# The Effectiveness of The Strategies Used in The Development of Reading Comprehension: A Meta-Analysis Study[1]

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## Abstract

In the thesis, it is aimed to measure the effects of the strategies, methods and techniques that is used in improving the comprehension of reading over the success of reading comprehension. The research was carried out using meta-analysis method. Experimental studies testing the effect of the strategies, methods and techniques used to improve reading comprehension between 2000-2016 were included in the research. There are 37 studies including master thesis, doctoral thesis, and article that meet the inclusion criteria at the beginning. After the studies that caused publication bias, 19 studies were combined using meta-analysis method. According to the research results, the overall effect size of reading comprehension strategies, methods and techniques was calculated as 0,896. This value is a large effect size according to Cohen's criteria. According to the type of publication in which studies were applied (master thesis, doctoral thesis, article), it was found that the biggest effect was the article type with 1.042(broad level). The effect size of PhD theses was 0.975(wide level) and the effect size of MA theses was founded 0.636(medium level).

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## Introduction

Among learning domains, reading skill is considered critical both for school and off-school life. Indeed, reading is regarded as one of the most important indicators of academic achievement, and educational contents are mainly constructed on reading. In this sense, how students can acquire an effective reading skill is often emphasized from the first years of primary school (Baştuğ and Çelik, 2015).

In the teaching of reading skill that starts from the first grade at school, recognition, pronunciation, discernment, and speed elements are taken as basis at the beginning. This is about the development of reading fluency, that is to say, teaching the basic reading skills. However, such elements of reading skill also become tools in subsequent grades and serves the purpose of actualizing the comprehension. Acquired reading and comprehension skills are elements which will make a student succeed in all courses throughout the educational life, in business life after school, and every domain of everyday life.

Akyol (2013: 33), states that providing students with reading skills and skills of making meaning of what is read is included in educational programs and teaching process as the greatest contribution to make human's life more meaningful. Per the 2015 Turkish course (1st-8th grades) Curriculum, general objectives were set by Ministry of National Education (MoNE) Board of Education such as accessing information from printed materials and multiple media sources, using and producing information; researching, exploring, interpreting information and constructing it in the mind, and the learning domain in regard to achieving these objectives was determined to be "reading" (MoNE, 2015). The reason for such changes in Turkish curriculum and other curricula might be the desire to have the shared educational outputs in parallel with the globalizing world. In fact, our country takes part in international assessment and evaluation activities such as PIRLS (Progress in International Reading Literacy Study) and PISA (The Programme for International Student Assessment).

According to the PISA National Final Report average score of Turkey significantly differs both in reading and other domains in favor of OECD countries in 2003, 2006, and 2009. In PISA 2012, Turkey scored 475 in the domain of reading skills to take the 31st place among 34 OECD countries and the 41st place among 65 participants in total, which meant an average below OECD member countries (MoNE, 2015).

In PIRLS project, another examination that measures reading skills of students internationally, Turkey fell behind the average international achievement by 51 points to take the 28th place among 35 countries (MoNE, 2003).

Given Turkey's results in these international examinations, one can argue that there are deficiencies in the development of reading skill. This requires the redefinition of reading and comprehension, which is the output of reading, and the use of more effective strategies in the teaching of these skills.

According to Keskin and Baştuğ (2012), reading is a skill which has not lost its significance to date and of which qualities have been changing depending on technological developments. This also means that definition and quality of reading will change in the future. Today, it is possible to observe several definitions of reading and studies on how it should be. The most exhaustive ones among them are given below:

"Reading is a dynamic process of making meaning which necessitates an active and effective communication between writer and reader" (Akyol, 2013: 33) and successful readers use the reading strategies that are the requirement of reading as a dynamic process (Akyol, 2009: 16).

Güneş (2013: 128) defines reading as an "active process in which individual integrates information within the text through their preliminary knowledge and produces new meanings" and states that reading is a "broad domain that involves several skills and techniques as a learning domain."

Baştuğ (2012) argues that reading is an active operation which involves physical and mental processes and requires interaction between reader and texts and aims comprehension and that readers use the reading strategies with their preliminary knowledge to achieve comprehension.

General conclusion can be drawn from the definitions of reading is that a good reader comprehends a given text and reaches new meanings from that text by using their preliminary knowledge and mental skills. When doing so, they use the reading comprehension skills. Güngör and Ün Açıkgöz (2006) suggest that development of reading comprehension depends on knowing the reading comprehension skills. Indeed, these strategies indicate how readers apprehend a process, how they draw meaning from what they read and what they do when they do not comprehend what they read (Temizkan, 2008). Thus, which of the reading comprehension skills that students will use for life and that will support their independent learning are more effective is important.

When determining the appropriate strategy, instructor will certainly prefer a strategy of which effectiveness has been tested before. However, in this case, the question which of strategies with tested effectiveness is more effective will come to mind. This calls for a meta-analysis study to be performed in the relevant field. This study will help researchers and practitioners working in the field see the effect levels of strategies, methods and techniques used in the development of reading comprehension comparatively. It is thought that results of this meta-analysis which will be obtained through the combination of experimental studies will contribute to the relevant field. To that end, this research aimed to obtain an overall idea about the effect of reading comprehension skills on the achievement of reading comprehension. The following subproblems were accordingly answered in an attempt:

1. Comparing the effectiveness of reading comprehension strategies, are there significant differences in the achievement of reading comprehension by grade levels?
2. Comparing the effectiveness of reading comprehension strategies, are there significant differences in the achievement of reading comprehension by types of publication (article, postgraduate thesis, doctoral thesis)?

## Method

Meta-analysis method of literature review methods was used in the research. Meta-analysis is a statistical analysis method performed to obtain an overall conclusion by combining the results achieved in the studies by different researchers (Dinçer, 2014). In this research using the meta-analysis method, the effect of strategies, methods and techniques used in reading comprehension on the achievement of reading comprehension was examined. The reason for choosing the meta-analysis method was to investigate the effectiveness of using reading comprehension strategies by combining the studies conducted on the subject rather than performing a study to examine the effect of reading comprehension strategies on the achievement of reading comprehension.

