

Research Article

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## How Leadership and School Climate Influence Student Achievement: Evidence from a Comparative Meta-Analysis

Mehmet Ozdogru<sup>ID</sup>, Yilmaz Sarier<sup>ID</sup>, Tezcan Korucuoglu<sup>ID</sup>

### Abstract

**Background/purpose:** This study aims to investigate the influence of leadership (principal and teacher leadership) and school climate on student achievement as well as the moderating effect of some variables in this relationship.

**Materials/methods:** With this purpose, a meta-analysis of data gathered from a total of 90 empirical studies including 83,337 participants was performed. The random effects model was utilized to measure the overall effect sizes.

**Results:** The results showed that leadership and school climate had a moderate effect on academic achievement. In the USA context, organizational climate, principal leadership, and teacher leadership affected student achievement respectively. However, in the Turkish context, teacher leadership had a greater influence on student achievement the school climate, and principal leadership. The analysis also revealed that the influence of leadership on student achievement was attained through transformational, supportive, distributed, and instructional leadership practices respectively. Among the moderators tested, only the education level was determined to moderate the effect of school climate on student achievement. It was also concluded that an open organizational climate in primary schools had a greater effect on academic achievement.

**Conclusion:** The current study evidenced that leadership and school climate are significant variables in improving student achievement.

## 1. Introduction

Schools exist both for and with students; student growth and achievement are the major goals of schooling, which makes student academic achievement the most important criterion of education quality and school effectiveness. The success of schools depends on the extent to which students develop themselves and fulfill their full potential.

Cognitive factors such as individual learning speed and intelligence, affective factors such as self-esteem, personality structure, self-efficacy, motivation, and study habits, and school or family-related factors such as parental involvement, socio-economic status, competencies and attitudes of school administrators and teachers significantly influence the speed and extend of students' learning and achievement (Arıcı, 2007; Howie & Pieterse, 2001; Şevik, 2014). The results of PISA have also evidenced that the most important factors affecting academic achievement are respectively family, student, and teacher and school-related (Sarier, 2016).

Among the several school-level factors that affect students' academic achievement, school culture and socio-economic status (Akkurt & Köse, 2019; Baker et al., 2002; Karaköse & Polat, 2025; Schoen & Teddlie, 2008;), teacher attitudes (Akbaşlı et al., 2018; Akkurt & Köse, 2019; Lee & Loeb, 2000; Şevik, 2014), family (Aydın, 2015; Kültür, 2019), organizational climate of schools (Aydın, 2015; Korkmaz, 2005; Sarier, 2016) come afore in the literature. In addition, the physical environment of the school, principal leadership, teacher leadership, and the experience and professional competence of teachers are effective in students' academic achievement (Alamdar, 2015; Eker, 2019; Kanmaz & Uyar, 2016; Karaköse & Tülübaş, 2024; Karaköse, Leithwood, & Tülübaş, 2024; Özdaş, 2019).

School principals are also among the school-level variables that influence student academic achievement. School principals influence the teaching-learning process significantly by several means such as monitoring and supervision of instruction, decision-making, conveying higher expectations from teachers and students, providing the necessary resources for quality education, and creating a learning-friendly school climate. In brief, school principals can significantly affect student academic achievement by means of these leadership acts (Culture, 2019; Şişman, 2014). Ensuring that every student is provided with the opportunity to fulfill their potential and attain educational goals is not only the responsibility of teachers but also one of the major roles of school principals (Erdem & Şimşek, 2009; Karaköse et al., 2025a).

School principals as educational leaders enact different leadership styles and approaches. Some school principals practice transformational leadership (Burn, 1978) to facilitate their followers' attitudes, beliefs, and behaviours and to encourage them to achieve higher levels of success and performance. They actively engage in the developmental processes of the school staff by providing them with the opportunity to learn new things, create and strengthen new organisational norms, create new meanings and ways of thinking, and thus transform school culture into a more supportive one (Şimşek, 2013). Some school principals' leadership style involves supportive leadership behaviours, and these principals have a stronger focus on establishing healthy interpersonal relationships among teachers rather than having a stronger duty orientation (Hoy et al., 1992). In some schools, leadership has a more distributed nature that prioritizes the interaction of school actors and relies on collaboration and collective expertise of everyone to achieve a result greater than the sum of their individual actions (Spillane et al., 2001). In addition to these leadership styles and characteristics, instructional leadership (Hoy & Miskel, 2008) has a stronger orientation towards facilitating teaching and learning as the primary responsibility of a school and, thus, is considered to be a significant model of leadership for the schooling context. Instructional leadership is enacted by defining the school vision, mission, and goals, managing the curriculum, and promoting a positive school climate. As emphasized by Fullan (2002), the practice of leadership at school becomes even

more significant when large-scale, sustainable education reforms are on the agenda. In this context, the instructional leadership role of the school principal becomes even more significant to facilitate learning and teaching to meet the desired standards of that educational reform (Fullan, 2002).

