THE FACTORS AFFECTING ACADEMIC ACHIEVEMENT: A SYSTEMATIC REVIEW OF META ANALYSES

Research Article

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Abstract

The study aimed to identify the factors and to demonstrate their effects on academic achievement in various publications that utilized meta-analyses. For this purpose, the meta-analyses publications on the Web of Science-All Database till 2018 were reviewed. In the study, the systematic review method was adopted. Following a related review, 169 meta-analyses were included in the scope of the study. The effects of 254 variables on academic achievement were investigated, and consequently, 427 effect sizes were found in total. Variables obtained from meta-analyses with the effect sizes between -.799 and 3.170 were examined in nine categories. The results revealed that the number of variables evaluated in the categories of psychological, socio-economic, socio-demographic and individual characteristics, learning theories and teaching strategies, and family was bigger than other categories.

Keywords: Academic achievement, academic success, meta-analysis, meta-review, systematic review

1. Introduction

Education is a phenomenon for which nations have developed policies for centuries and which they have laid special emphasis to leave the next generations a more sustainable world. According to the results of PISA 2015, TIMMS 2015 and PIRLS 2016- in which more than 60 countries participated- Estonia, Finland, Japan, Singapore, Russian Federation, and Chinese Taipei are among the most successful countries (OECD, 2018; TIMMS & PIRLS, n.d.). The data concerning some of those countries for the year 2014 demonstrated that Japan allocated 3.6% of gross domestic product (GDP) in the budget to education while Estonia allocated 5.5% and Finland allocated more than 7% to education. In addition to that such country as the US, the UK, France, and Germany- which are in the category of developed nations- spend approximately 5% of GDP on education (UNESCO, 2019). Those countries which spend a considerable amount of their GDP aim to raise capable and successful students who are to build their future (Steenbergen-Hu, Makel, & Olszevski-Kubilius, 2016; UNESCO, 2019). All nations aim to raise such capable students by means of state schools or private schools. One of the factors coming into mind primarily is academic achievement when such concepts as school, student, education and teaching are discussed (Voltmer & von Salisch, 2017). Candidates are firstly compared in terms of academic achievement in transition into an upper-level education or in employment (von Stumm, Hell, & Chamorro-Premuzic, 2011). Thus, academic achievement is important and determining the future education of individuals and job

opportunities for them (Flashman, 2012). Educators and researchers try several ways and new methods to investigate academic achievement- which is considered very important for the future of generations in all age groups (Marques, Gallagher, & Lopez, 2017). Academic achievement and variables influencing academic achievement in positive and negative ways are analyzed by researchers so that the investments made can attain the goals (Credé & Kuncel, 2008); this is because one of the goals of teaching is to raise academically well-equipped individuals. Yet, it is not so easy as it is though because there are several variables influential in and correlated with academic achievement. There are many factors with positive or negative effects on or correlated with students' academic achievement such as learning-teaching methods (Donker, de Boer, Kontos, Dinath van Ewjk, & van der Werf, 2014), the circumstances students are in (White, 1982), factors stemming from students (Perera & DiGiacomo, 2013), factors stemming from school and teachers (Rivkin, Hanushek, & Kain, 2005), physical activities (Alvarez-Bueno et al., 2017), parents attitudes towards students (Jeynes, 2017; Pinquart, 2016) and students' medical status (Galland et al., 2015). Especially effective factors are thought to be influential in and determiner of academic achievement (Credé, Tynan, & Harms, 2017).

Research into learning and teaching processes is necessary to find whether or not the teaching method used or the variable considered is influential in learning and whether or not students gain the targeted academic capabilities (Vo, Zhu, & Diep, 2017). Such research demonstrates the effects of a number of variables on academic achievement (Gajda, Karwowski, & Beghetto, 2017). It is also thought that review studies (e.g. meta-analyses) about the variables affecting academic achievement which will guide practitioners are important. Studies in which review studies are combined are also important. Such studies are known as a second-order meta-analysis, overviews of reviews, systematic reviews of reviews or as a meta-analysis of meta-analyses (Polanin, Maynard, & Dell, 2017). Also, it can be defined as a quantitatively summarizing meta-analyses addressing a similar topic or research question (Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011). A review of the literature demonstrated that the number of studies analyzing the meta-analyses focusing on academic achievement at all stages of education was limited (Hattie, 2009, 2015; Schneider & Preckel, 2017; Sipe & Curlette, 1996; Steenbergen-Hu et al., 2016; Tamim et al., 2011). Besides, the fact that the studies except for Hattie (2009) generally focus on one category or on one stage of education makes this current study different from others. Hattie (2015), in a study analyzing 1200 meta-analyses, found 195 effect sizes (ESs) influencing academic achievement. Thus, the effect size changed between -.42 and 1.65. Hattie (2015) divided the variables influencing academic achievement into such categories as students, administration, school, peers, home, and teachers. Another study analyzing 103 meta-analyses and summarizing the variables correlated with academic achievement found effect sizes ranging between -.03 and 1.15 (Sipe & Curlette, 1996). While some of the studies investigated the variables influential in academic achievement only for one stage of education, some of the studies investigated the variables influential only in a certain category. Schneider and Preckel (2017), for instance, investigating the variables related to academic achievement in higher education, had access to 38 meta-analyses and found that 105 ESs ranged between -.52 and 1.91 and they also found that there were high correlations between social interaction in courses and academic achievement. Steenbergen-Hu et al. (2016), in another analysis of meta-analyses, compiled meta-analyses that included stages of education from primary education to high school education in the analyses and divided students into groups according to their capabilities, academically accelerated them and thus analyzed the effects on academic achievement. As a result of the compilation, it was found that grouping students with special education, forming groups in the classroom and forming groups of students who are at different levels would affect academic achievement in positive ways. It was claimed, however, that forming groups between classes

at the same level did not have any effects on academic achievement. Another variable, academic acceleration, was found to have medium level of positive effects. Tamim et al. (2011), compiling the meta-analyses analyzing the effects of educational technologies on learning, found that the effect size was .33 on average. Richardson, Abraham, and Bond (2012) performed meta-analyses on the psychological factors influencing the academic achievement of university students and they found that the size of correlations was between -0.24 and .59. They also found that the correlation between self-efficacy and academic achievement was high.

It became important for meta-analyses and for review studies to bring several studies together and thus to make evaluations since reliability problems influencing the result in experimental and relational studies concerning the increase in academic achievement. This review study was believed to contribute to relevant literature in that it would lead researchers to conduct researches on academic achievement, and would increase awareness of educators, parents, students, and administrators in terms of factors related to academic achievement. In this context, the study aimed to compile the variables in meta-analyses examining the effect on or their correlations with academic achievement, as well as to draw a general framework on variables connected with academic achievement by classifying them into categories.

2. Method

The study adopted review method, and analyzed some meta-analyses in terms of their effects on and correlations with academic achievement. Academic achievement was measured with school degree and standardized tests, and studies that were correlated with academic achievement or whose effects on academic achievement were clearly demonstrated in meta-analyses were included in this paper. The flow described by Moher, Liberati, Tetzlaff, Altman and PRISMA Group (2009) for choosing studies was used at the stage of reviewing the studies. It is thought that Web of Science (WOS) database was preferred for reviewing the studies. WOS, the oldest database, has a strong scope of reference and contains good quality studies (Aghaei Chadegani et al., 2013). In addition to that, it was observed in some review studies that only WOS database was used at the stage of choosing the studies to be considered (Chamberlain et al., 2012; Chen, Yang, Yang, Jiang, & Zhou, 2014; Zhang et al., 2016).

2.1. Inclusion and Exclusion Criteria

In the study, a comprehensive review of related literature was conducted on the "Web of Science-All Databases" by using the phrases ("academic achievement" or "academic success", or "academic outcomes" or "academic performance") and (meta analysis OR meta-analysis) in the title, abstract and keywords parts of the studies to reach the studies. The studies published in English before 2018 were filtered and, as a consequence, 538 studies in total were reached out. They were downloaded by the researchers, their abstracts were examined, and 246 of them were excluded from analyses. After analyzing the full-text articles, 123 of them were also excluded from the content and 169 articles in total were included in analyses. The process of selecting the studies is shown in Figure 1.

Besides, meta-analyses conducted within the scope of the same issue or the same research question can also contain the same primary studies. In that case, the overlap is taken into consideration to attain the validity and reliability of review studies (Tamim et al., 2011). It was found that the rate of overlap in meta-analyses considering the same variable was below 25% - in a method similar to the one used by Wilson and Lipsey (2001), and therefore any of the meta-analyses were not excluded.
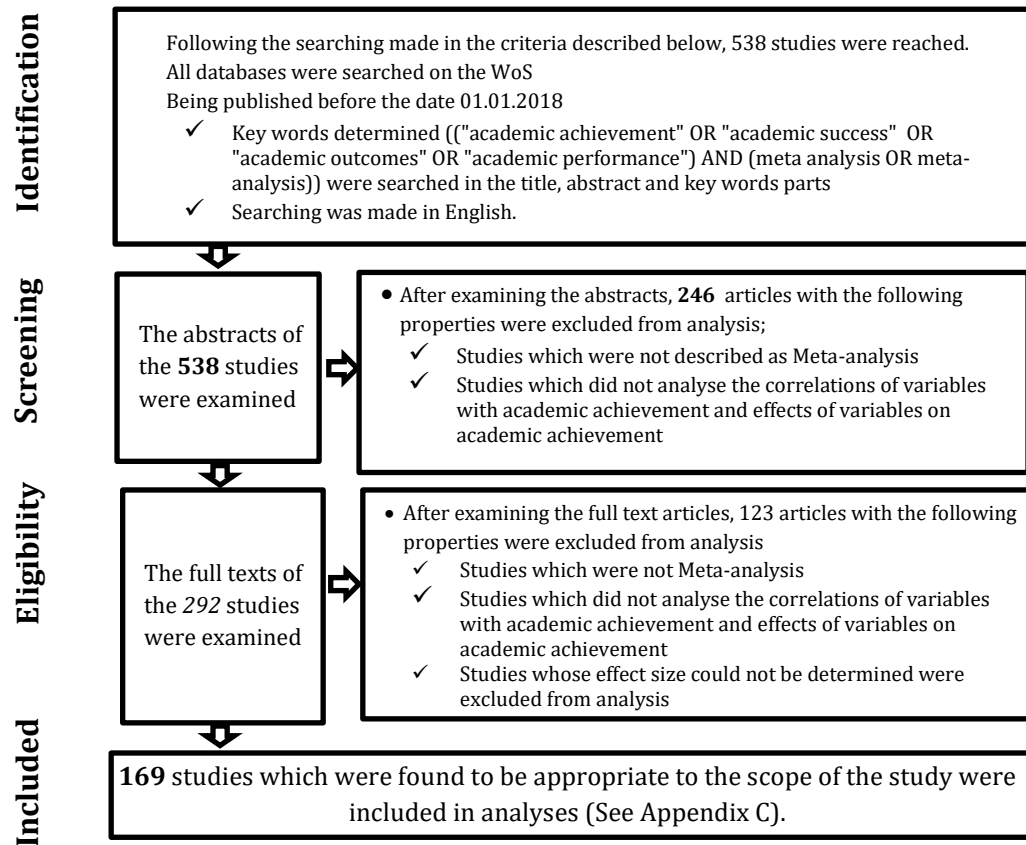
Figure 1. Inclusion and exclusion process

