kullanılmıştır. Verilerin analizinde bilgisayar yazılımlarından yararlanılmıştır.

Bulgular: Çalışmaların etki büyüklüklerinin heterojen yapıda (Q>x^2, p< 0.05) ve çalışmalar arasındaki heterojenliğin (I^2=97.30) yüksek miktarda olmasından dolayı genel etki büyüklüğü, rastgele etkiler modeline göre kabul edilmiştir. Rastgele etkiler

modeline göre yapılan meta-analiz sonucunda öz düzenlemeli öğrenmenin akademik başarı üzerinde "geniş" aralıkta (d=0.859) bir etkiye sahip olduğu belirlenmiştir. Yapılan moderatör analizi sonucunda hesaplanan genel etki büyüklüğünün çalışmaların desen türüne, çalışmaların yürütüldüğü ders türüne ve öğretim kademesine, çalışmalarda kullanılan öz düzenlemeli öğretim stratejisine göre anlamlı farklılık göstermediği (Q_b< χ^2, p>0.05) belirlenmiştir. Hesaplanan genel etki büyüklüğünün yayın yanlılığının ürünü olup olmadığını belirlemek için yapılan moderatör analizi sonucunda çalışmaların tez veya makale olmasına göre anlamlı farklılık göstermediği belirlenmiştir. Ayrıca Egger'in Regresyon Kesişim testi sonucunda yayın yanlılığı olmadığı ve Rosenthal'ın Korumalı N testi sonucunda genel etki büyüklüğünün oldukça güçlü olduğu belirlenmiştir.

Sonuç ve Öneriler: Bu çalışma sonucunda öz düzenlemeli öğrenme stratejilerin akademik başarıyı önemli ölçüde etkilediği ortaya çıkmıştır. Ayrıca akademik başarının öz düzenlemeli öğrenme stratejilerine, ders türüne, öğretim kademesine, çalışma türü ve çalışma desenine göre anlamlı farklılık gösterdiği sonucuna varılmıştır. Bu sonuçlara göre öz-düzenlemeli öğrenme stratejilerinin tüm derslerde ve her öğretim kademesinde öğrencilerin akademik başarılarının arttırdığı söylenebilir. Bu nedenle öğretmenlerin öğrenme ortamlarında öz düzenlemeli öğrenme stratejileri etkin biçimde kullanmaları, öğrencilerinin akademik başarılarını arttırmaları açısından önemli görülmektedir. Bu amaçla öğretmenlere öz düzenlemeli öğrenme ortamları oluşturmalarına yönelik mesleki gelişim programları hazırlanabileceği gibi öğretmen adaylarının lisans programlarına bu becerileri geliştirmeye yönelik çalışmalar yaptırılabilir. Bununla birlikte bu meta analiz çalışması sonucunda öz düzenlemeli öğretim ile ilgili yapılan çalışmalarda en az deneysel desenin kullanıldığı ve bu çalışmaların en az dil derslerinde (Türkçe, Yabancı Dil) yürütüldüğü belirlenmiştir. Bu nedenle bundan sonra yapılacak bireysel çalışmaların dil derslerinde ve deneysel desen kullanılarak yürütülmesi alanyazına katkı sağlayabilir. Buna ek olarak öz düzenlemeli öğrenme ile ilgili meta analiz çalışması yürütecek araştırmacıların öz düzenlemeli öğrenmenin derse karşı tutum, kalıcılık, öz yeterlik ve üst düzey düşünme becerileri (eleştirel ve yaratıcı düşünme, problem çözme vb.) gibi bağımlı değişkenler üzerindeki etkisini incelemeleri yararlı olabilir. Böylece bu değişkenler üzerindeki genel etki büyüklüğü hesaplanarak hangi tür moderatörlerin bu değişkenleri etkilediği belirlenebilir.

Anahtar Sözcükler: Öz düzenlemeli öğretim stratejisi, Akademik başarı, Meta-analiz, Moderatör analizi