Chapter 6
The Effect of Self-efficacy on Student Achievement

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6.1 Introduction

The most important outcome of educational activities can be considered as raising individuals who can keep pace with the requirements of the age and who can transform the behaviors which are necessary for the welfare of the society they live in into performance as well as contributing to their personal development. People attempt to achieve these gains through the educational programs from pre-school to higher education. Within the existing systems, individuals are classified according to an achievement scale. Raising a successful generation which will make a contribution to the welfare of the country and humanity is a common expectation of the educators, politicians and the community. From this perspective, achievement in education can be considered as an important parameter. Achievement is a positive expression of the activities that individuals display in accordance with their competencies. There are many factors affecting the achievement of students, such as self-regulation skills (Zimmerman 1990), meta-cognitive skills (Vrugt and Oort 2008), anxiety (Brook and Willoughby 2015), self-esteem (Trautwein et al. 2006), motivation (Meece et al. 2006), the locus of control (Shepherd et al. 2006), perfectionism (Nounopoulos et al. 2006) and learning styles (Komarraju et al. 2011). In addition to the above, another important variable which, according to educational studies, is linked with achievement is self-efficacy (Acun 2014; Caprara et al. 2011; Di Giunta et al. 2013; Hwang et al. 2016; Topkaya 2016a, b). The latter is a concept that is related to the belief of the individuals in their own competences and in exhibiting the behaviors that they have (Bandura 1977).

Bandura (1986) stated that individuals have a core (self) system allowing them to control their own feelings, ideas and behaviors and to make various regulations. This core system hosts the cognitive and affective structures of the individual, and it

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includes competencies such as symbolization, model-based learning, developing alternative strategies, behavior regulation and self-judgment (Pajares 1996). Self-efficacy is a crucial factor affecting individual qualification processes (Bandura 1989). Self-efficacy is related to the beliefs of individuals about their competence to bring their educational life and behaviors to the appropriate levels. Self-efficacy is knowing what the individual can do rather that what he has to do. In other words, it means that an individual transforms his performance into behavior by assessing his own abilities and competencies (Bandura 2001b).

According to Bandura, self-efficacy beliefs guide individuals' strategic, irregular, optimistic or pessimistic thinking in a direct way; they affect their motivation level at the point of shaping behaviors. In other words, individuals' behaviors can change as a result of the assessment of existing individual competencies. Perceived self-efficacy has a key role in the formation of human behaviors. Although the perceived self-efficacy does not affect the behavior directly it has a significant effect on its determinants such as goals, expectations, emotional tendencies, barriers and opportunities (Bandura 2000). On the basis of the above, it can be concluded that individuals' beliefs about their self-efficacy affects their motivation, emotions and behaviors. Therefore, questioning the competencies that allow individuals to make deductions is the core of doing. Self-efficacy theory discusses the origins of the beliefs about self-efficacy as well as the structure and functioning of these beliefs at both the individual and the collective level. A self-efficacy belief system can be integrated with different findings obtained from functional processes of human behavior and with social cognitive theory. As a result, it can be said that self-efficacy theory provides quite explicit instructions about how to improve individual skills (Bandura 1995).

Self-efficacy is a subjective judgment of individual competencies associated with the maintenance and regulation of goal-directed behaviors. It is interpreted as a belief system featuring what can be done better as well as self-judgments of the individuals about their physical and personality traits (Zimmerman and Cleary 2006). Bandura (1977, 1986) has examined academic qualification in various dimensions related to self-efficacy, namely level, generalizability, and power. The self-efficacy level is the variation in the difficulty level of particular tasks. The generalizability of self-efficacy can be explained by the fact that individuals can transfer their self-efficacy perceptions into different tasks and fields. The power of self-efficacy is associated with the level of certainty that the individual can accomplish a certain task. Solving complex mathematic problems is an example of self-efficacy level, whereas overcoming various academic problems is an example of the generalizability of self-efficacy (Zimmerman 2000).

On the basis of the theoretical approaches mentioned above, it can be said that there might be a bidirectional relationship between achievement and self-efficacy. Accordingly, the increase observed in the self-efficacy of the individuals is reflected positively to their achievement. This is because self-efficacy beliefs affect human behaviors in several ways. Firstly, it is argued that self-efficacy affects the selection of behaviors, meaning that the behaviors that an individual will exhibit are determined by his self-efficacy beliefs. In other words, individuals are affected from their

self-efficacy perceptions while transforming their cognitive and affective competencies into performance. Therefore, it is quite likely that an individual who exhibits a cognitive and affective behavior with a positive expectation will complete the process successfully. Secondly, self-efficacy helps individuals to determine how much effort and time they should spend in order to handle an anxious situation. Regarding academic achievement, individuals can determine through self-efficacy the behaviors that they should exhibit in order to obtain the desired result (achievement) in tough experiences or situations (Kumar and Lal 2006).