### Steps of Meta-Analysis

As every scientific research method, meta-analysis method has its specific process even though there is no certain standard to it (Dinçer, 2014: 10). In this meta-analysis, the steps below were followed:

- Collecting the relevant studies for meta-analysis,
- Deciding the studies to be included in the research,
- Coding the studies that met the inclusion criteria and calculating their effect sizes.

### Collecting the Relevant Studies

To determine the effect of reading comprehension strategies on the achievement of reading comprehension, scientific articles, postgraduate and doctoral theses which were performed quantitative studies in reading comprehension between 2000 and 2016 were examined in the research. The steps below were followed to collect data:

- Theses in the subject matter were searched on Council of Higher Education (CoHE) National Thesis Center.
- Scientific articles in the subject matter were accessed through Turkish Academic Network and Information Center (ULAKBİM), electronic catalogs of university libraries in Turkey, Google Scholar, and bibliographies of similar studies accessed.
- When necessary, authors of the studies were contacted to access all relevant studies.

- The following keywords were used throughout the review: "*okuma*" (reading), "*anlama*" (comprehension), "*okuduğunu anlama*" (reading comprehension), "*okuduğunu anlama stratejileri*" (reading comprehension strategies), "*okuduğunu anlama strateji, yöntem ve tekniklerinin okuduğunu anlamaya etkisi*" (effect of reading comprehension strategies, methods and techniques on reading comprehension), "*okuma becerilerinin geliştirilmesi*" (development of reading skills), and "*okuma eğitimi*" (reading education).
- 226 studies were accessed with these keywords at the end of the review. Those which are non-experimental, those without a control group, and those without required statistical data were not included in the analysis.
- The research sample was formed by 37 studies in total which examined the effect of reading comprehension strategies on the achievement of reading comprehension and met the inclusion criteria.
- Following the publication bias test, 18 of these studies were omitted from the study as they caused publication bias. Finally, 19 studies were included in the research.
- Among the studies meeting the inclusion criteria, it was determined that the doctoral thesis by Epçaçan (2008) tested the effectiveness of two reading comprehension strategies and different results were obtained on the strategy effectiveness. Hence, the strategies of which effects were tested individually were evaluated as two separate studies in the meta-analysis.

### Identifying the Study Characteristics

Study characteristics were identified to determine the effect size of independent variables which were thought to affect the meta-analysis. Characteristics used in this study can be listed as follows:

- Publication type of study
- Grade levels of the students who participated in the study

### Inclusion Criteria

The following criteria were used to choose the studies to be included in the meta-analysis:

- Studies conducted between 2000 and 2016,
- Studies measuring the effect of reading comprehension strategy on the achievement of reading comprehension,
- Studies with findings obtained from experimental studies,
- Experimental studies that applied reading comprehension strategies and used the pretest-posttest control group model,
- Studies with sufficient data (arithmetic mean, standard deviation, experimental group and control group sample sizes) to calculate the standardized effect size,
- Study sample being on primary and secondary school levels,
- Published or unpublished postgraduate, doctoral theses, and scientific articles,
- Studies conducted in Turkey and written in Turkish.

### Coding Method

Once the data collected for meta-analysis meet the inclusion criteria, a coding method needs to be developed to transform research characteristics into continuous or categorical variables so that the data can be used in the comparison of studies later. Accordingly, a clear and detailed coding form should be developed about the research included in the meta-analysis. Coding system utilized in the research is composed of three parts: The first part is study credentials. This part includes details such as ID no, name, author(s) name(s), year, type of publication of the study. The second part is study's content. This part involves information such as grade level of group on which reading comprehension strategies were applied and reading comprehension strategies used in the experiment. The third part is study data. This part addresses information on sample size of experimental and control groups, their means and standard deviation values in the studies.

*Data Analysis*

Studies found in the literature review are examined qualitatively to decide the ones to be included in the meta-analysis. Next, results to be derived from these studies need to be combined statistically. Statistical meta-analysis model may vary by research data (Yıldız, 2002). In meta-analysis, analyses can be conducted by two statistical models which are fixed-effects model and random-effects model. Since the data forming this study were homogenous, statistical analysis were performed by fixed-effects model.

*Calculating the Effect Size*

The main term that constitutes the nature of meta-analysis is effect size. Effect size is a measure that gives information about to what extent independent variable affects dependent variable positively or negatively in a study (Dinçer, 2014: 16). In meta-analysis, effect size is calculated individually for each study. Thus, effect size of each study was calculated in this analysis in the first place. Hedges' g was utilized for calculating the effect sizes.

In meta-analysis studies, firstly, effect sizes of two-group experiments need to be calculated for each study. Then, general effect size needs to be calculated using the effect sizes of the studies (Tarım, 2003). Cohen called the effect size "d". Cohen's d is found by dividing the difference between arithmetic means of experimental and control groups by the standard deviation of one of the two groups. Cohen described effect size as small, medium, and large when d=0.2, d=0.5, and d=0.8, respectively (Demir, 2013).

The measure below is usually used when classifying the sizes of studies. While this measure is given for Cohen's d, it can also be used for Hedges' g (Dinçer, 2014: 33).

- -.15     ≤ Effect size     <.15 very small
- .15     ≤ Effect size     <.40 small
- .40     ≤ Effect size     <.75 medium
- .75     ≤ Effect size     <1.10 large
- 1.10     ≤ Effect size     <1.45 very large
- 1.45     ≤ Effect size     huge

After calculating the effect size and variances, it can be proceeded with homogeneity tests which are the main aspect of a meta-analysis. How effect sizes vary between studies is detected with a "homogeneity test". This test aims to determine the expected sample error differences of the variance in effect sizes (Kaşarcı, 2013). In meta-analysis, homogeneity is tested with the calculated p and Q values. A p value smaller than 0.05 means a significant difference between individual studies. This significant difference indicates heterogeneity of the study. If p value is greater than 0.05, it means that the study is homogeneous. Another measure of homogeneity is Q value. If Q value is greater than the value corresponding to df value in $X^2$ table, it means that the meta-analysis is heterogeneous. Otherwise, it indicates homogeneity of the meta-analysis (Dinçer, 2014: 71).