2.2. Data Analysis

This study followed the stages of PRISMA guide in the whole process from the stage of searching the electronic database to analyzing the data and reporting them. Additionally, Google Sheets application was used in analyzing the data and thus Figure 2 was prepared. We used this application because it offers researchers the opportunity to work simultaneously. Random effects model was taken into consideration in studies that presented all effect sizes unless otherwise stated. Weighted ES was regarded as the base in studies that presented the correlation values unless the opposite was stated.

Figure 2. Codes created in Google Sheets

Meta-analyses analyzing the same variable in the same type of ES were brought together to be able to present more meaningful findings. In accordance with this principle, the overall ES of the studies which were independent of each other but which investigated the same type of ES was calculated according to mean. The overall ES was not presented in some of the studies. Because more than one ESs were divided into such categories as content (science, verbal, and math) and level (pre-school, elementary school) and thus analyzed, the mean of the values of the variable was again calculated. Pearson correlation (r) was transformed into Cohen's d from effect size in studies analyzing the correlations between variables. The formula for changing correlations into Cohen's d proposed by Borenstein, Hedges, Higgins, and Rothstein (2009) was used in changing the correlations into ES (See Formula 2). For variables with more than one correlation values, first Cohen's d was found for each size and then ES mean was calculated. In some studies, Fisher's Z correlation coefficient was given as the correlation coefficient. They were first transformed into Pearson's correlation coefficient (r) through Fisher Z-Transformation Table and then into Cohen's d with Formula 2. Eta square (η2) was transformed into Cohen's d with Formula 3 (Cohen, 1988). The effects sizes turned into Cohen's d were shown in tables in the Findings part of the study.

$$d = \frac{2r}{\sqrt{1 - r^2}}$$

Formula 2. Transforming correlation (r) into Cohen's d

$$f = \sqrt{\frac{\eta2}{(1 - \eta2)}}$$

$$d = 2 * f$$

Formula 3. Transforming Eta-Square (η2) into Cohen's d

Because the ES of Hedge's g was not transformed into the ES of Cohen's d in the meta-analyses, the ES of Hedge's g was presented as it was. Besides, the ES of Glass' Delta (Glass's Δ), which could not be transformed into another type of ES, was given as it was. In addition to that, in some studies, the type of ES was not described, and therefore they were labelled as "ES".

2.3. Dividing the Variables into Categories

The variables which were found to be correlated with or to have effects on academic achievement in meta-analyses published before 2018 were divided into nine categories such as Psychological Characteristics", "Learning Theories and Teaching Strategies", "SES&SDC and Individual Characteristics", "Family", "Teacher", "Special Education", "School", "Educational Technology" and "Violence"; and each category was presented under sub-headings. The categories were created by considering similar review studies in the literature (Engin-Demir, 2009; Hattie, 2015; Richardson et al., 2012; Sarier, 2016; Schneider & Preckel, 2017; Zaff et al., 2017). All the variables found in this study were categorized by five experts separately and the variables were put into the most suitable category. The full texts of the relevant studies were re-examined for the variables fitting in more than one category, and thus they were put into the most suitable category with consensus. Intraclass Correlation Coefficient (ICC) analysis was performed to ensure inter-rater reliability at the stage of creating categories. The average measures ICC was .86 and according to Koo and Li (2016), it indicates good

reliability. The definitions of the variables in the categories were prepared to benefit from the relevant studies so that their purpose could be reflected correctly and so that this study could be interpreted correctly by readers, and they are presented in Appendix B.

2.4. Interpreting the Effect Size

Kelley and Preacher (2012) point out that ES is statistical data and that it represents the quantitative reflection of the size of phenomena containing a problem. The ESs in the findings obtained in this study were interpreted in Table 1 which was created in accordance with Sawilowsky (2009) and Cohen (1988). Besides, some of the meta-analyses examined the correlations between academic achievement and a number of variables. Thus, readers can evaluate the ESs obtained for those variables as relational values rather than as experimental effects.

Table 1. *Comment rules of the ES*

Definition	ES Range	References
Very small	ES ≥ .01 and < .2	Sawilowsky, 2009
Small	ES ≥ .2 and < .5	Cohen, 1988; Sawilowsky, 2009
Medium	ES ≥ .5 and < .8	Cohen, 1988; Sawilowsky, 2009
Large	ES ≥ .8 and < 1.2	Cohen, 1988; Sawilowsky, 2009
Very Large	ES ≥ 1.2 and < 2.0	Sawilowsky, 2009
Huge	ES ≥ 2.0	Sawilowsky, 2009

3. Results

This study, examining 169 meta-analyses, found that there were 254 different variables influencing academic achievement and that 427 different ESs were identified in relation to those variables. The findings obtained were described under ten headings. The variables with effects sizes ranging between huge and small were shown in the tables in the findings section, and the variables with effect size of very small were given in Appendix A. The ESs found for some of the variables were shown in tables separately because they were of different types and because they could not be transformed into Cohen's d. Readers need to know that the relevant variables and ESs are the results of meta-analyses having different qualities and limitations and they need to consider it in interpreting the results given in the tables below and in making comparisons. The fact that no limitations were put on the levels of education in including the relevant meta-analyses in this study is also supportive of this necessity. Different colors were also used in tables to show the moves from the positive to the negative in the tables so that the ES levels could be understood better.

3.1. Psychological Characteristics

A number of psychological variables influencing academic achievement and having effect sizes between small and huge are shown in Table 2. Accordingly, 87 ES values were found for 64 variables in 25 meta-analyses. On examining Table 2, it is evident that self-efficacy (ES= 1.173) and academic emotions positive low-arousal (ES= .812) have positive and huge effects on academic achievement. The variables with medium effects on academic achievement are self-assigned minimal goal standards (ES= .747), academic self-efficacy (ES= .735), recognition of emotions in faces (ES= .676), effort regulation (ES= .676), academic emotions comprising positive high arousal (PHA) (ES= .657), attitude towards the course (ES= .638), motivation (ES= .558), study attitude (ES= .539) and academic motivation (ES= .532), respectively. It is remarkable that academic extrinsic motivation (ES= .020) has very small effects on academic achievement (see Appendix A).

Table 2. *Variables related to psychological characteristics*

	Variables	References	SI	PS	IES	OES	ES
1	Self-efficacy	Sarier (2016)	2000-2015	62	8	1	1.173
2	Academic emotions PLA	Lei & Cui (2016)	2005-2016	35	39	1	.812
3	Self-assigned minimal goal standards	Richardson et al. (2012)	1997-2010	217	13	1	.747
4	Academic self-efficacy	Richardson et al. (2012)	1997-2010	217	67	2	.735[†]
		Robbins et al. (2004)	After 1984	109	18		(.652, .817)
5	Emotion knowledge	Voltmer & von Salisch (2017)	NA	49	84	1	.676
6	Effort regulation	Richardson et al. (2012)	1997-2010	217	19	1	.676
7	Academic emotions comprising PHA	Lei & Cui (2016)	2005-2016	35	39	1	.657
8	Attitude towards the course	Sarier (2016)	2000-2015	62	26	1	.638
9	Motivation	Fong et al. (2017a);	NA	95	106	2	.558[†]
		Sarier (2016)	2000-2015	62	9		(.345, .771)
10	Study habits and attitudes-study attitude	Credé & Kuncel (2008)	1980-2005	344	37	1	.539
11	Academic motivation	Robbins et al. (2004)	After 1984	109	17	1	.532
12	Critical thinking	Fong et al. (2017b)	1976-2014	23	27	3	.498[†]
		Richardson et al. (2012)	1997-2010	217	9		(min: .303,
		Ross et al. (2013)	1980-2011	41	41		max: .652)
13	Study habits and attitudes-study motivation	Credé & Kuncel (2008)	1980-2005	344	25	1	.473
14	Hope	Marques et al. (2017)	NA	29	24	1	.387
15	Need for cognition	Richardson et al. (2012)	1997-2010	217	5	1	.387
16	Self-regulation	Fong et al. (2017a)	NA	95	57	1	.366
17	Elaboration	Richardson et al. (2012)	1997-2010	217	12	1	.366
18	Meta cognition	Richardson et al. (2012)	1997-2010	217	9	1	.366
19	Psychotherapy	Baskin et al. (2010)	1980-2008	83	27	1*	.360
20	Identified regulation	Taylor et al. (2014)	1956-2013	18	11	1*	.350
21	Concentration	Richardson et al. (2012)	1997-2010	217	12	1	.324
22	Academic goals	Robbins et al. (2004)	After 1984	109	34	1	.314
23	Intrinsic motivation	Taylor et al. (2014)	1956-2013	18	10	2*	.308[†]
		Richardson et al. (2012)	1997-2010	217	22		(.270, .345)
24	Help seeking	Richardson et al. (2012)	1997-2010	217	8	1	.303
25	Goal commitment	Richardson et al. (2012)	1997-2010	217	10	1	.303
26	Self-esteem	Sarier (2016)	2000-2015	62	6	2	.294[†]
		Richardson et al. (2012)	1997-2010	217	21		(.181, .408)
27	Grit	Credé et al. (2016)	NA	73	76	2	.293[†]
							(.283, .303)
28	Self-perception	Fong et al. (2017a)	NA	95	108	1	.262
29	Locus of control	Richardson et al. (2012)	1997-2010	217	13	1	.262
30	Active coping	Clarke (2006)	1980-2001	40	6	1	.242
31	Mastery approach goals	Wirthwein et al. (2013)	1980-2011	180	209	2	.232[†]
		Huang (2012)	Until 2008	151	19		(.201, .262)
32	Self-concept	Ma & Kishor (1997)	1966-1993	143	89	1***	.230
33	Optimism	Richardson et al. (2012)	1997-2010	217	6	1	.221
34	Instutional commitment	Robbins et al. (2004)	After 1984	109	11	1	.217
	--- Variables with effect size between "-.20" and ".20" are given in Appendix A ---						
52	Depression	Richardson et al. (2012)	1997-2010	217	17	1	-.201
53	Anxiety	Fong et al. (2017a)	NA	95	50	2	-.217[†]
		Richardson et al. (2012)	1997-2010	217	29		(-.494, .060)
54	External regulation	Taylor et al. (2014)	1956-2013	18	11	1*	-.220
55	Work-avoidance	Wirthwein et al. (2013)	1980-2011	180	25	1	-.221
56	Academic Stress	Richardson et al. (2012)	1997-2010	217	4	1	-.242
57	Performance avoidance goals	Wirthwein et al. (2013)	1980-2011	180	109	4	-.257[†]
		Huang (2012)	Until 2008	151	19		(min: -.283,
		Richardson et al. (2012)	1997-2010	217	31		max: -.242)
58	Stress	Richardson et al. (2012)	1997-2010	217	8	1	-.262
59	Subsequent depression	Huang (2015)	Until 2012	43	50	1	-.303
60	Boredom	Tze et al. (2016)	1990-2013	29	21	1	-.324
61	Study habits and attitudes-study anxiety	Credé & Kuncel (2008)	1980-2005	344	22	1	-.345
62	Academic emotions NHA	Lei & Cui (2016)	2005-2016	35	39	1	-.364
63	Self Handcaping	Schwinger et al. (2014)	Until 2013	36	49	1	-.473
64	Amotivation	Taylor et al. (2014)	1956-2013	18	7	1*	-.610
65	Academic emotions NLA	Lei & Cui (2016)	2005-2016	35	39	1	-.799