This study investigated the effect of self-efficacy on student achievement. Additionally, the factors that are thought to affect the average effect size obtained in the study were set as moderators. These are *(i)* the publication year of the research, *(ii)* the publication type of the research, *(iii)* the country (culture) where the research was carried out, *(iv)* the course in which the achievement was measured and *(v)* the level of education.

6.2 Method

6.2.1 Study Design

In this study, the effect of self-efficacy on student achievement was tested with a meta-analysis design.

6.2.2 Review Strategy and Criteria for Inclusion/Exclusion

To determine the research studies to include in the meta-analysis, the Science-Direct, Proquest and Ebsco academic databases were used to conduct a literature review. For this process, the terms *self-efficacy* and *student achievement/student success* included in the titles of the studies were used to screen the research studies. The end date for the research studies included in the research was identified as January 2016. Doctoral dissertations and peer-reviewed journals were included in the study.

Many strategies were used to identify the research studies that were appropriate for the meta-analysis of the study. First, a research study pool (943 research studies) was established; it included all studies with self-efficacy and student achievement/success in their titles. The abstracts of these studies were reviewed, and all were found to be appropriate to include in the study. In the second stage, all research studies in the pool were examined in detail. The results of the examination found that 231 of the research studies in the pool were appropriate, and 712 were not found to be suitable. The descriptive statistics of the 231 research studies included in the analysis are presented in Table 6.1.

Table 6.1 Characteristics of the studies included in the meta-analysis

The years of the studies	*n*	%
2016–2012	110	47.6
2011–2007	66	28.6
2006–2002	27	11.7
2001–1997	13	5.6
1996–1992	12	5.2
1991–1987	3	1.3
Type of publication		
Dissertation	108	46.8
Article	123	53.2
Culture		
Vertical collectivist	80	34.6
Horizontal individualist	145	62.8
Not reported	6	2.6
School subject or assessment type		
Cumulative point average	109	47.2
English	14	6.1
Geometry	3	1.3
Language	7	3
Mathematic	54	23.4
Mechanics	3	1.3
Psychology	2	.9
Reading	13	5.6
Science	13	5.6
Social science	5	2.2
Statistics	2	.9
Writing	6	2.6
Sample group		
Primary School	24	10.4
Primary and Secondary School	5	2.2
Secondary School	42	18.2
Secondary and High School	4	1.7
High school	62	26.8
University	94	40.7

The criteria for inclusion of the research studies in the analysis study were identified as follows:

- To have the statistical information necessary for correlational meta-analysis (n and r, or R^2 values)
- To be a study measuring the correlation self-efficacy and student achievement/success

Reasons for not including a research study in the meta-analysis:

- Having no quantitative data (qualitative research)
- Not having a correlation coefficient
- Not focusing on student achievement
- Not focusing on self-efficacy

6.2.3 Coding Process

The coding process was essentially a data sorting process used to ascertain which data were clear and suitable for the study. In this scope, a coding form was developed before the statistical analysis was conducted, and the coding was conducted according to the form. The main aim was to develop a specific coding system that allowed the study to see the entirety of the research studies in general and that would not miss any characteristics of each individual research study. The coding form developed in the study was comprised of:

- References for the research
- Sample information
- The years of the studies
- Type of publication
- Culture
- School subject or assessment type
  Sample group

6.2.4 Statistical Processes

The effect size acquired in meta-analysis is a standard measure value used in the determination of the strength and direction of the relationship in the study (Borenstein et al. 2009). Pearson's correlation coefficient (r) was determined to be the effect size in this study. Because the correlation coefficient has a value between $+1$ and -1, the r value calculated was evaluated by converting this value into the value as it appears in the z table (Hedges and Olkin 1985a, b). Provided that more than one correlation value is given between the same structure categories in correlational meta-analysis studies, two different approaches are used in the determination of the one to be used in the meta-analysis (Borenstein et al. 2009; Kulinskaya et al. 2008). For this study, (*i*) first, if the correlations were independent, all the related correlations were included in the analysis and were considered to be independent studies, and (*ii*) if there were dependent correlations, then the *highest correlation value* was accepted. A *random effect model* was used for the

meta-analysis processes in this study. The *Comprehensive Meta-Analysis* program was used in the meta-analysis process.