In meta-analysis, if the structure is homogeneous, analysis carries on with the fixed-effects model. If it is heterogeneous, it proceeds with the random-effects model. Fixed-effects model is based on the assumption that all of the collected studies estimate the same effect (Küçükönder, 2007). This model assumes that variance between study results stems from the interrelated data (Okursoy, 2009). Random-effects model is based on the assumption that actual effect size varies by studies. This model provides an assessment in consideration of the variance both within and between the studies (Okursoy, 2009). In this meta-analysis, results obtained with p value and Q statistics showed that the studies are homogeneous. Thus, general effect size was calculated by the fixed-effects model.

# Findings

This section addresses findings of the studies included in the meta-analysis. Descriptive information on the studies included in the meta-analysis, effect sizes calculated and relevant interpretations are provided respectively. Before the calculation of effect sizes, publication bias analysis was performed for the studies included in the meta-analysis.

*Findings on Descriptive Statistics*

This section includes findings of the studies on the effect of reading comprehension strategies on reading comprehension achievement derived in this meta-analysis. First, descriptive information on the studies included in the meta-analysis are given, and then, whether the calculated Hedges' effect size values and effect sizes calculated for each group in subcategories were significant was examined.

19 studies that met the inclusion criteria and were conducted in Turkey were combined with the meta-analysis method. It was attempted to answer the following questions:

1. Comparing the effectiveness of reading comprehension strategies, are there significant differences in the achievement of reading comprehension by grade levels?

2. Comparing the effectiveness of reading comprehension strategies, are there significant differences in the achievement of reading comprehension by types of publication (article, postgraduate thesis, doctoral thesis)?

Statistical significance level of the studies was taken as p=.05. Tables below present the studies included in the meta-analysis and their descriptive statistics.

**Table 1.** Studies included in the meta-analysis

| Author and Year of Publication | Grade Level | Type of Publication |
|---|---|---|
| Aslan Ali, 2006 | 4 | Postgraduate |
| Balta Elif Emine, 2011 | 8 | Doctorate |
| Baştuğ M, Keskin H. K. 2011 | 5 | Article |
| Bozpolat Ebru, 2012 | 5 | Doctorate |
| Bulut Berker, 2013 | 4 | Postgraduate |
| Çayır Necla Belkıs, 2011 | 4 | Postgraduate |
| Epçaçan Cevdet1, 2008* | 5 | Doctorate |
| Epçaçan Cevdet2, 2008* | 5 | Doctorate |
| Hamzadayı Ergün, 2010 | 8 | Doctorate |
| Kanmaz Ahmet, 2012 | 5 | Doctorate |
| Karasu Mehmet, 2013 | 4 | Doctorate |
| Kırkkılıç et al. 2011 | 8 | Article |
| Kocaarslan Mustafa, 2015 | 4 | Doctorate |
| Koç Canan, 2007 | 8 | Doctorate |
| Kuşdemir Yasemin, 2014 | 4 | Doctorate |
| Küçükavşar Aslıhan, 2010 | 6 | Doctorate |
| Pilten Gülhiz, 2007 | 5 | Doctorate |
| Sulak Süleyman Erkam, 2014 | 4 | Doctorate |
| Şahin İlhami, 2012 | 5 | Postgraduate |

*Different results were derived for the method effectiveness in this study. Thus, individual methods were evaluated as individual studies.

According to Table 1, 19 studies were included in the meta-analysis.

**Table 2**. Frequencies on year of study

| Year of Study | Frequency | % |
|---|---|---|
| 2006 | 1 | 5% |
| 2007 | 2 | 11% |
| 2008 | 2 | 11% |
| 2010 | 2 | 11% |
| 2011 | 4 | 21% |
| 2012 | 3 | 16% |
| 2013 | 2 | 11% |
| 2014 | 2 | 11% |
| 2015 | 1 | 5% |
| Total | 19 | 100% |

Table 2 showed the distribution of studies included in the meta-analysis by years. It is accordingly seen that the highest number (21%) of studies were conducted in 2011. Frequency distributions of the studies by type of publication are given in Table 3.

**Table 3.** Frequencies by type of publication

| Type of Publication | Frequency | % |
|---|---|---|
| Postgraduate Thesis | 4 | 21% |
| Doctoral Thesis | 13 | 68% |
| Article | 2 | 11% |
| Total | 19 | 100% |

As seen in Table 3, 4 of the studies are postgraduate theses, 13 are doctoral thesis, and 2 are articles. Accordingly, doctoral thesis has the greatest share (68%) among the type of studies included in the meta-analysis.
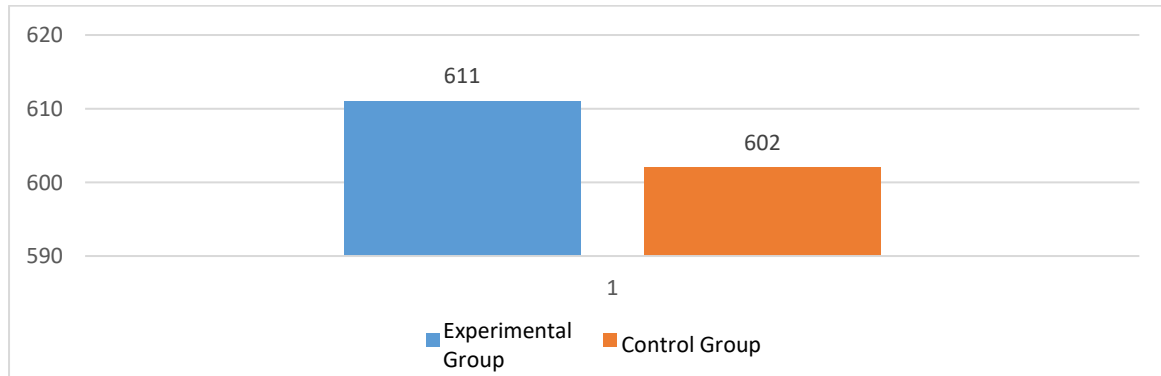


**Figure 1.** Column chart for total sample distribution of experimental and control groups

In Figure 2, total sample size of the studies included in the meta-analysis is 1213 participants, 611 of which are experimental group and 602 of which are control group.