*: Cohen's d, **: Hedges' g, ***: Type of ES is unclear, Others: Converted to Cohen's d,
†: Mean of more than one effect size of the same type, NLA: Negative low-arousal,
NHA: Negative high-arousal, PHA: Positive high-arousal, PLA: Positive low-arousal,
SI: Search Interval, NA: Not available, PS: Number of primary studies,
IES: Number of independent ES, OES: Number of overall ES

Negative Effect		Positive Effect
(+) Effect Size	0	Effect Size (+)

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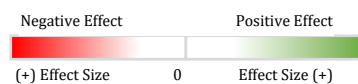
An examination of variables influencing academic achievement in negative ways demonstrated that NLA (ES= -.799) and amotivation (ES= -.610) had medium effects. According to Table 2, most of the variables having negative influences represent negativity whereas performance-avoidance goals (ES= -.257) and external regulation (ES= -.220) are positive variables- which is remarkable.
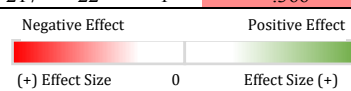
3.2. Learning Theories and Teaching Strategies

48 variables were identified in 43 meta-analyses in total which were examined. 82 ESs were calculated between the variables and academic achievement. An examination of Table 3 made it clear that 18 variables had positive and very large effects on academic achievement, but 6 variables had positive and very small effects on academic achievement (See Appendix A). According to Table 3, creative drama (ES= 1.453), constructivist learning (ES= 1.391), learning strategy instruction (ES= 1.250) and collaborative learning (ES= 1.230) have very large effects on academic achievement. Those variables are followed by 4MAT model (ES= 1.168), conceptual change text (ES= 1.160), multiple intelligence (ES= 1.077), Kolb learning styles model (ES= 1.067), mind mapping techniques (ES= 1.057), learning style (ES= 1.029), constructivist learning (ES= 1.003), Dunn and Dunn learning style model (ES= 1.001), project-based learning (ES= .997), peer learning (ES= .900), graphic organizers (ES= .897), cognitive learning strategies (ES= .876), perceptual learning styles (ES= .870) and portfolio (ES= .831).

Table 3. *Variables related to learning theories and teaching strategies*

	Variables	References	SI	PS	IES	OES	ES
1	Creative Drama	Ulubey & Toraman (2015)	1997-2015	65	65	2***	1.453†
		Batdi & Batdi (2015)	2000-2014	40	40		(1.225, 1.680)
2	Constructivist learning	Erisen & Gunay (2015)	2001-2013	27	27	1**	1.391
3	Learning strategy instruction	Donker et al. (2014)	2000-2012	58	95	1**	1.250
4	Collaborative learning	Kalaian & Kasim (2017)	1987-2014	19	1	1**	1.230
5	4MAT model	Kanadli (2016)	2004-2014	30	10	1*	1.168
6	Conceptual change text	Armagan et al. (2010)	1995-2010	42	42	1*	1.160
7	Multiple intelligence	Bas (2016)	1998-2014	75	75	1**	1.077
8	Kolb learning styles model	Kanadli (2016)	2004-2014	30	2	1*	1.067
9	Mind mapping techniques	Batdi (2015b)	2005-2013	15	10	1**	1.057
10	Learning style	Kanadli (2016)	2004-2014	30	29	1*	1.029
11	Constructivist learning	Ural & Bümen (2016)	2002-2012	77	27	1*	1.003
12	Dunn and Dunn learning style model	Kanadli (2016)	2004-2014	30	3	2*	1.001†
		Lovelace (2005)	1980-2000	68	168		(.670, 1.331)
13	Project based learning	Ayaz & Söylemez (2015)	2002-2013	41	42	1*	.997
14	Peer learning	Kalaian & Kasim (2017)	1987-2014	19	1	1**	.900
15	Graphic organizers	Kansızoğlu (2017)	2000-2016	70	70	1**	.897
16	Cognitive learning strategies	Kim et al. (2008)	1990-2006	50	21	5*	.876† (min: .510, max: 1.550)
17	Perceptual learning styles	Kanadli (2016)	2004-2014	30	13	1*	.870
18	Portfolio	Başol & Erbay (2017	1990-2017	24	46	1*	.831
19	Student respond cards	Randolph (2007)	Until 2005	18	NA	2*	.730† (.380, 1.080)
20	Study habits and attitudes-aggregate measures	Credé & Kuncel (2008)	1980-2005	344	107	1	.699
21	Strategy instruction	Ardasheva et al. (2017)	2008-2014	37	90	8*	.660† (min: .130, max: 1.230)
22	Educational interventions	de Boer et al. (2014)	2000-2011	58	93	5**	.646† (min: .360, max: 1.250)
23	Brain based learning	Gozuyesil & Dikici (2014)	1999-2011	31	42	1**	.640
24	Various innovative learning methods	Kalaian & Kasim (2017)	1987-2014	19	21	1**	.590
25	Cooperative learning	Capar & Tarim (2015)	1988-2010	26	36	1**	.590
26	Problem-based learning	Kalaian & Kasim (2017)	1987-2014	19	16	2**	.560†
		Dagyar & Demirel (2015)					(.290, .830)
27	Self-regulated learning	Dent & Koenka (2015)	2000-2010	61	81	4	.545†
		Dignath et al. (2008)	1992-2006	48	102		(min: .408,
		Dignath & Büttner (2008)	1992-2006	74	136		max: .620)
28	Study skills	Credé & Kuncel (2008)	1980-2005	344	87	1	.516
29	Small-group learning	Springer et al. (1999)	After 1980	37	116	1*	.510
30	Strategic approach to learning	Richardson et al. (2012)	1997-2010	217	15	1	.473
31	Universal SEL programmes	Sklad et al. (2012)	1995-2008	75	10	1*	.460
32	Services learning	Conway et al. (2009)	Until 2008	78	19	1*	.430
33	Blended learning	Vo et al. (2017)	2001-2017	40	51	1**	.385
34	Peer assisted learning	Ginsburg-Block et al. (2006)	NA	36	26	1**	.350
35	Homework	Fan et al. (2017)	1986-2015	28	61	3	.335†
		Cooper et al. (2006)	1987-2003	32	69		(min: .229,
		Bas et al. (2017)	NA	11	11		max: .453)
36	Phonics reading instruction	Jeynes (2008)	1966-2000	22	NA	1**	.300
37	POGIL	Walker & Warfa (2017)	NA	21	21	1**	.290
38	Deep approach to learning	Richardson et al. (2012)	1997-2010	217	23	1	.283
39	Universal SEL programmes	Wigelsworth et al. (2016)	NA	89	15	1**	.280
40	Universal SEL programmes	Durlak et al. (2011)	1970-2017	213	35	1***	.270
41	Peer tutoring	Leung (2015)	NA	72	72	2*	.261†
		Richardson et al. (2012)	1997-2010	217	4		(.260, .262)
42	Experimental interventions	Braithwaite & Corr (2016)	NA	47	14	1**	.259
43	Study habits and attitudes-deep processing	Credé & Kuncel (2008)	1980-2005	344	28	1	.242
44	Learning goal orientation	Richardson et al. (2012)	1997-2010	217	60	1	.201

--- Variables with effect size between "-.20" and ".20" are given in Appendix A ---

| 52 | Surface approach to learning | Richardson et al. (2012) | 1997-2010 | 217 | 22 | 1 | -.366 |

*: Cohen's d, **: Hedges' g, ***: Type of ES is unclear, Others: Converted to Cohen's d
†: Mean of more than one effect size of the same type
SEL: Social and emotional learning, POGIL: Process-oriented guided inquiry learning,
SI: Search Interval, NA: Not available, PS: Number of primary studies,
IES: Number of independent ES, OES: Number of overall ES

Negative Effect   Positive Effect

(+) Effect Size   0   Effect Size (+)

On examining the variables with negative effects, it was found that the surface approach to learning (ES= -.366) had small effects on academic achievement. Although negative effect size was also found in relation to cross-age tutoring, the mean effect size (ES= .107) was very small but it was positive- as can be seen in Appendix A. besides, it was also remarkable that cooperative learning (ES= -.140) had negative effects- despite very small effects- on achievement (See Appendix A). It became apparent that no learning theories or teaching strategies apart from the surface approach to learning and cooperative learning had negative effects on academic achievement.
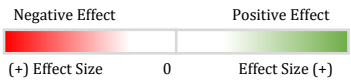
3.3. Family

34 variables and 79 ES values affecting academic achievement were found from 20 meta-analyses in relation to the family. Family-related variables and the effect sizes for them are shown in Table 4. Accordingly, parents' attitudes and behaviors (ES= .873), parental expectations (ESCohen's d= .865) and academic socialization parental involvement (ES= .847) had large effects on academic achievement. However, variables such as parental expectations (ESHedges' g= .730), parental involvement in homework (ES= .720), maternal employment (ES= .699), parental attendance and participation (ES= .668), parental involvement types (other) (ES= .622), parental involvement (ES= .538), communication parental involvement (ES= .530) and education level of father (ES= .519) have medium effects. It was observed that the education level of fathers affected academic achievement more than the education level of the mother (ES= .324).