6.2.5 Moderator Variables

To determine the statistical significance of the differences between the moderators of the study, only the Q_b values were used. Five moderator variables that were expected to have a role in the average effect size were identified in the study. The first of these considered is the *years of the studies* as a moderator in regards to the relationship between self-efficacy and student achievement. The second is the *type of publication* which was thought to have a role on the average impact of self-efficacy on student achievement. The rest are the *culture*, *school subject or assessment type,* and *sample group*.

6.2.6 Publication Bias

A funnel plot for the research studies included in the meta-analysis of can be seen in Fig. 6.1. Evidence that publication bias affected the research studies included in the meta-analysis can be seen in Fig. 6.1. A serious asymmetry would be expected in the funnel plot if there were a publication bias. The concentration of plots on one side under the line of average effect size, particularly in the bottom section of the funnel, suggests the probability of a publication bias in the research studies. In this study, no evidence of partiality of the publications was observed in any of the 231 data subjected to meta-analysis.

Although no partiality in publications was observed in the funnel plot, the results of Duval and Tweedie's trim and fill test, which was applied to determine the effect of partiality in publications acquired with the meta-analysis using the random effect model, are given in Table 6.2. As is seen in Table 6.2, there is no difference between the effect observed and the artificial effect size created to fix the effect of the partiality of publications. The research on each side of the center line is

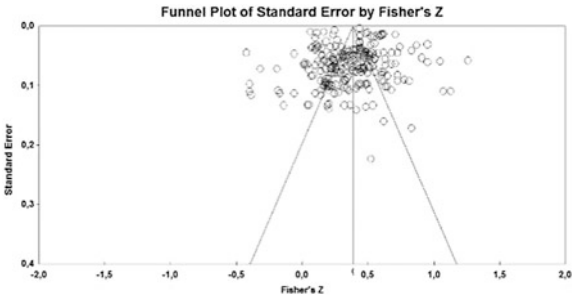

Fig. 6.1 Effect size funnel for publication bias

Table 6.2 Duval and Tweedie's trim and fill test results

	Excluded studies	Point estimate	CI (confidence interval)		*Q*
			Lower limit	Upper limit	
Observed values		0.3681	0.3646	0.3715	9116.03
Corrected values	0	0.3681	0.3646	0.3715	9116.03

symmetrical, and this is the indicator of non-difference. Because there is no evidence indicating lost data on either side of the center line, the difference between the fixed effect size and observed effect size is zero.

6.2.7 Findings

The results of the meta-analysis about the relationship between self-efficacy and student achievement are displayed in Table 6.3. The findings supported hypothesis H1 which stated that there is a positive relationship between self-efficacy and student achievement. The effect size of self-efficacy on student achievement was calculated as 0.34 which shows that self-efficacy has a medium level effect (see Cohen 1988) on student achievement.

The results supported hypothesis H2 which formulated that the publication year plays a moderator role in the effect size of self-efficacy on achievement ($Qb = 21.57$, $p < .01$). Accordingly, the effect of self-efficacy on achievement was at a medium level for studies conducted in the years 2012–2016 [$r = .38$], 2007–2011 [$r = .29$], 2002–2006 [$r = .27$], 1997–2001 [$r = .44$] and 1992–1996 [$r = .28$]. On the other hand, it was found that the effect of self-efficacy on achievement was not statistically significant for studies conducted between 1987 and 1991 [$r = .12$, $p > .05$].

Publication type is the second moderator variable analyzed in the study. The findings of the research supported hypothesis H3. The effect of self-efficacy on student achievement is at a medium level in the papers [$r = .38$] and theses [$r = .28$] included in the meta-analysis.

The culture where the research has been carried out was taken as another moderator variable. The findings supported hypothesis H4 which formulated that the culture where the research was carried out is a moderator ($Qb = 16.71$, $p < .001$). The effect of self-efficacy on achievement was found to be at a medium level in horizontal individualistic [$r = .31$] and vertical-collectivist [$r = .40$] cultures. Moreover, the effect of self-efficacy on achievement was found to be low [$r = .21$] for the studies for which there was no information about the culture where the research has been carried out ($N = 6$).