Another significant in-school factor closely related to student academic achievement is the organizational climate of schools. Organizational climate is often used as an umbrella term in the educational literature that encompasses teachers' attitudes towards teaching and students, the school's capability to support students' potential, the physical structure of the school, the attitudes of the school principal, and several such variables that are vital for the healthy functioning of schools (Akbaşlı et al., 2018). Therefore, the organizational climate of schools determines the collective behavior within the school and distinguishes schools from each other in terms of quality (Hoy & Miskel, 2012). Similarly, Özdemir et al. (2010) emphasize that a positive school climate has an impact on a student's academic life and that positive relationships established in schools enhance the feeling of belonging in students and teachers, which eventually impacts respect, justice, and discipline in the school.

Student academic achievement also depends on school culture to a significant extent. School culture involves a model of basic assumptions that a particular group has invented, discovered, or developed to learn to cope with external adaptation and internal integration problems, that work well enough to be considered valid and therefore to be taught to new members as the correct way to perceive, think, and feel about these problems (Schein, 1983). This theory by Schein consists of three aspects: basic underlying assumptions, adopted values, and artifacts. The theory suggests that in order to promote organizational performance, basic artifacts, adopted values, and underlying assumptions should be reflected in the school culture. According to another organizational culture theory by Denison (1990), organizational culture involves four aspects: (a) participation, (b) consistency, (c) adaptability, and (d) mission. According to the theory, participation and consistency are internal factors that affect the development of an effective organizational culture, while adaptability and mission are external factors.

Considering the evidence provided by prior research for the complex relationships among leadership (principal and teacher leadership in particular), organizational climate of schools, and student academic achievement, the current study employs a meta-analysis of the existing results to provide a more generalizable and holistic perspective into their relationships. The study also provides a comparative analysis of quantitative results from the USA and Türkiye, as an example of Western and Eastern contexts respectively. The study particularly addresses the following research questions:

How do principal leadership, teacher leadership, and school climate influence student achievement?

What is the influence of leadership style on student achievement?

Do the publication year, the publication type, and the school level moderate the influence of leadership and school climate on student achievement?

## **2. Materials and Methods**

The current study conducts the meta-analysis of results from prior studies regarding the influence of leadership and organizational climate in schools on academic achievement. The purpose of a meta-analysis is to combine the findings from multiple independent studies, perform statistical analysis, and reinterpret the findings (Hedges and Olkin, 1985). Therefore, it offers the opportunity to summarise the results of various studies and reach a common conclusion (Chin, 2007).

## 2.1. Data Collection

In meta-analysis studies, data for the analysis is gathered from prior research on the variables under investigation. For the current study, data was collected from both published (e.g., articles) and unpublished (e.g., dissertations) research.

Data search was performed using these particular keywords selected after a detailed literature review on the variables included in the study: "leadership", "leadership behaviours", "teacher leadership", "principal leadership", "organizational climate", "school cli-mate", "school environment", "student success", "academic achievement" both in English and Turkish on Science-direct, EBSCO, DergiPark, ProQuest, and YÖK National Dissertation Search Center.