Table 4. *Variables related to family*

	Variables	References	SI	PS	IES	OES	ES
1	Parents attitudes and behaviors	Sarier (2016)	2000-2015	62	6	1	.873
2	Parental expectations	Fan & Chen (2001)	NA	25	10	1	.865
3	Academic socialization parental involvement	Hill & Tyson (2009)	1985-2006	50	16	1	.847
4	Parental expectations	Jeynes (2005) Jeynes (2007)	1975-2000 1972-2002	41 52	NA NA	2**	.730† (.580, .880)
5	Parental involvement in homework	Jeynes (2003)	1988-1999	20	NA	1***	.720
6	Maternal employment	Goldberg et al. (2008)	Until 2005	68	57	1	.699
7	Parental attendance and participation	Fan & Chen (2001)	NA	25	7	1	.668
8	Parental involvement types (other)	Fan & Chen (2001)	NA	25	53	1	.622
9	Parental involvement	Ma et al. (2016) Hill & Tyson (2009) Sarier (2016) Fan & Chen (2001)	After 1990 1985-2006 2000-2015 NA	46 50 62 25	100 32 6 92	4	.538† (min: .080, max: 1.183)
10	Communication parental involvement	Jeynes (2003)	1988-1999	20	NA	1***	.530
11	Education level of father	Sarier (2016)	2000-2015	62	5	1	.519
12	Parental reading	Jeynes (2005)	1975-2000	41	NA	1**	.420
13	Communication parental involvement	Fan & Chen (2001)	NA	25	10	1	.391
14	School based parental involvement	Hill & Tyson (2009)	1985-2006	50	21	1	.387
15	Parental involvement	Jeynes (2003)	1988-1999	20	NA	6***	.378† (min: .220, max: .480)
16	Parental involvement	Goldman & Burke (2017) Jeynes (2005) Jeynes (2007) Jeynes (2012) Jeynes (2015) Jeynes (2016)	Until 2015 1975-2000 1972-2002 1964-2006 NA 1970-2013	8 41 52 51 28 42	8 NA NA 51 NA NA	9**	.361† (min: -.080, max: .740)
17	Parental style	Jeynes (2005) Jeynes (2007)	1975-2000 1972-2002	41 52	NA NA	2**	.355† (.310, .400)
18	Authoritative parenting style	Pinquart (2016)	Until 2015	308	29	1	.345
19	Specific parental involvement	Jeynes (2005) Jeynes (2007)	1975-2000 1972-2002	41 52	NA NA	2**	.340† (.290, .390)
20	Education level of mother	Sarier (2016)	2000-2015	62	5	1	.324
21	Specific parental involvement	Jeynes (2003)	1988-1999	20	NA	2***	.305† (.300, .310)
22	Mother involvement in education	Hill et al. (2015)	1980-2013	52	23	1	.303
23	Parental reading	Jeynes (2003)	1988-1999	20	NA	2***	.300† (.210, .390)
24	Parental responsiveness (warmth)	Pinquart (2016)	Until 2015	308	53	1	.283
25	Parental expectations	Jeynes (2003)	1988-1999	20	NA	3***	.280† (min: -.290, max: .620)
26	Home-based parental involvement (activities at home)	Hill & Tyson (2009)	1985-2006	50	19	1	.242
27	Communication parental involvement	Jeynes (2005) Jeynes (2007)	1975-2000 1972-2002	41 52	NA NA	2**	.240† (.240, .240)
28	Father involvement in education	Jeynes (2015)	1974-2012	66	66	2	.222† (.160, .283)
29	Autonomy granting parenting	Pinquart (2016); Vasquez et al. (2016)	Until 2015 1986-2011	308 36	17 29	2	.221† (.221, .221)
30	Behavioral control parenting	Pinquart (2016)	Until 2015	308	45	1	.221
31	Parental style	Jeynes (2003)	1988-1999	20	NA	2***	.215† (-.010, .440)
	--- Variables with effect size between "-.20" and ".20" are given in Appendix A ---						
44	Psychological control parenting	Pinquart (2016)	Until 2015	308	21	1	-.221
45	Harsh control parenting	Pinquart (2016)	Until 2015	308	12	1	-.324

*: Cohen's d, **: Hedges' g, ***: Type of ES is unclear, Others: Converted to Cohen's d

†: Mean of more than one effect size of the same type,
SI: Search Interval, NA: Not available, PS: Number of primary studies,
IES: Number of independent ES, OES: Number of overall ES

Negative Effect			Positive Effect
(+) Effect Size		0	Effect Size (+)

Psychological control parenting (ES= -.324) and harsh control parenting (ES= -.221) had small effects on academic achievement- as can be seen in Table 4. On the other hand, it was remarkable that behavioral control parenting (ES= .221) had small but positive effects.

3.4. SES & SDC and Individual Characteristics

45 variables related to SES, SDC and students' individual characteristics which were obtained from 35 meta-analyses and 87 ES values were found. On examining Table 5, it is clear that the majority of the variables (N=35) have small or very small effects. The other variables have medium (N=6), large (N=2), and very large (N=2) effects.

According to Table 5, grade retention (ES= 1.616) and college admissions test (ES= 1.416) can be said to have very large effects on academic achievement. Besides, high school GPA (ES= .907) and class attendance (ES= .899) have large effects on academic achievement. It was found that ACT/SAT (ES= .792), bible literacy (ES= 0.730), general intelligence (ES= .610), socio-economic status (ES= .547), conscientiousness (ES= .539) and level examination (ES= .515) had medium effects.

Conscientiousness, one of the variables with the highest number of overall effect size (OES=7) had medium effect (ES= .539) and extraversion (See Appendix A) had very small effect (ES= -.011) on academic achievement. Openness, which ranked second according to number of overall effect size (OES=6) was found to have small effect (ES= .281) on academic achievement.

Table 5. *Variables related to SES & SDC and individual characteristics*

	Variables	References	SI	PS	IES	OES	ES
1	Grade retention	Allen et al. (2009)	1990-2007	22	207	1	1.616
2	College admissions test	Kreiter & Kreiter (2007)	After 1991	12	NA	3	1.416† (min: 1.283, max: 1.540)
3	High School GPA	Robbins et al. (2004)	After 1984	109	30	1	.907
4	Class attendance	Credé et al. (2010)	1927-2009	90	33	1	.899
5	ACT/SAT	Robbins et al. (2004)	After 1984	109	31	1	.792
6	Bible literacy	Jeynes (2010)	1970-2007	11	3	1	.730
7	General intelligence	Von Stumm et al. (2011)	NA	11	NA	2	.610† (.473, .747)
		Poropat (2009)	Until 2007	80	47		
8	Socio-economic status	White, K. R. (1982)	NA	101	620		.547† (min: .221, max: 1.094)
		Sarier (2016)	2000-2015	62	11		
		Sirin (2005)	1990-2000	58	102	5	
		Robbins et al. (2004)	After 1984	109	13		
		Strenze (2007)	1929-2003	NA	27		
9	Conscientiousness	Vedel (2014)	1996-2013	20	21		.539† (min: .387, max: .953)
		Poropat (2009)	Until 2007	80	138		
		Poropat (2014a)	NA	12	23		
		Richardson et al. (2012)	1997-2010	217	69	7	
		Trapmann et al. (2007)	After 1980	58	41		
		O'Connor & Paunonen (2007)	1991-2006	23	23		
		Von Stumm et al. (2011)	NA	11	NA		
10	Level examinations	Peers & Johnston (1994)	1954-1983	20	120	3*	.515† (min: .350, max: .620)
11	Number acuity	Chen & Li (2014)	Until 2013	36	35	1	.494
12	Shifting ability	Yeniad et al. (2013)	Until 2011	18	34	2	.484† (.430, .539)
13	Study habits	Credé & Kuncel (2008)	1980-2005	344	102	1	.473
14	Time/study management	Richardson et al. (2012)	1997-2010	217	7	1	.451
15	Creativity	Gajda et al. (2017)	NA	120	782	1	.451
16	Within-language oral proficiency	Prevoo et al. (2016)	NA	88	4	1	.451
17	Typical intellectual engagement	Von Stumm et al. (2011)	NA	11	NA	1	.408
18	Financial support	Robbins et al. (2004)	After 1984	109	5	1	.398
19	Study habits and attitudes-metacognition	Credé & Kuncel (2008)	1980-2005	344	7	1	.366
20	National mathematics performance	Wang & Lin (2009)	NA	16	28	1***	.350
21	Emotional intelligence	Ranjbar et al. (2017)	NA	23	23		.336† (min: .283, max: .408)
		Richardson et al. (2012)	1997-2010	217	14	3	
		Perera & DiGiacomo (2013)	1980-2011	40	74		
22	Eveningness	Preckel et al. (2011)	1989-2010	21	6	1	.324
23	Private tutoring expenditure	Nam et al. (2017)	NA	16	275	1	.303
24	Attributions	Fong et al. (2017a)	NA	95	52	1	.283
25	Openness	Vedel (2014)	1996-2013	20	21		.281† (min: .120, max: .797)
		O'Connor & Paunonen (2007)	1991-2006	23	23		
		Poropat (2009)	Until 2007	80	113	6	
		Poropat (2014a)	NA	12	22		
		Richardson et al. (2012)	1997-2010	217	52		
		Trapmann et al. (2007)	After 1984	58	41		
26	Study habits	Sarier (2016)	2000-2015	62	5	1	.279
27	Academic-related skills	Robbins et al. (2004)	After 1984	109	33	1	.260
28	Social involvement	Robbins et al. (2004)	After 1984	109	33	1	.250
	--- Variables with effect size between "-.20" and ".20" are given in Appendix A ---						
46	Procrastination	Kim & Seo (2015)	1984-2014	33	82	2	-.357† (-.451, -.262)
		Richardson et al. (2012)	1997-2010	217	10		