The courses in which the academic achievement of the students was calculated were also tested as moderator variable. The outcomes supported hypothesis H5 which formulated that the course in which the achievement was measured plays a

Table 6.3 Findings of the correlations between self-efficacy and student achievement: results of the meta-analysis

Variable	*k*	*N*	*r*	CI (confidence interval)		*Q*	Q_b
				Lower limit	Upper limit		
Self-efficacy	231	242023	.34*	.31	.36	9116.03*	
Moderator (the years of the studies)						21.57**	
2016–2012	110	181298	.38*	.35	.42		
2011–2007	66	48043	.29*	.24	.34		
2006–2002	27	7081	.27*	.19	.34		
2001–1997	13	4103	.44*	.34	.53		
1996–1992	12	1166	.28*	.16	.39		
1991–1987	3	332	.12	−.12	.36		
Moderator (publication type)						16.23*	
Article	123	104031	.38*	.35	.42		
Dissertation	108	137992	.28*	.24	.32		
Moderator (culture)						16.71*	
Horizontal Individualist	145	164255	.31*	.27	.34		
Vertical collectivist	80	76152	.40*	.36	.44		
Not reported	6	1616	.21***	.04	.36		
Moderator (school subject or assessment type)						20.71***	
CPA	109	130612	.29*	.25	.33		
English	14	6830	.37*	.27	.47		
Geometry	3	1576	.40**	.18	.58		
Language	7	2931	.47*	.34	.58		
Mathematic	54	86157	.40*	.35	.45		
Mechanics	3	1035	.42*	.21	.60		
Psychology	2	538	.41**	.13	.62		
Reading	13	2843	.26*	.14	.37		
Science	13	4814	.34*	.23	.44		
Social Science	5	3058	.40*	.24	.55		
Statistics	2	683	.38**	.11	.60		
Writing	6	946	.32*	.15	.47		
Moderator (sample group)						8.22	
Primary school	24	10838	.43*	.36	.50		
Primary and Secondary School	5	6246	.38*	.20	.53		
Secondary School	42	51671	.34*	.28	.40		
Secondary and High School	4	982	.33**	.12	.51		
High School	62	85001	.34*	0.29	.39		
University	94	87285	.31*	.27	.35		

*$p < .001$, **$p < .01$, ***$p < .05$

moderator role in the effect of self-efficacy on student achievement ($Qb = 20.71$, $p < .05$). Accordingly, the effect of self-efficacy is at a medium level in the achievement of cumulative point average (CPA) [$r = .29$] and in language [$r = .37$], geometry [$r = .40$], foreign languages [$r = .47$], mathematics [$r = .40$], mechanic [$r = .42$], psychology [$r = .41$], science [$r = .34$], social sciences [$r = .40$], statistic [$r = .38$] and writing [$r = .32$] courses. The effect size of self-efficacy on reading achievement was found to be low [$r = .26$].

In this study the education levels in which the research was conducted were considered as the final moderator variable. The results of the moderator analysis did not support hypothesis H6 which stated that the level of education plays a moderator role in the effect of self-efficacy on student achievement ($Qb = 8.22$, $p > .05$). Although the effect size difference was not statistically significant the effect of self-efficacy on achievement was found to be at a medium level for all education levels: Primary School [$r = .43$], Primary and Secondary School [$r = .38$], Secondary School [$r = .34$], Secondary and High School [$r = .33$], High School [$r = .34$], University [$r = .31$]).

6.3 Conclusion

In this study, a meta-analysis was performed to determine the effect size of self-efficacy on achievement, and the findings obtained from the theses and articles which assessed the relationship between self-efficacy and achievement were evaluated. The publication year, publication type, the country (culture), the course in which the achievement was measured and the level of education were the variables that were considered as the moderator variables for the effect of self-efficacy on achievement.

The findings show that self-efficacy has a positive and significant effect on achievement which is a quite expected result. This identified effect is at a medium level. According to Bandura (1997), direct achievement experiences affect self-efficacy of the individuals directly. As mentioned before, the bidirectional interaction between self-efficacy and achievement is also the key of cumulative development. In other words, the achievement that the individual gets in one area affects positively the individual's self-efficacy perception towards similar experiences. Individuals, who possess a rational self-efficacy perception, may succeed in the future by using their potential more freely (Bandura 2001a). On the other hand, the self-efficacy perception of the individuals who have failed after various experiences is negatively affected. These individuals do not feel capable in certain areas and cannot use their capacity effectively. As a result of this process, the individual may fail (Bandura 2001b). In sum, a clear distinction in the interaction between self-efficacy and achievement cannot be made. It is argued that self-efficacy and achievement are the formations that continuously reinforce or block each other.