**Table 4.** Sample sizes of the studies included in the study

| Number of participants | Frequency | % |
|---|---|---|
| n <30 | 16 | 42% |
| 30 ≤ n < 40 | 16 | 42% |
| 40 ≤ n | 6 | 16% |

Table 4 presented sample sizes of the studies included in the meta-analysis and findings on their rates in the meta-analysis. "n" refers to total number of participants in experimental and control groups. Of the studies, 16 (42%) were conducted with less than 30 participants, 16 (42%) were conducted with 30 to 40 participants, and 6 (16%) were conducted with more than 40 participants.

### Findings on Publication Bias

One of the greatest concerns in meta-analysis studies is the bias of studies included in the analysis. Such studies are substantially chosen from among published studies. The assumption that published studies generally achieved significant differences gives rise to the thought that accumulations towards a certain direction would be observed in these studies. For eliminating the sample tendency, or taking the distribution back to normal, in other words, for significance to be eliminated, it is necessary to calculate how many more studies which provide zero effect size on the subject matter need to be included in the meta-analysis. This calculated number is called fail-safe n. This number refers to the publication bias calculated to present reliability of the meta-analysis. It is the number of studies, which will reverse the results (Long, 2001). In other words, number of studies to be included in the analysis so that strength of the study and p value are greater than alpha value can be learned in classic fail-safe n. The fail-safe n was calculated to be 5538 for this meta-analysis. That is to say, 5558 individual studies are further required for alpha value to be 0.05. This means that the analysis is not much reliable and there is publication bias in the analysis. For a more realistic interpretation, Tau squared coefficient was calculated. Tau squared coefficient is defined as the variance of actual effect size. For no publication bias, it is expected that Tau value is close to 1 and p value is greater than 0.05. Tau of 0.53 and p value of 0.000 calculated for this study indicate that there is publication bias in this meta-analysis.

According to the Rosenthal method, fail-safe n was found to be 902.2. It means that there must be at least 902.2 more studies with findings which contrast with the findings at hand in the literature for findings of this meta-analysis of 37 studies to be considered invalid.

The findings indicate that there is publication bias for 37 studies to be included in the meta-analysis. Hence, studies causing the publication bias were excluded from the dataset. Once the studies causing the publication bias were excluded from the dataset, Tau was calculated to be 0.32 and p value was found to be 0.054 for the remaining 19 studies. This statistical analysis concludes that there is no publication bias in the meta-analysis.

Whether there is publication bias can also be interpreted through the funnel plot given in Figure 2.
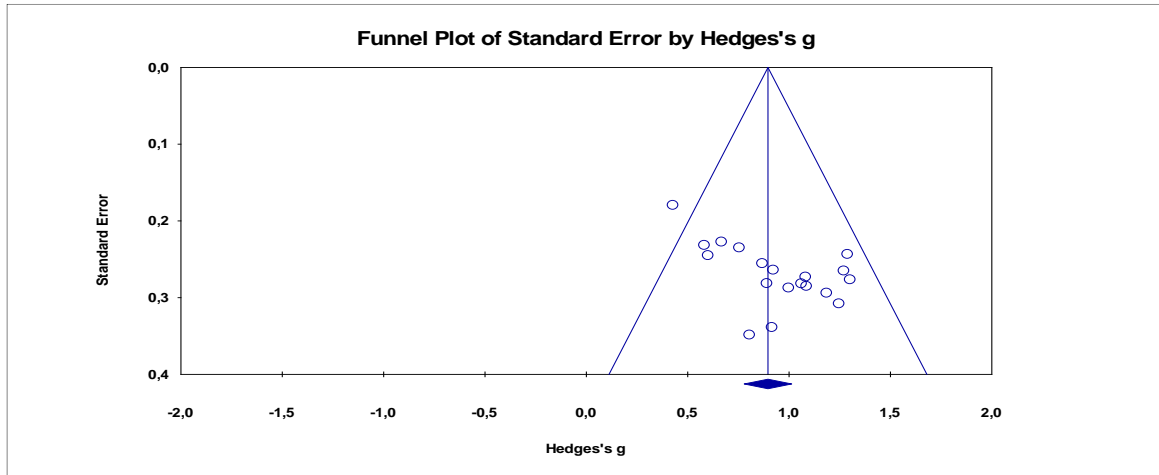
**Figure 2.** Funnel plot

In case of publication bias in the meta-analysis, effect sizes (shapes shown with circles) in the funnel plot would be asymmetrical. Effect sizes would be distributed symmetrically in case of no publication bias. In Figure 3, circles represent effect sizes of individual studies while diamond at the bottom of the plot represents the general effect. As can be understood from Figure 3, presence of publication bias for 19 studies does not appear to be strong.

Thus, fixed-effects model was utilized as the studies included in the meta-analysis were similar both in their designs and variables. The CMA statistical analysis software was used in the data analysis. After the effect size and variance had been calculated for the meta-analysis, homogeneity test Q statistics were calculated. Where effect sizes were statistically and significantly heterogeneous ($Q_B > \chi2.95$; $p<.05$), $I^2$ statistic was taken into consideration to determine the degree of heterogeneity.