*: Cohen's d, **: Hedges' g, ***: Type of ES is unclear, Others: Converted to Cohen's d
†: Mean of more than one effect size of the same type
GPA: Grade Point Average, ACT/SAT: American college testing/scholastic assessment test, SI: Search Interval, NA: Not available, PS: Number of primary studies, IES: Number of independent ES, OES: Number of overall ES

Negative Effect   Positive Effect
(+) Effect Size   0   Effect Size (+)
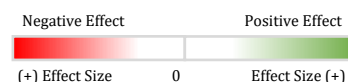
Procrastination (ES= -.357) had small effects and negative effects on academic achievement (See Table 5) but some of the variables (extraversion, crossed laterality, neuroticism, sex (being male) and cross-language relations between oral proficiency and academic achievement) had

very small and negative effects (See Appendix A). On examining the variables related to sex, being female (ES= .140) was found to have very small and positive effects but being male (ES= -.160) was found to have very small and negative effects on academic achievement (See Appendix A) - which was also remarkable.

3.5. Teacher

The findings of the effects of variables related to teachers on students' academic achievement are shown in Table 6. In relation to the effects of those variables on academic achievement, 16 variables and 17 effect sizes were found in 10 meta-analyses. Teachers' judgments of students' academic achievement (ES= 1.622) and students' intelligence (ES= 1.540) were found to have very large effects on academic achievement. Teacher conscientiousness (self) (ES= .699) was, however, found to have medium effects on academic achievement. Teacher openness (ES= .473), closeness in teacher-child relationship (ES= .430), teacher support (ES= .355), teacher emotional stability (ES= .324), positive teacher-student relationship (ES= .324) and instructor leadership (ES= .267) had small effects on academic achievement.

Table 6. *Variables related to teacher*

	Variables	References	SI	PS	IES	OES	ES
1	Teachers' judgments of students' academic achievement	Sudkamp et al. (2012)	1989-2009	75	73	1	1.622
2	Teachers' judgments of students' intelligence	Machts et al. (2016)	NA	33	106	1	1.540
3	Teacher conscientiousness (self)	Poropat (2014b)	NA	16	22	1	.699
4	Teacher openness	Poropat (2014b)	NA	16	14	1	.473
5	Closeness in teacher–child relationship	Nurmi (2012)	Until 2011	19	7	1	.430
6	Teacher support	Givens Rolland (2012)	1991-2011	49	7	1	.355
7	Teacher emotional stability	Poropat (2014b)	NA	16	17	1	.324
8	Positive teacher-student relationship	Roardo et al. (2011)	1990-2011	99	61	1	.324
9	Instructor leadership	Balwant (2016)	Until 2015	22	7	2	.267†
		Sarier (2016)	2000-2015	62	19		(.209, .324)
--- *Variables with effect size between "-.20" and ".20" are given in Appendix A* ---							
14	Negative teacher-student relationship	Roardo et al. (2011)	1990-2011	99	28	1	-.366
15	Child dependency in teacher-child relationship	Nurmi (2012)	Until 2011	19	2	1	-.387
16	Conflicts in teacher–child relationship	Nurmi (2012)	Until 2011	19	10	1	-.408

*: Cohen's d, **: Hedges' g, ***: Type of ES is unclear, Others: Converted to Cohen's d

†: Mean of more than one effect size of the same type, SI: Search Interval,
NA: Not available, PS: Number of primary studies,
IES: Number of independent ES, OES: Number of overall ES

Negative Effect ————— Positive Effect
(+) Effect Size   0   Effect Size (+)

On examining the variables with negative effects on academic achievement, it was found that variables such as conflicts in a teacher-child relationship (ES= -.408), child dependency in teacher-child relationship (ES= -.387) and negative teacher-student relationship (ES= -.366) had at least small effects. No other teacher-related variables having negative effects on academic achievement were found. On the other hand, it was remarkable that such positive variables as teacher extraversion, academic integration, classroom management strategies and programs and teacher agreeableness had very small effects on academic achievement (See Appendix A).

3.6. School

In the study, 14 variables and 17 effect sizes were found related to school in 14 meta-analyses. Classroom-based physical activities (ES= 2.987) were found to have huge effects on academic achievement. School-based interventions that target executive function (ES= .641) and physical activities (ES= .539) in general had medium effects. According to Table 7, leadership of school director (ES= .498), attending a religious school (ES= .250), building condition (ES= .242) and full-day kindergarten (ES= .240) have small effects. On the other hand, it was found that career education interventions, academic admission interviews,

institutional integration, and first-year seminars had very small effects on academic achievement (See Appendix A).

Table 7. *Variables related to school*

	Variables	References	SI	PS	IES	OES	ES
1	Classroom-based physical activity	Watson et al. (2017)	Until 2017	16	10	1	2.987
2	School-based interventions that target executive function	Jacob & Parkinson (2015)	2000-2015	67	104	2	.641† (.629, .652)
3	Physical activity	Álvarez-Bueno et al. (2017)	Until 2016	26	23	1	.539
4	School culture	Sarier (2016); Bektas et al. (2015)	2000-2015 / 2004-2014	62 / 25	6 / 25	2	.498† (.473, .523)
5	Leadership of school director	Sarier (2016)	2000-2015	62	6	1	.362
6	Attending a religious school	Jeynes (2002)	1970-2002	15	NA	1***	.250
7	Building condition	Gunter & Shao (2016)	NA	215	NA	1	.242
8	Full-day kindergarten	Cooper et al. (2010)	1979-2009	40	43	1*	.240
	--- Variables with effect size between "-.20" and ".20" are given in Appendix A ---						
14	School mobility	Mehana & Reynolds (2004)	1975-1994	45	NA	2	-.748† (-.797, -.699)

*: Cohen's d, **: Hedges' g, ***: Type of ES is unclear, Others: Converted to Cohen's d

†: Mean of more than one effect size of the same type, SI: Search Interval, NA: Not available, PS: Number of primary studies, IES: Number of independent ES, OES: Number of overall ES

Negative Effect   Positive Effect
(+) Effect Size   0   Effect Size (+)

On examining the variables with negative effects, it was found that school mobility (ES= -.748) was remarkable. While school mobility had medium effects, school-based mentoring for adolescents had negative and very small effects (See Appendix A).

3.7. Educational Technology

In the study, 10 variables that were considered in the category of educational technologies were obtained from 18 meta-analyses. An examination of Table 8 makes it clear that computer-aided teaching (ES= 1.690), the material used in classroom instruction (ES= 1.269) and one-to-one laptop programs (ES= 1.249) have positive and huge effects on academic achievement. In addition to that, information technology (ES= .507) was found to have medium effects on academic achievement. It was also found that technology (ES= .456) in general, augmented reality (ES= .360) and audience response system (ES= .249) had small effects on academic achievement.

Table 8. *Variables related to educational technology*

	Variables	References	SI	PS	IES	OES	ES
1	Computer-aided teaching	Christmann et al. (1997) / Yesilyurt (2011)	NA / 2002-2010	27 / 25	52 / 54	2***	1.690† (.209, 3.170)
2	Material use in classroom instruction	Kablan et al. (2013)	2000-2012	57	57	1*	1.269
3	One-to-one laptop programs	Zheng et al. (2016)	2001-2015	10	NA	1*	1.249
4	Computer-aided teaching	Palavan & Sunğur (2017) / Batdi (2015a) / Demir & Basol (2014) / Thomas et al. (2013)	2002-2014 / 2006-2014 / NA / Until 2011	60 / 78 / 40 / 50	60 / 78 / 40 / 55	4**	.842† (min: .175, max: 1.162)
5	Computer-aided teaching	Zheng (2016) / Camnalbur & Erdogan (2008)	2004-2015 / 1998-2007	29 / 78	NA / NA	2*	.744† (.438, 1.050)
6	Information technology	Lim & Chang (2003)	After 1990	58	52	1*	.507
7	Technology	Chauhan (2017)	2000-2017	122	212	1*	.456
8	Augmented reality	Yılmaz & Batdı (2016)	2005-2016	12	NA	1*	.360
9	Audience response system	Castillo-Manzano et al. (2016) / Hunsu et al. (2016)	2008-2012 / NA	33 / 53	53 / 41	2**	.249† (.210, .288)
	--- 3 more variables with effect size between "-.20" and ".20" are given in Appendix A ---						

*: Cohen's d, **: Hedges' g, ***: Type of ES is unclear, Others: Converted to Cohen's d

†: Mean of more than one effect size of the same type, SI: Search Interval, NA: Not available, PS: Number of primary studies, IES: Number of independent ES, OES: Number of overall ES

Negative Effect   Positive Effect
(+) Effect Size   0   Effect Size (+)

Only video game and social network site use, of the variables related to educational technologies influential in academic achievement, were found to have negative but very small effects on academic achievement (See Appendix A).