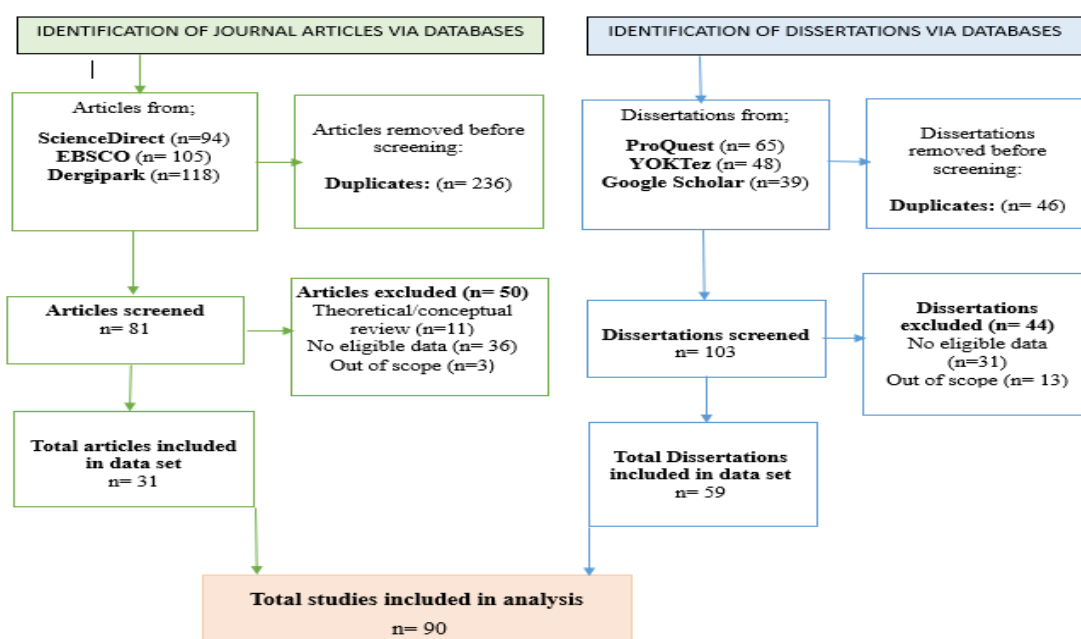
The following inclusion/exclusion criteria were used while selecting studies to be included in the meta-analysis:

**Include:** studies that provide eligible statistical data for meta-analysis (Lipsey and Wilson, 2001); studies published in Turkish and English; studies conducted in primary, secondary, and high-school contexts.

**Exclude:** theoretical and conceptual papers, qualitative studies, conference proceedings, papers in other languages than English/Turkish; quantitative studies not providing eligible statistical data; studies conducted in the preschool and higher-education context.

The process of data search and extraction is reported in the PRISMA 2020 diagram in Figure 1, which was adapted from Page et al. (2021).

The initial data search, which was conducted on 04 January 2024, yielded a total of 317 articles and 152 dissertations. After removing 236 articles and 46 dissertations for being duplicates, a total of 81 articles and 103 dissertations were left for detailed screening. Among the 81 articles, 11 were excluded due to being theoretical or conceptual papers, 36 were excluded for not providing eligible data, and 3 were excluded for being out of scope. As for the 103 dissertations screened, 31 were excluded for not providing eligible data while 13 were excluded for being out of scope. At the end of this process, data from a total of 90 documents (31 articles and 59 dissertations) were included in the final analysis.



**Figure 1.** The flow chart of data search and extraction (in accordance with PRISMA 2020 guidelines)

These 90 studies were then coded into a Microsoft Office Excel document, and the author name, the publication year, school level, the country where the study was conducted, leadership types investigated, Pearson correlation coefficients ( $r$ ), and sample sizes are noted. Thus, a coding form containing information about the studies was created. Descriptive data regarding the studies included in the analysis are presented in Table 1.

**Table 1.** Frequency and percentages of descriptive data regarding studies

|  |                             | f  | %     |                                   |             | f     | %     |
|--|-----------------------------|----|-------|-----------------------------------|-------------|-------|-------|
| <b>Leadership and Organizational Climate</b> | Principal leadership        | 46 | 51.11 | <b>Country Context</b>            | The USA     | 49    | 54.45 |
|  | Teacher leadership          | 19 | 21.11 |                                   | Türkiye     | 30    | 33.33 |
|  | School climate              | 25 | 27.78 |                                   | Others      | 11    | 12.22 |
| <b>Leadership</b>                            | Leadership (overall)        | 15 | 16.67 | <b>Range of Publication Years</b> | 2000-2007   | 10    | 13.33 |
|  | Supportive leadership       | 15 | 16.67 |                                   | 2008-2014   | 20    | 44.45 |
|  | Instructional leadership    | 11 | 12.22 |                                   | 2015-2023   | 25    | 42.22 |
|  | Distributed leadership      | 9  | 10.00 | <b>School Level</b>               | Primary     | 23    | 25.56 |
|  | Transformational leadership | 8  | 8.89  |                                   | Secondary   | 37    | 41.11 |
|  | Other leadership types      | 7  | 7.78  |                                   | High School | 19    | 21.11 |
| <b>Publication Type</b>                      | Dissertation                | 59 | 65,56 | Mixed                             | 11          | 12.22 |       |
|  | Article                     | 31 | 34,44 |                                   |             |       |       |

As presented in Table 1, the relationships between principal leadership and student achievement have been investigated more frequently (51.11%) than others. The studies particularly focused on supportive, instructional, distributed, and transformational leadership approaches (23.64%, 21.82%, and 20.00%, respectively). Nearly two-thirds of the studies (65.56%) were dissertations. The majority of studies (86.67%) were conducted in 2008 and later, which indicates that the relationship between the variables investigated has been frequently studied in recent years. More than half (54.45%) of the studies were produced in the USA. Two-thirds (66.67%) of the studies were conducted at primary and secondary school levels. Some studies have also investigated the combined effect of principal leadership, teacher leadership, and school climate on student achievement despite most providing separate data sets for each relationship.