### Findings of the Effect Size Analysis for Studies Included in the Meta-Analysis

With the arithmetic means, standard deviation values and sample sizes of the studies included in the meta-analysis, effectiveness of strategies, methods and techniques used in reading comprehension in the achievement of reading comprehension was examined. As concluded in the data analysis on CMA software, Hedges' effect size, standard error, variance, and minimum and maximum values for 95% confidence interval are given in Table 5.

**Table 5.** Findings of the analysis of the calculated effect sizes (before the exclusion of studies causing the publication bias)

| Study | (Hedges' g) | | | | 95% CI | |
|---|---|---|---|---|---|---|
| | Effect Size | Level of Effect Size | Standard Error | Variance | Min. Value | Max. Value |
| Şahin, 2012 | 1.000 | Large | 0.288 | 0.083 | 0.436 | 1.564 |
| Belet, 2005 | 1.460 | Huge | 0.338 | 0.114 | 0.797 | 2.123 |
| Kırkkılıç et al., 2011 | 1.187 | Very large | 0.294 | 0.087 | 0.610 | 1.764 |
| Arı, 2014 | -0.042 | Very small | 0.249 | 0.062 | -0.530 | 0.446 |
| Kocaarslan, 2015 | 0.892 | Large | 0.282 | 0.079 | 0.340 | 1.445 |
| Koç, 2007 | 0.917 | Large | 0.339 | 0.115 | 0.253 | 1.582 |
| Kuşdemir, 2014 | 1.248 | Very large | 0.308 | 0.095 | 0.644 | 1.852 |
| Hamzadayı, 2010 | 1.063 | Large | 0.282 | 0.080 | 0.510 | 1.615 |
| Kuşdemir, 2007 | 0.351 | Small | 0.229 | 0.052 | -0.097 | 0.800 |
| Epçaçan1, 2008* | 0.584 | Medium | 0.232 | 0.054 | 0.129 | 1.038 |
| Epçaçan2, 2008* | 0.756 | Large | 0.235 | 0.055 | 0.295 | 1.217 |
| Bozpolat, 2012 | 0.870 | Large | 0.256 | 0.065 | 0.369 | 1.371 |
| Aslan, 2006 | 0.669 | Medium | 0.228 | 0.052 | 0.223 | 1.115 |
| Bozkurt, 2005 | 1.498 | Huge | 0.381 | 0.145 | 0.751 | 2.244 |
| Özaslan, 2006 | 1.630 | Huge | 0.459 | 0.211 | 0.730 | 2.530 |
| Kaya, 2006 | 1.563 | Huge | 0.356 | 0.127 | 0.866 | 2.261 |
| Pilten, 2007 | 1.272 | Very large | 0.265 | 0.070 | 0.752 | 1.792 |
| Çakıroğlu, 2007 | 1.974 | Huge | 0.418 | 0.175 | 1.155 | 2.793 |
| Temizkan, 2007 | 1.459 | Huge | 0.321 | 0.103 | 0.831 | 2.088 |
| Ayçin, 2009 | 2.563 | Huge | 0.379 | 0.143 | 1.821 | 3.305 |
| Özyılmaz, 2010 | 0.228 | Small | 0.239 | 0.057 | -0.240 | 0.697 |
| Küçükavşar, 2010 | 0.602 | Medium | 0.245 | 0.060 | 0.121 | 1.083 |
| Yıldırım, 2010 | 0.133 | Very small | 0.298 | 0.089 | -0.451 | 0.716 |
| Balta, 2011 | 1.083 | Large | 0.273 | 0.075 | 0.548 | 1.619 |
| Çayır, 2011 | 0.807 | Large | 0.349 | 0.122 | 0.123 | 1.491 |
| Hacıoğlu, 2011 | 0.445 | Medium | 0.200 | 0.040 | 0.053 | 0.837 |
| Coşkun, 2011 | 292.916 | Huge | 20.214 | 408.610 | 253.297 | 332.535 |
| Kanmaz, 2012 | 1.088 | Large | 0.285 | 0.081 | 0.528 | 1.647 |
| Bulut, 2013 | 0.429 | Medium | 0.180 | 0.032 | 0.076 | 0.781 |
| Karasu, 2013 | 1.290 | Very large | 0.244 | 0.059 | 0.812 | 1.768 |
| Sulak, 2014 | 1.303 | Very large | 0.277 | 0.077 | 0.760 | 1.845 |
| Epçaçan, 2010 | 1.770 | Huge | 0.312 | 0.097 | 1.158 | 2.382 |
| Tok, 2008 | 0.489 | Medium | 0.251 | 0.063 | -0.003 | 0.980 |
| Baştuğ and Kağan, 2011 | 0.924 | Large | 0.264 | 0.070 | 0.406 | 1.442 |
| Top, 2014 | 0.516 | Medium | 0.252 | 0.063 | 0.022 | 1.009 |
| Çelikçi, 2000 | 1.807 | Huge | 0.236 | 0.056 | 1.344 | 2.270 |
| Tuna, 2016 | 11.273 | Huge | 1.043 | 1.088 | 9.229 | 13.317 |
| Total Effect Size | 1.169 | Very large | 0.164 | 0.027 | 0.849 | 1.490 |

$Z_{Total}$= 7.151, Q= 436.946, df=36, p=0.0000

    *Different results were derived for the method effectiveness in this study. Thus, individual methods were evaluated as individual studies.

In the homogeneity test performed before the exclusion of studies causing the publication bias, $Q_B$ value was found 436.946, degree of freedom was found 36, and p value was found 0.000. According to the results in Table 5, the studies were concluded to be heterogeneous (df=36, Q-value= 436,946, p= 0,000), therefore, it was understood that random-effects model was to be used for the studies included in the meta-analysis. In the meta-analysis conducted by the random-effects model, the following values were found: mean standard error (0.164), variance (0.027) and general effect size (1.169) calculated with lower limit (0.849) and upper limit (1.490) within 95% confidence interval. This effect size of 1.169 indicates that strategies, methods and techniques used in reading comprehension have a positive and very large effect on the achievement of reading comprehension. Z value was found 7.151. These values are statistically significant (p=0.000).