3.8. Special Education

In the study, 16 variables and 30 effect sizes were found from 15 meta-analyses related to special education. The findings of the variables having effects on academic achievement are shown in Table 9. According to Table 9, without reading disability (ES= 1.266) has very large effects. Besides, it is the variable with the biggest number of overall ESs (OES=5). The variables such as reading instruction on reading skills of the student with/at risk of behavioral disorder (ES= 1.020) and enrichment programs on gifted students (ES= .960) were also found to have medium effects on academic achievement. The other variables affecting academic achievement were facilitation of school re-entry of children with cancer (ES= .591), school-based interventions for attention deficit hyperactivity disorder (ES= .565) and gifted education programs for gifted ethnic minority students (ES= .251), respectively; and they had small effects. An examination of the variables related to special education demonstrated that only three of the negative effects and that the rest had positive effects on academic achievement at various levels.

Table 9. *Variables related to special education*

	Variables	References	SI	PS	IES	OES	ES
1	Without reading disability	Kudo et al. (2015)	1957-2013	48	109	5*	1.266[†] (min: .830, max: 1.850)
2	Reading the instruction on reading skills of the student with/at risk of behavioral disorder	Benner et al. (2010)	1970-2010	24	NA	1**	1.020
3	Enrichment programs on gifted students	Kim (2016)	1985-2014	13	13	1**	.960
4	Facilitation of school re-entry and peer acceptance of children with cancer	Helms et al. (2016)	NA	6	3	1**	.591
5	School-based interventions for attention deficit hyperactivity disorder	DuPaul & Eckert (1997)	1971-1995	60	55	2^	.565[†] (.310, .820)
6	Gifted education programs on gifted ethnic minority students	Henfield et al. (2017)	1983-2014	13	13	1**	.251
	--- Variables with effect size between "-.20" and ".20" are given in Appendix A ---						
14	Sleep-disordered breathing	Galland et al. (2015)	Until 2015	16	16	1*	-.300
15	Neurocognitive sequelae of treatment for childhood acute lymphocytic leukemia	Campbell et al. (2007)	1980-2004	28	41	3**	-.530[†] (min: -.600, max: -.420)
16	Emotional/behavioral disturbance	Reid et al. (2004)	1961-2000	25	101	1*	-.690

*: Cohen's d, **: Hedges' g, ***: Type of ES is unclear, Others: Converted to Cohen's d

†: Mean of more than one effect size of the same type

^: Glass's Delta, SI: Search Interval, NA: Not available, PS: Number of primary studies, IES: Number of independent ES, OES: Number of overall ES

Negative Effect — Positive Effect
(+) Effect Size — 0 — Effect Size (+)

On examining the variables affecting academic achievement in negative ways, the variables emotional/behavioral disturbance (ES= -.690) and neurocognitive sequelae of treatment for childhood acute lymphocytic leukemia (ES= -.530) were found to come to the fore. According to Table 9, those variables had medium effects on academic achievement. Another variable having a negative effect was sleep-disordered breathing (ES= -.300).

3.9. Violence

In the study, 6 variables and 10 effect sizes were found from 6 meta-analyses about the effects of violence-related variables on academic achievement. The findings are shown in Table 10. Accordingly, the variables with the highest effects were peer victimization (ES= -.292), physically aggressive or violent behavior (ES= -.289) and cyber-victimization (ES= -.283).

Table 10. *Variables related to violence*

	Variables	References	SI	PS	IES	OES	ES
	--- Variables with effect size between "-.20" and ".20" are given in Appendix A ---						
4	Cyber-Victimization	Gardella et al. (2017)	1989-2017	7	7	1	-.283
5	Physically aggressive or violent behavior	Savage et al. (2017)	NA	28	28	1	-.289
6	Peer Victimization	Nakamoto & Schwartz (2010)	1978-2007	33	31	5	-.292[†] (min: -.430, max:-.100)

*: Cohen's d, **: Hedges' g, ***: Type of ES is unclear, Others: Converted to Cohen's d

†: Mean of more than one effect size of the same type, SI: Search Interval, NA: Not available, PS: Number of primary studies, IES: Number of independent ES, OES: Number of overall ES

Negative Effect   Positive Effect

(+) Effect Size   0   Effect Size (+)

It is remarkable in Table 10 that all three variables in the Table have medium effects in addition to being close to each other and having negative effects. As in the mean effect size of the variable with the biggest number of overall effect sizes, peer victimization (OES=5). Child sexual abuse, another variable related to violence had negative and very small effects on academic achievement (See Appendix A). On the other hand, it was also found that juvenile delinquency intervention and understanding of and ability to deal with racism had positive and very small effects (See Appendix A).

3.10. The Most Effective Variables on Academic Achievement

In the study, 254 variables influencing academic achievement were found in 169 meta-analyses. 427 effect sizes were found for the variables which were considered in nine categories. The distribution of the variables according to positive and negative effect sizes are shown in Figure 3. The fact that the number of variables in Figure 3 was 272 stemmed from the fact that some of the variables had different types of effect sizes.
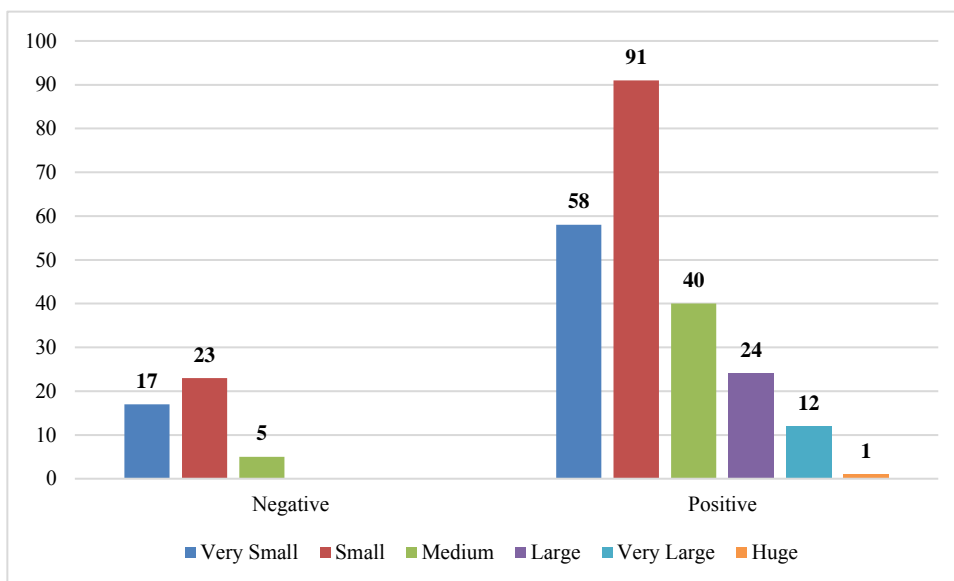
Figure 3. Distribution of variables by effect size

According to Figure 3, there are no variables with large, very large and huge negative effects. In addition to that, the majority of the variables have small or very small effects and the number of variables with small and positive effects is greater than others.

On examining the variables in the categories shown in Figure 4 on the basis of levels, it became apparent that there were several variables with small effects in the category of psychological characteristics whereas there were variables with large and medium effects in the category of learning theories and teaching strategies.
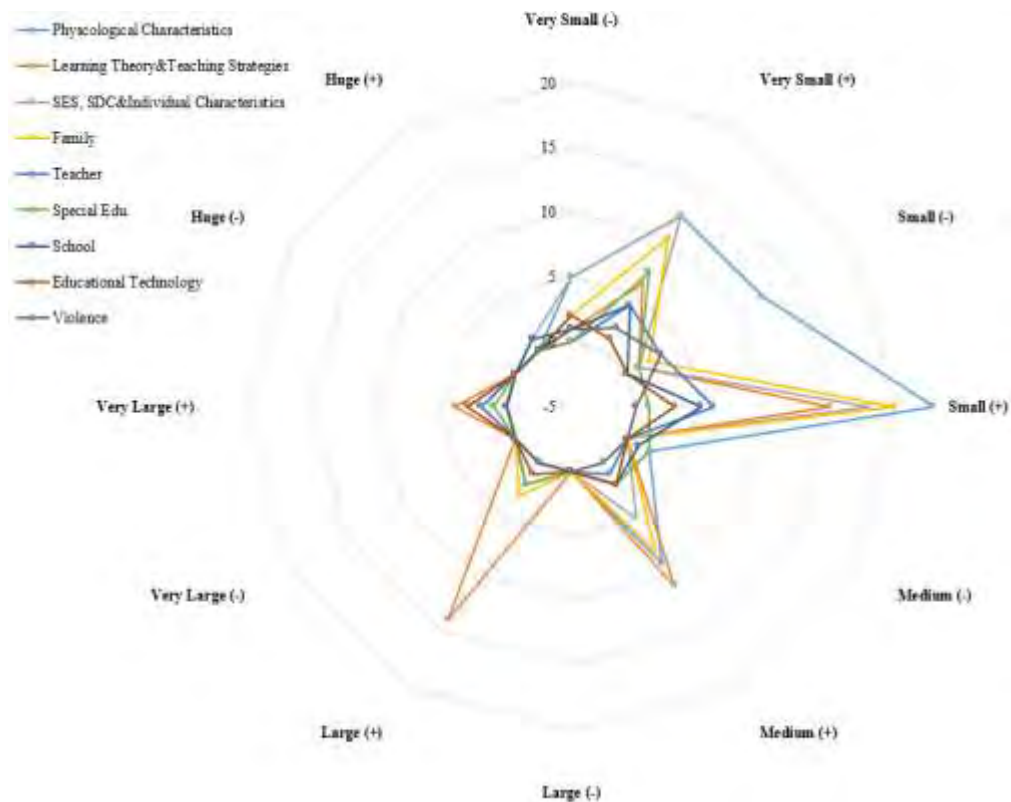
Figure 4. Distribution of categories by effect size

Variables with large, very large and huge effects were identified by considering all the categories, and they are shown in Table 11 below. Accordingly, it is evident that classroom-based physical activity is the variable with huge effect.