In order to examine the interaction between self-efficacy and achievement across years, the publication year of the studies included in the meta-analysis was taken as moderator variable. According to the findings, it can be seen that publication year is a significant moderator variable for the effect of self-efficacy on achievement. In other words, different results regarding the effect of self-efficacy on achievement can be obtained across different years. Indeed, the findings obtained from the heterogeneity analysis made in this study showed that the effect size of self-efficacy on achievement is bigger in the studies conducted between 1997 and 2001 compared to the effect size of the studies conducted in other years. Moreover, the effect of self-efficacy on achievement was found to be insignificant for the studies conducted between 1987 and 1991. This finding may be due to the low number of studies featuring the association between self-efficacy and achievement ($k = 3$) and the low sample size ($N = 332$). The overall overview across the years shows that the significant effect of self-efficacy on achievement, which is at a medium level, remains constant. It is an undeniable fact that all the developments that are happening in the world have reflections in educational environments. Experts argue that students' achievements in education can be increased through the development of relevant technology and its integration to education (MEB 2015; Tosuntaş et al. 2015). The increase in the use of technology in educational environments can be offered as a reason for the higher effect size of self-efficacy on achievement between 1997 and 2001. It is assumed that as a result of new approaches and practices affecting student achievement, students' self-efficacy perceptions were affected positively. The decline of the interaction between self-efficacy and achievement in the subsequent years can be explained by the uniform character of the educational environments over time.

Regarding the publication type, it was found that publication type plays a moderator role in the effect of self-efficacy on achievement. According to the findings, the effect of self-efficacy on achievement is at a medium level for the papers and theses. There are significant differences between theses and papers. The occurrence of significant differences between these publication types indicates that the relevant results for allow for differentiation. The majority of the studies included in this meta-analysis are papers which tend to result in higher values, whereas this concern is lower for theses. This fact, which is reflected in the clustering of the values at one side, is called "publication bias" in the literature (Borenstein et al. 2009). This study shows that the type of the analyzed studies creates a difference in the effect of self-efficacy on achievement. The moderator analysis shows that this interaction was found to be higher in the articles compared to theses.

The culture where the research was carried out (vertical-collectivist or horizontal-individualistic) was included as another moderator variable. The findings show that the culture where the research was carried out is a significant moderator for the effect of self-efficacy on achievement. Although these effect sizes are at a medium level the effect of self-efficacy on achievement was found to be higher in horizontal-individualistic communities. It is argued that individualistic communities

are academically more successful (İlhan 2009). On the other hand, collectivist communities are more successful in finding solutions to problems (Yavuz 2013). It is believed that the self-efficacy perception of the individuals who live in horizontal-individualistic communities, where they have to struggle with challenging life conditions alone, would be more developed compared to the self-efficacy perception of individuals who live in collectivist communities. This is because, as expressed before, direct experiences are quite important for the development of self-efficacy and especially the accomplishment of achievement.

In this study the course in which the research was carried out was evaluated as another moderator variable. The findings showed that the course in which the research was carried out is indeed a moderator variable. The analysis of the interaction between self-efficacy and achievement across different courses indicates that the highest effect is observed in foreign language courses. Additionally, it was found that the interaction between self-efficacy and achievement was significant and at a medium level for all courses. This finding can be interpreted as an indicator that the self-efficacy perception of the individuals may be influential in various areas. In addition to the general self-efficacy perception, it is argued that self-efficacies developed in particular areas also support the development of self-efficacy perception in other areas. Thus, an individual who has succeeded in one area can associate this achievement with self-efficacy and can further his achievements by directing this self-efficacy perception to other areas.

The analysis showed that the level of education does not play a moderator role in the effect of self-efficacy on achievement. At the same time, the effect of self-efficacy on achievement was found to be significant and at a medium level at all education levels. In other words, even though the level of education is not a moderator for the effect of self-efficacy on achievement, there are various differentiations in all education levels. This finding shows that self-efficacy is a variable affecting achievement irrespective of the level of education.

Regarding the overall evaluation of the research findings, it can be said that self-efficacy is an important variable affecting achievement. The change observed in the self-efficacy perception of individuals is reflected accordingly to achievement (either positively or negatively). In this context, the adequate feedback of the educators, given in educational environments where students' personality is shaped through a rational orientation, may affect the self-efficacy of students positively. Indeed, they should be very careful while performing this activity. Underlining the performance of the students too much while making positive evaluations of their achievement may affect the development of self-efficacy negatively. For example, overemphasizing the performance that the student has showed for succeeding may cause an irrational and negative self-efficacy perception, such as "I am already insufficient, I can only succeed if I put too much effort". In this regard, both the educators and the parents should take proper care for the children to develop a healthy self-efficacy perception.

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Note. "*" References marked with an asterisk indicate studies included in the meta–analysis. The in–text citations to studies selected for meta–analysis are not followed by asterisks.

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