As seen in Table 5, effect sizes of the studies included in the meta-analysis before the exclusion of studies causing the publication bias are as follows: very small (2 studies), small (2 studies), medium (7 studies), large (10 studies), very large (5 studies), and huge (11 studies).

**Table 6.** Findings of the effect size analysis for studies included in the study (after the exclusion of studies causing the publication bias

| Study | (Hedges' g) | | | | 95% CI | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Effect Size. | Effect Size. Level | Std. error | Variance | Min. Val. | Max. Val. | Weight (%) | Strategy used |
| Sulak, 2014 | 1.303 | Very large | 0.277 | 0.077 | 0.76 | 1.845 | 4.31 | Procedural Model |
| Karasu, 2013 | 1.29 | Very large | 0.244 | 0.059 | 0.812 | 1.768 | 6.06 | Dialog-Based Instruction |
| Pilten, 2007 | 1.272 | Very large | 0.265 | 0.07 | 0.752 | 1.792 | 5.10 | Finding the Main Idea Strategy |
| Kuşdemir, 2014 | 1.248 | Very large | 0.308 | 0.095 | 0.644 | 1.852 | 5.96 | Direct Instruction Model |
| Kırkkılıç et al. 2011 | 1.187 | Very large | 0.294 | 0.087 | 0.61 | 1.764 | 4.12 | Concept Map |
| Kanmaz, 2012 | 1.088 | Large | 0.285 | 0.081 | 0.528 | 1.647 | 4.38 | SQ3R (Survey, Question, Read, Recite, Review) |
| Balta, 2011 | 1.083 | Large | 0.273 | 0.075 | 0.548 | 1.619 | 4.79 | Waldmann Model |
| Hamzadayı, 2010 | 1.063 | Large | 0.282 | 0.08 | 0.51 | 1.615 | 4.49 | Holistic Learning-Teaching Approach |
| Şahin, 2012 | 1 | Large | 0.288 | 0.083 | 0.436 | 1.564 | 4.67 | Story Map |
| Baştuğ and Keskin, 2011 | 0.924 | Large | 0.264 | 0.07 | 0.406 | 1.442 | 5.13 | Teaching Informational Text Structure |
| Koç, 2007 | 0.917 | Large | 0.339 | 0.115 | 0.253 | 1.582 | 4.49 | Active Learning |
| Kocaarslan, 2015 | 0.892 | Large | 0.282 | 0.079 | 0.34 | 1.445 | 3.06 | Mental Imagery |
| Bozpolat, 2012 | 0.87 | Large | 0.256 | 0.065 | 0.369 | 1.371 | 5.48 | Story Map Used with Cooperative Integrated Learning and Composition |
| Çayır, 2011 | 0.807 | Large | 0.349 | 0.122 | 0.123 | 1.491 | 2.88 | Theory of Multiple Intelligences |
| Epçaçan2, 2008* | 0.756 | Large | 0.235 | 0.055 | 0.295 | 1.217 | 6.50 | POSSE (Predict, Organize, Search, Summarize, Evaluate) |
| Aslan, 2006 | 0.669 | Medium | 0.228 | 0.052 | 0.223 | 1.115 | 6.95 | Mental Map |
| Küçükavşar, 2010 | 0.602 | Medium | 0.245 | 0.06 | 0.121 | 1.083 | 3.74 | Constructive Model |
| Epçaçan1, 2008* | 0.584 | Medium | 0.232 | 0.054 | 0.129 | 1.038 | 6.69 | Cooperative Learning - Discussion and Questioning |
| Bulut, 2013 | 0.429 | Medium | 0.18 | 0.032 | 0.076 | 0.781 | 11.21 | Effective Listening |
| Total Effect Size | 0.896 | Large | 0.060 | 0.004 | 0.778 | 1.013 | | |

$Z_{Total}$= 14.956, Q= 22.139, df=18, p=0.2259

In the homogeneity test, $Q_B$ value was found 22.139, degree of freedom was found 18, and p value was found 0.226. The results in Table 6 show that the studies were homogeneous (df=18, Q-value= 22,139, p= 0,226), therefore, it was understood that fixed-effects model was to be used for the studies included in the meta-analysis. In the meta-analysis conducted by the fixed-effects model, the following values were found: mean standard error (0.060), variance (0.004) and general effect size (0.896) calculated with lower limit (0.778) and upper limit (1.013) within 95% confidence interval. This effect

size of 0.896 indicates that strategies, methods and techniques used in reading comprehension have a positive and large effect on the achievement of reading comprehension. Moreover, all effect sizes were found positive for individual studies. This shows that all 19 studies have an effect in favor of experimental groups. Z value was found 14.956. These values are statistically significant (p=0.000). Effect classifications of individual studies are given in Figure 5.
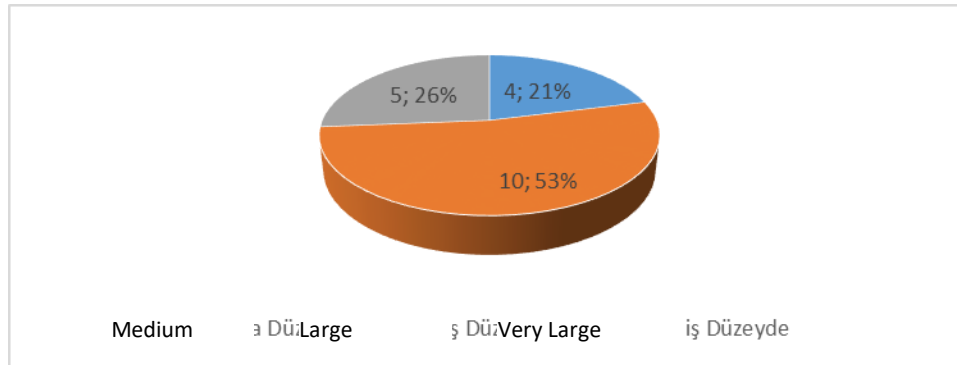


**Figure 3.** Pie Chart for the distribution of studies by effect size levels

According to the pie chart in Figure 5, of the studies, 4 have a medium effect size, 10 have a large effect size, and 5 have a very large effect size.