Table 11. *Variables with the highest effects on academic achievement*

	Category: Variables	ES
Huge	**School:** Classroom-based physical activity.	2.987
Very Large	**Educational Technologies:** Computer-aided teaching, the material used in classroom instruction, one-to-one laptop programs.	between 1.230 and 1.690
	Learning Theory and Teaching Strategies: Creative drama, constructivist learning, learning strategy instruction, collaborative learning.	
	SES, SDC and Individual Characteristics: Grade retention, college admissions test.	
	Special Education: Without reading disability.	
	Teacher: Teachers' judgments of students' academic achievement, teachers' judgments of students' intelligence.	
Large	**Family:** Parents attitudes and behaviors, parental expectations, academic socialization parental involvement.	between .812 and 1.173
	Learning Theory and Teaching Strategies: 4MAT model, conceptual change text, multiple intelligence, Kolb learning styles model, mind mapping techniques, learning style, constructivist learning, Dunn and Dunn learning style model, project-based learning, peer learning, graphic organizers, cognitive learning strategies, perceptual learning styles, portfolio	
	Psychological Characteristics: Self-efficacy, academic emotions PLA	
	SES, SDC and Individual Characteristics: High school GPA, class attendance	
	Special Education: Reading instruction on reading skills of the student with/at risk of behavioral disorder, enrichment programs on gifted students.	

As is clear from Table 11, there are no variables related to family and psychological characteristics and having very large and huge effects. A general exanimation of the table

shows that there are several variables related to learning theory and teaching strategies with large effects. Besides, it is remarkable that there are no variables related to violence in the Table. Another thing remarkable in the Table is that there are no variables with negative and huge, very large and large effects on academic achievement.

4. Discussion

This study made a systematic compilation of variables that were considered in meta-analyses as related to or as having effects on academic achievement, and it presented them in nine categories. It was noticed in the categorization of the variables that some of the variables also fitted in different categories and therefore they were placed in the most consistent categories on the basis of researchers' views. The variables were transformed into Cohen's d effect size so that the findings obtained in the meta-analyses could be interpreted and discussed. The types of effect size which could not be transformed were given as they were. However, Cohen's d effect size was used in general in the study. Despite this, it was impossible to compare all the ESs and to discuss them because of the great number of variables, because of the fact that this study included only one level that most of the variables were obtained from one meta-analysis and that meta-analyses had limitations. Therefore, readers are expected to make their own inferences for the conclusions we have reached but we cannot discuss.

254 variables and 427 effect sizes were found from the meta-analyses considered in nine categories in this study. Hattie (2009), in a study analyzing 800 meta-analyses, identified 138 variables related to academic achievement. The researcher, in a study, conducted later and analyzed 1200 meta-analyses, did not give the number of variables clearly but found 195 ESs in total (Hattie, 2015). Schneider and Preckel (2017) found 105 variables from 38 meta-analyses related to higher education. This current study, however, found greater number of variables than the above-mentioned studies. The major reason for it was that meta-analyses related to all levels of teaching were included in the scope of this study. Besides, the fact that the number of meta-analyses increased in recent years was also a factor influential in it.

Schneider and Preckel (2017), distinguishing two main categories related to teaching and students, formed sub-categories such as presentation, technology, extra-curricular learning activities, meaningful learning and assessment in the category of teaching variables. The researchers formed the sub-categories of intelligence, preliminary achievement, strategy, motivation, character and contextual in the category of students. Hattie (2015) divided the variables influencing academic achievement into such categories as students, administration, school, peers, home, and teachers. Another study considered the variables influential in academic achievement in such categories as family, individual characteristics and school (Engin-Demir, 2009). This study, on the other hand, distinguished nine categories labelled as "psychological characteristics", "learning theories and teaching strategies", "SES & SDC and individual characteristics", "family", "teacher", "special education", "school", "educational technologies" and "violence". The reason for distinguishing different categories in this study was that the study contained a great number of variables and that its scope was broader.

Richardson et al (2012) divided psychological variables into five categories as personal characteristics, motivational factors, self-regulated learning strategies, students' approaches towards learning and psycho-social contextual effects in their meta-analysis investigating the correlations between psychological variables related to university students and academic achievement. On examining the effect sizes of the variables in those categories, it was found that the variables were mostly positively correlated with academic achievement, but that there were also variables which were negatively correlated. This study also found that there were variables with negative effects on academic achievement but that most of the variables had positive effects. Richardson et al (2012) found that the correlations of the variables with academic achievement were between -.24 and .59. In this study, however, the effects of

psychological characteristics on academic achievement were between -.799 and 1.173. The difference might have stemmed from the fact that Richardson et al (2012) analyzed the correlations between academic achievement and variables but that this study analyzed the effects of variables on academic achievement. The values were almost doubled when the correlation coefficients were transformed into effect sizes (Cohen, 1988). Besides, the fact that the number of variables identified in this study was great could also be a significant factor in the difference. Hattie (2009) found 138 variables that were correlated with academic achievement and found that almost all effect sizes related to the variables were positive. The researcher also found that the variables related to teaching methods were positively correlated with academic achievement. Hattie (2015) found that the effect sizes influencing academic achievement ranged between -.42 and 1.65. The effect sizes found in this current study, however, ranged between -799 and 2.987. The fact that the number of variables identified in this study was greater than the ones identified in Richardson et al (2012) and in Hattie (2009, 2015 stemmed from the fact that this study is more up to date. It was found that the variables in the category of educational technologies affected academic achievement between -.161 and 1.69. Tamim et al (2011), on the other hand, found that educational technologies had small effects (ES= .33) on learning. Some of the variables which were found remarkable in this study are discussed below on the basis of categories.

Psychological. On examining the results in detail, it was found that self-efficacy, one of the psychological characteristics, had large effects (ES= 1.173). Schneider and Preckel (2017), on the other hand, concluded that self-efficacy had very large effects (ES=1.81) on students' academic achievement. Another study found through analyses for the factor of motivation that self-efficacy belief (ES= .822) had large effects (Sipe & Curlette, 1996). That the most effective variable in the category of psychological characteristics was self-efficacy in this study was consistent with the results obtained in the literature. The fact that the number of variables having negative effects in the category of psychological characteristics was also a significant finding obtained in this study. The variables academic emotions NLA (ES= -.799) and amotivation (ES= .610) - which had high negative effects on academic achievement- were also available in this category. Hattie (2015) found that the variable with the greatest negative effect on academic achievement was depression (ES= -.42). Lei and Cui (2016) state that NLA's emotions also contain depression. It was remarkable in this study that the effect sizes found for motivation were similar for motivation (ES= .558) and for amotivation (ES= -.610). Amotivation is expected to have negative effects on academic achievement as motivation is expected to have positive effects on academic achievement. Credé et al. (2017) state that mostly affective factors are the factors affecting and determining academic achievement- which is supportive of the conclusion that psychological characteristics are among the important variables affecting academic achievement.

Learning theories and teaching strategies. It was remarkable that the number of variables related to learning theories and teaching strategies which had negative effects was small. The reason for it could be that this study included meta-analyses investigating the effects of a number of independent variables in its scope to improve academic achievement. In addition to that, it might have also stemmed from the fact that some of the results were obtained by calculating the averages for the positive and negative effects sizes of the same variables. That the number of variables in the category of learning theories and teaching strategies having large effects was greater than the variables in other categories was an important result. The situation indicated that learning theories and teaching strategies were stronger in predicting academic achievement. Those were the results consistent with the ones obtained in Hattie (2009) and in Kulik and Kulik (1989). It was found in this category that the variables creative drama, constructivist learning, learning strategy instruction, and collaborative learning had very large effects. Creative drama- which is used physically or orally and which provides students with

opportunities to practice and to gain experience (Bailey, 1997) - was the variable with the most significant effect in this study. However, the fact that it can have certain negative effects (Batdı & Batdı, 2015) as a teaching strategy on academic achievement due to its difficulty to implement in the classroom should be taken into consideration. That the ES found in the meta-analysis (Erisen & Gunay, 2015) done on constructivist learning- which reflected the constructivist philosophy, one of the approaches which shaped the educational paradigm through the end of the 20th century- was very large indicated that constructivist philosophy would continue shaping educational processes. It was found in Sipe and Curlette (1996) that direct instruction- which did not overlap with constructivist philosophy- was one of the five largest effects sizes. Yet, the fact that the study is not recent should be taken into consideration. It was concluded that collaborative learning - among learning theories and teaching strategies- (Kalaian & Kasim, 2017) had very large effects on achievement. McMaster and Fuchs (2003), in their qualitative review study, emphasized that collaborative learning was influential in academic achievement.

Family. It became apparent in relation to the category of a family that parents' attitudes and behaviors, their expectations and involvement had large effects on academic achievement. A similar review study also concluded that there were correlations between variables related to family and academic achievement (Shute, Hansen, Underwood, & Razzouk, 2011). In a review study Boonk, Gijselaers, Ritzen, and Brand-Gruwel (2018) analysed articles published recently and concerning all levels of teaching found correlations between parental involvement and parental expectations. There are several studies emphasizing that parental involvement and parental expectations were influential in academic achievement. Considering the fact that parental involvement is parents' right, responsibility and also their social need (Castro et al., 2015); it is natural that there are so many studies demonstrating that parents are so influential in their children's academic achievement. The importance of parental involvement is apparent in those studies; yet, it should not be forgotten that the obstacles in front of parental involvement may stem from parents themselves and from students, teachers or from a number of social factors- as pointed out by Hornby and Blackwell (2018). It can also be said that parental involvement causes negative effects in some cases; because it was concluded in this study that the variables psychological control parenting and harsh control parenting had small and negative effects on academic achievement. Although parents' involvement in the process of their children's education is important, it can be said that involvement without pressure is important.

SES, SDC, and individual characteristics. It was remarkable in this category that grade retention and college admissions tests had very large effects on academic achievement. It was found in this study that while grade retention did not have significant effects on academic achievement in the short term in higher education, it had negative effects on schooling outcomes in the long term (Cockx, Picchio, & Baert, 2019) - a result which was not overlapping with the result obtained in this study that grade retention had very large effects. The fact that the study conducted by Cockx et al (2019) included in its scope only higher education but that the meta-analysis (Allen, Chen, Wilson &Hughes, 2009) examined in this study included primary and secondary education only indicated that the effects of grade retention on academic achievement could differ according to levels of education. Besides, the circumstances in the process of learning and teaching should also be taken into consideration in evaluating the conclusion that grade retention promotes academic achievement. In other words, it can be said that grade retention can promote students' achievement only if appropriate learning and teaching occurs. It is claimed that otherwise, students can even drop out of school (Roderick, 1994). In addition to that, another interpretation could be that grade retention can affect achievement significantly in the following year in the case of students who fail. Another variable, SES, was found to have medium effects on academic achievement. In relation to SES,

Marks (2017) claimed that the emphasis frequently laid on the educational outcomes of this variable in studies was out of place and that it had very small effects when students' cognitive skills and previous achievements were considered. Hattie (2009) argues that teachers in addition to students' individual abilities were significant determiners in situations of students' learning.

Teacher. In this category, it was found that teachers' positive judgments about students' academic achievement and intelligence had very large effects on their academic achievement. Teachers' judgments about their students are the main sources in students' attributional processes and in the development of their self-concept (Machts, Kaiser, Schmidt, & Möller, 2016); and therefore, they are thought to influence the processes of decision making about students. However, teachers' prejudices can be influenced by several variables in this process. Kaiser, Südkamp, and Möller (2017) claim that teachers' judgments about students' academic achievement can be influenced by their demographic properties as well as by their achievement. On evaluating the effects of teachers' judgments on academic achievement, it should not be ignored that those judgments can also be related to class properties (Kaiser et al., 2017). Classroom management strategy, a variable that is thought to be important for teachers, had positive but very small effects on students' academic achievement. It was demonstrated in the literature that classroom management affected learning directly and that it was more effective than some of the policies affecting learning indirectly (Wang & Haertel, 1993). This is a conclusion which does not overlap with our conclusion that classroom management strategies have very small effects on academic achievement. Another element remarkable in this category was the availability of several variables about teacher-student relations (closeness in a teacher-child relationship, positive teacher-student relationship, negative teacher-student relationship, child dependency in teacher-child relationship, conflicts in teacher-child relationship). Those variables were found to have small effects. Positiveness and closeness in teacher-student relations affect academic achievement in positive ways, but negativeness, conflicts or dependency in relations affects academic achievement in negative ways. In addition to that, a review study concluded that teacher-student relations had correlations with such variables as students' psychological states, involvement in school, academic achievement, expelling from school and dropping out of school (Quin, 2017). This situation shows that teacher-student relations occupy an important place in school life.

School. It was found in this category that the variable classroom-based activities had huge effect on academic achievement and that the variable had the biggest ES found in this study. The huge ES found in this study demonstrated the strength of the correlations and supported the conclusions reached in previous studies. In a review study, Donnelly et al. (2016) analyzed 73 studies and found that there were correlations between physical activities and academic achievement. Especially studies centering on elementary level lay emphasis on elements hindering classroom-based activities. Accordingly, factors such as time consumption and curriculum pressures in addition to lack of resources, space and competence can hinder the efficiency of classroom-based activities (Knudsen, Skovgaard, & Bredahl, 2018). Another variable remarkable in this category was school mobility. It was found that school mobility had negative and medium effects on academic achievement. Even though it was the result obtained on the basis of only one meta-analysis (Mehana & Reynolds, 2004), it is known that there are many studies concluding that school mobility has negative effects on students' academic achievement (Herbers, Reynolds, & Chen, 2013). Besides, the longitudinal study conducted in 25 years by Herbers et al. (2013) indicated that individuals who experienced in nursery school or in K12 were more likely to fail to graduate from school on time, to fail to get a popular job and to have symptoms of depression.

Educational technology. It became apparent that computer-aided teaching and the use of educational technologies in classes in general affected students' academic achievement in positive ways. Considering the fact that educational technologies are included in educational environments so as to improve teaching and learning processes, it can be said that the result we had obtained was the expected result. This result did not overlap with the one obtained in Tamim et al. (2011) - who had found that educational technologies had small effects on academic achievement- because the majority of the variables in this study had medium and large effects. Some of the variables in this category had negative and very small effects on academic achievement. The fact that variables such as video games and network site use had negative effects on academic achievement can be considered as an expected result. Young et al. (2012), in their review study, demonstrated that video games had weak effects on academic achievement. Sahin, Gumus, and Dincel (2016) stress that there are negative correlations between addiction to games and academic achievement. Our finding in this study that effect size was negative and very small indicated that there was need for experimental studies to demonstrate more clearly the correlations between video games and academic achievement.

Special education. It was remarkable in this category that without reading disability had very large effects. This result showed that having no difficulty in reading affected students' academic achievement largely. The other variables which were considered in this category and which had large effects on academic achievement were related to students with behavioral disorders and intellectually gifted students. Thus, it was concluded that reading instructions given to students with behavioral disorders to improve their reading skills would have large effects on their academic achievement. Besides, enrichment programs to be used with intellectually gifted children would also have large effects on achievement. The result for the variables in this category demonstrates that the processes followed to a plan and a schedule for students needing special education yield positive results in general. When such programs are not implemented students' achievement will be affected in negative ways; because emotional/behavioral disturbance - another variable that we identified- was found to have negative and medium effects on students' achievement. Yet, methods of treatment that students with special status have to receive can have negative effects on academic achievement; because neurocognitive sequelae treatment given to lymphoblastic leukemia patients in this study affected academic achievement in negative ways. Another result remarkable in this study was that sleep-disordered breathing had negative and at least small effects on academic achievement. The fact that some of the studies associate sleep problems with low academic achievement is supportive of this result (Abdulghani et al., 2012; Rasekhi, Pour Ashouri, & Pirouzan, 2016).

Violence. It was the category with the smallest number of variables having positive effects on academic achievement. Considering that any type of violence that children can be exposed to (for instance, peer victimization, family violence, community violence) is capable of affecting children's development in negative ways (Vaillancourt & McDougall, 2013), this finding can be considered as an expected result. Moreover, one of those negative results can befall in academic achievement- which is an important indicator in children's academic life. This is because the academic achievement of children who are exposed to violence decreases and this situation can raise the probability of grade retention for those children (Fry et al., 2018). Even though the variables such as cyber-victimization, physically aggressive or violent behavior, and peer-victimization had small effects on academic achievement in this study, they need considering because it is claimed that there can be problems in the development of students who are exposed to such situations in the following years (Vaillancourt & McDougall, 2013).

5. Limitations

Since the findings obtained in this study are the systematic compilations of meta-analyses, they contain the limitations of those meta-analyses. The fact that the ESs whose averages were calculated were found from meta-analyses of differing qualities and scopes should also be considered as a limitation. The major reason for using this method- which is unique in the literature- was to facilitate making interpretations in relation to effects on academic achievement rather than to compare the relevant variables with other variables. Within the scope of this study, only meta-analyses that were published in journals indexed by the WoS database were analyzed. Certain keywords were used in searching on WoS database in accordance with the purpose of this study. Considering this situation as a limitation stemmed from naming the concepts differ in the literature. The fact that some of the variables which were known to be correlated with academic achievement in the literature but which were not encountered in meta-analyses and thus which were not included in this study can also be considered as a limitation. A great number of variables were included in one category although they could have been included in many categories in the process of categorizing them. The effect sizes of some of the variables whose ESs were not given as Cohen's d were transformed into Cohen's d by using the methods available in the literature so as to be able to present the variables systematically and in integrity.

6. Conclusion and Recommendations

It was important in this study that the variables which were considered important for their effects on academic achievement were compiled from meta-analyses which enabled researchers to bring together the results obtained in quantitative studies and thus to make inferences. This study divided 254 variables and 427 effect sizes into nine categories. The variables had effect sizes ranging between -.799 and 2.987. It was found that there were variables having negative effects in all categories but that the number of the variables was small in categories apart from the category of psychological characteristics. There were variables in the categories of psychological characteristics, school and special education having significant negative effects, but the negative variables in other categories had small effects. It was concluded that there were variables with very large and positive effects in all categories except for the categories of psychological characteristics, family and violence. Many variables attracting researchers' attention in every category were discussed in the literature. Yet, a great number of variables were presented in tables to make the paper readable. It was thought that the rank of ESs for the variables in relation to each other would not be determined in the evaluation and therefore they should be evaluated from a holistic perspective.

The following ten golden recommendations might be made in the light of the results obtained in this study:

1. The variables which were found to affect students' academic achievement in negative ways could be taken into consideration in planning the learning and teaching processes and the existing conditions could be revised accordingly.

2. It should not be forgotten that teachers' relations, especially with students and the probable conflicts with them, can influence achievement in negative ways. Additionally, it should be remembered that teachers' adoption of constructivist approach in teaching, their emphasis on physical activities, making use of educational technologies and their positive attitudes towards students can affect students' academic achievement significantly.

3. Students' self-confidence, positive thoughts, no hesitation to learn collaboratively in school, avoiding superficial approaches towards learning and avoiding conflicts with their teachers can be important in their academic achievement.

4. Parents should consider the fact that their children's academic achievement might be affected in negative ways if they have conflicts with their children, if they display pressurizing attitudes towards their children or if they use violence against their children.

5. It is considered important for school administrators to create areas for physical activities.

6. It is important for the users of social network sites to resort to authorities from whom they can receive help (school administration, parents, the police, etc.) without wasting any time if they are exposed to cyber violence or peer violence.

7. The fact that grade retention had high ES value in this study indicated that countries that do not use the method in their educational system should develop policies accordingly.

8. School mobility mostly stems from family displacement (Rumberger, 2003), and it is highly probable to affect individuals both cognitively and psychologically. Therefore, parents, company managers, and statesmen should take it into consideration and make decisions or develop policies accordingly.

9. The limited number of similar review studies makes it difficult for us to reach clear conclusions or to make comparisons. Therefore, conducting review studies in a narrower framework would facilitate reaching more clear conclusions about the variables affecting academic achievement.

10. The rapid change of the dynamics of the society in the 21st century modifies students' teachers' and parents' needs and expectations and, consequently, it also causes changes in school culture. Thus, the validity of the experimental studies which are performed individually can be lost. In this respect, it is considered important for meta-analyses and systematic reviews to focus on up to date studies in particular (maybe the last decade and no more).

7. Conflict of Interest

The authors declare that there is no conflict of interest.

8. Acknowledgement

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