### Findings on Effect Sizes of Studies by Grade Levels

**Table 7.** Frequency of studies included in the meta-analysis by grade levels before and after the publication bias test

| Grade Level | Frequency before the Publication Bias Test | Frequency after the Publication Bias Test |
|---|---|---|
| 1. Grade | 0 | 0 |
| 2. Grade | 0 | 0 |
| 3. Grade | 2 | 0 |
| 4. Grade | 9 | 7 |
| 5. Grade | 13 | 7 |
| 6. Grade | 2 | 1 |
| 7. Grade | 4 | 0 |
| 8. Grade | 7 | 4 |

As seen in Table 7, before the exclusion of studies causing the publication bias from the meta-analysis, distribution of the studies by grade levels are as follows: 2nd grade (0 study), 3rd grade (2 studies), 4th grade (9 studies), 5th grade (13 studies), 6th grade (2 studies), 7th grade (4 studies), and 8th grade (7 studies). After the exclusion of studies causing the publication bias from the meta-analysis, 7 studies on the 4th-grade level, 7 studies on the 5th-grade level, 1 study on the 6th-grade level and 4 studies on the 8th-grade level included in the meta-analysis. No studies on 2nd-grade level were observed to meet the inclusion criteria before and after the publication bias test. All of the studies on 3rd- and 7th-grade levels were excluded. The fact that there was 1 study left on the 6th-grade level indicates that it was not possible to make a comparison in this grade level. In addition, the fact that there was no study on the 2nd-, 3rd-, and 7th-grade levels which met the inclusion criteria made it impossible to make comparisons in these grade levels. For all these reasons, effectiveness of strategies, methods and techniques used in reading comprehension could not be compared among grade levels.

*Findings on Effect Sizes of Studies by Types of Publication*

With the arithmetic means, standard deviation values and sample sizes of the studies included in the meta-analysis, effect of reading comprehension strategies on the achievement of reading comprehension was examined by types of publication. As concluded in the data analysis on CMA software, Hedges' effect size, standard error, variance, and minimum and maximum values for 95% confidence interval are given in Table 8.

**Table 8.** Effect of strategies, methods and techniques used in reading comprehension on the achievement of reading comprehension by types of publication

| | | (Hedges' g) | | | | 95% CI | |
|---|---|---|---|---|---|---|---|
| Type of Publication | N | Effect Size | Level of Effect Size | Standard Error | Variance | Min. Value | Max. Value |
| Postgraduate Thesis | 4 | 0.636 | Medium | 0.119 | 0.014 | 0.403 | 0.870 |
| Doctoral Thesis | 13 | 0.975 | Large | 0.074 | 0.005 | 0.830 | 1.120 |
| Article | 2 | 1.042 | Large | 0.197 | 0.039 | 0.656 | 1.427 |
| Total Effect Size | 19 | 0.896 | Large | 0.060 | 0.004 | 0.778 | 1.013 |
| $Z_{Total}$= 14,964, $Q_B$= 5.866, df=2, p=0.053 | | | | | | | |

According to Table 8, effect size levels of the strategies, methods and techniques used in reading comprehension over the achievement of reading comprehension are positive by types of publication.

The homogeneity test found a QB value of 5.866, a degree of freedom of 2 and a p value of 0.053. IT was understood from the results in Table 8 that the studies were homogeneous (df=2, Q-value= 5,866, p= 0,053), therefore, it was understood that fixed-effects model was to be used for the studies included in the meta-analysis. In the meta-analysis conducted by the fixed-effects model, the following values were found: mean standard error (0.060), variance (0.004) and general effect size (0.896) calculated with lower limit (0.778) and upper limit (1.013) within 95% confidence interval. This effect size of 0.896 indicates that strategies, methods and techniques used in reading comprehension have a positive and large effect on the achievement of reading comprehension (by types of publication). Z value was found 14.964. These values are statistically significant (p=0.000).

## Discussion, Conclusion and Recommendations

In this meta-analysis, to examine the effect of using strategies, methods and techniques in the development of reading comprehension on the achievement of reading comprehension, experimental studies on the subject matter were investigated and their findings were numerically combined.

General effect of reading comprehension strategies on the achievement of reading comprehension was found to be positive and large. Comparing the total participants of experimental groups (611) and control groups (602) in the studies included in the meta-analysis, a significant difference was found in favor of experimental groups which used strategies in reading comprehension. In the meta-analysis by Sidekli and Çetin (2017), reading comprehension strategies on the achievement of reading comprehension was found to have a very large, positive and significant effect size. Individual studies on the subject matter (Baştuğ and Kağan, 2011; Balta, 2011; Bozpolat, 2012; Çayır, 2011; Sidekli, 2012; Hamzadayı, 2010; Kanmaz, 2012; Kocaarslan, 2015; Koç, 2007; Şahin, 2012) also indicate that use of strategies, methods and techniques have a positive effect on the achievement of reading comprehension. Thus, one can argue that the results of this meta-analysis are very consistent with the relevant literature. This indicates that using different strategies, methods and techniques in the development of reading comprehension would increase the achievement of reading comprehension.

Considering the effect sizes of individual studies included in the meta-analysis by strategies used, the top four strategies with the highest positive effect level (very large) were found to be procedural model, dialog-based instruction (mutual instruction) model, finding the main idea strategy, and direct instruction model (application of finding the main idea strategy with direct instruction model), respectively. The common aspects of all four strategies include examining the text in light of preliminary knowledge, making estimations about text, reviewing the text part by part and analyzing the auxiliary

ideas, associating the auxiliary ideas with each other, reaching the main idea, and addressing the main idea from reader's perspective (making deductions). According to the meta-analysis, it is possible to argue that basic principles of these four strategies with the highest effect levels are common and share the same framework. The meta-analysis performed by Sidekli and Çetin (2017) found the most effective strategies in reading comprehension to be cooperative learning based on the theory of multiple intelligence, SQ3R technique, and meta-cognitive strategy. The meta-analysis by Davis (2010) concluded the most effective reading comprehension strategies to be mutual instruction, peer-supported learning, education for thinking, procedural strategies teaching, and concept-oriented reading teaching. Swanson's (1999) meta-analysis found the most effective reading comprehension strategies to be cognitive and direct instruction strategy.

A significant difference was observed in the effect of strategies, methods, and techniques used in reading comprehension on the achievement of reading comprehension by types of publication. Articles and doctoral theses were found to have large effect sizes while postgraduate theses were found to have medium effect sizes, which means that the articles and doctoral theses have higher effect size levels than the postgraduate theses in the meta-analysis. In their meta-analysis, Sidekli and Çetin (2017) found doctoral theses to be more effective than postgraduate theses among individual studies testing the effect of reading comprehension strategies on reading comprehension.

In this meta-analysis, 15 postgraduate theses, 18 doctoral theses, and 4 articles that met the inclusion criteria were subjected to analysis. A Tau value of 0.53 and a p value of 0.000 as calculated in the analysis indicate a publication bias. For no publication bias, it is expected that Tau value is close to 1 and p value is greater than 0.05. 18 studies found to be causing the publication bias were excluded from the meta-analysis. Tau and p values were calculated to be 0.32 and 0.054, respectively, for the remaining 19 studies following the exclusion. This result showed that there was no publication bias for 19 studies. 19 studies (4 postgraduate theses, 13 doctoral theses, and 2 articles) that met the inclusion criteria were combined with the meta-analysis method.

Next, in the meta-analysis conducted by the fixed-effects model, the following values were found: mean standard error (0.060), variance (0.004) and general effect size (0.896) calculated with lower limit (0.778) and upper limit (1.013) within 95% confidence interval. This effect size of 0.896 showed reading comprehension strategies to have a positive and large effect on the achievement of reading comprehension. All effect levels being positive for individual studies indicated that all 19 studies were concluded in favor of experimental groups. Z value was found 14.956. These values are statistically significant (p=0.000).

Considering the effect sizes of individual studies included in the meta-analysis by strategies used, strategies with the highest effect levels (very large and positive) were found to be Procedural Model (Sulak, 2014), Dialog-Based Instruction (Karasu, 2013), Finding the Main Idea Strategy (Pilten, 2007), Direct Instruction Model (Application of Finding the Main Idea Strategy with Direct Instruction Model) (Kuşdemir, 2014), and Concept Map (Kırkkılıç et al., 2011), respectively. The strategy with the lowest effect level (medium and positive) was found to be the Effective Listening (Bulut, 2013).

After the exclusion of studies causing the publication bias from the meta-analysis, 7 studies on the 4th-grade level, 7 studies on the 5th-grade level, 1 study on the 6th-grade level and 4 studies on the 8th-grade level included in the meta-analysis. All of the studies on 3rd- and 7th-grade levels were excluded. It was understood that there needed to be more than 1 study on the 6th-grade level to make a comparison in this grade level. This showed that effectiveness of the strategies used in reading comprehension were not fit for a comparison by grade levels. One can argue that results from more experimental studies on different grade levels are required to perform a comparison by grade levels.

The meta-analysis conducted for the types of publication concluded that studies of all publication types had positive effect size and Hedge's g effect sizes of the studies by types of publication were homogeneous. As for the effectiveness of studies included in the meta-analysis by types of publication, strategies, methods and techniques used in reading comprehension were found to have a positive effect on the achievement of reading comprehension in all types of publication. Studies conducted as articles and doctoral theses were found to have large effect sizes while studies conducted as postgraduate theses were observed to have medium effect size. By types of publication, the articles

(Baştuğ and Keskin, 2011; Kırkkılıç et al., 2011) were found to have the highest effect size by 1.042. Postgraduate theses (Aslan, 2006; Bulut, 2013; Çayır, 2011; Şahin, 2012) were found to have the lowest effect level by 0.636. Z value was found 14.964. These values are statistically significant (p=0.000).

Based on the results achieved in this meta-analysis on the effect of reading comprehension strategies on the achievement of reading comprehension, the following recommendations can be offered:

- According to the results of the descriptive analysis, more experimental studies should be carried out on the use of strategies in the development of reading comprehension.
- Majority of the experimental studies testing the effectiveness of strategies used in the development of reading comprehension in Turkey was found to be conducted as postgraduate theses. Accordingly, more articles should be prepared on this subject matter with the experimental method.
- Some of the studies to be included in the meta-analysis did not mention the duration for the application of experimental procedure while some of them conducted the procedure in very short durations. Hence, researchers should perform more long-term procedures and clearly mention about the duration in their studies.
- In this meta-analysis, the effect of reading comprehension strategies on reading comprehension skills was examined, and their effects on other variables were not included in the meta-analysis. Meta-analysis studies can be carried out on the effects of reading comprehension strategies on different variables (motivation, reading attitude, gender, etc.).
- Articles and theses of higher education only conducted in Turkey and written in Turkish were combined in this meta-analysis. Future research can combine studies performed both in Turkey and other countries with meta-analysis and make comparisons.
- Studies with different effect size levels can be individually examined, and what factors cause such differences can be determined in an attempt.
- For ensuring the effective use of reading comprehension skills, experts in the field can provide trainings for classroom teachers of primary schools and Turkish teachers of secondary schools.
- Different strategies, methods and techniques should be used in the development of reading comprehension.

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