## 2.2. Model Selection

Either fixed or random effects models are used in meta-analysis. The model to be used is determined according to the characteristics of the studies included in the meta-analysis, sample diversity, and the purpose of the study (Hedges and Olkin, 1985). The fixed effects model is used to calculate the effect size value of the studies examined in a certain population that has functionally similar characteristics. If the studies differ functionally and generalizations to larger populations are desired, a random effects model should be chosen (Field, 2001). In the current study, the meta-analysis was conducted using the fixed effects model, and the results of the heterogeneity test are presented in Table 2.

**Table 2.** Results of the heterogeneity test regarding the studies included in the meta-analysis

| Number of studies (f) | Degrees of freedom (df) | Heterogeneity value (Q) | p   | I <sup>2</sup> value |
|-----------------------|-------------------------|-------------------------|-----|----------------------|
| 123                   | 122                     | 12769.72                | .00 | 99.05                |

As shown in Table 2, the heterogeneity value (Q) was calculated as 12936.41 using the fixed effects model. The effect size of the studies was found to be at a 95% significance level, 122 degrees of freedom, and displayed significant heterogeneity ( $p = .00$ ). I<sup>2</sup> value, used as a complement to the Q statistic, provides a clearer result regarding the heterogeneity (Petticrew & Roberts, 2006). The I<sup>2</sup> value indicates a low level of heterogeneity of up to 25%, a medium level of heterogeneity of up to 50%, and a high level of heterogeneity of 75% or above (Cooper et al., 2009). According to this scale, the I<sup>2</sup> value (99.05%) calculated in the current study indicates a high level of heterogeneity, which shows that the publications included in the study did not show functionally similar features. Therefore, the meta-analysis was performed using the random effects model.

### **2.3. Data Analysis**

Fixed effects and random effects models are the two models used in meta-analysis. The model to be used in a particular study is determined according to the characteristics of the studies included in the meta-analysis, sample diversity, and the purpose of the study (Hedges & Olkin, 1985). In the fixed effects model, the aim is to calculate the effect size value of studies involved in the analysis of a certain population that has functionally similar characteristics. If the analysis involves studies that are functionally different and aim to reach generalizations to wider populations, the random effects model should be selected (Field, 2001). The current study employed the random effects model since it takes into account both the variances within and between the studies and has a wider confidence interval.

The study also utilized the relational meta-analysis methodology since it investigates the relationship between leadership, organizational climate, and student achievement using relational data. The analysis was conducted using the "CMA 2.0 (Comprehensive Meta-Analysis 2.0)" software. In relational studies, correlation coefficients are used as effect size values and correlation coefficients are included in the meta-analysis by performing Fisher Z transformation (Borenstein et al., 2013). With this method, the results are presented with p values (Field, 2001). The purpose of meta-analysis using correlation values is to combine the data, calculate the average effect size value, and determine homogeneity. The overall effect sizes obtained can be interpreted with the help of some criteria. In this study, effect sizes were interpreted according to Cohen et al.'s (2007, p. 221) criteria presented below:

Effect sizes;

*between 0.00 - 0.10 indicate a very small effect.*

*between 0.10 - 0.30 indicate a small effect.*

*between 0.30 - 0.50 indicate a moderate effect.*

*between 0.50 - 0.80 indicate large effect.*

*0.80 and above indicate a very large effect*

Moderator analysis was also conducted to determine the direction of the differences in the subgroups and the differences between the average effect sizes. When heterogeneity was determined between effect sizes, a moderator analysis was performed to identify the reasons for this heterogeneity (Borenstein et al., 2009). The intergroup heterogeneity value (Q<sub>b</sub>) statistic developed by Hedges and Olkin (1985) was used to determine the statistical significance of the heterogeneity between groups (Borenstein et al., 2009). The moderators were selected based on available datasets and the variables that are likely to affect student achievement. Therefore, variables that were not provided by a sufficient number of studies were not selected as moderators because they were not viable to conduct meta-analysis. Many moderator variables such as teacher characteristics, school size, socioeconomic factors, publication year, publication type, and education level were involved in

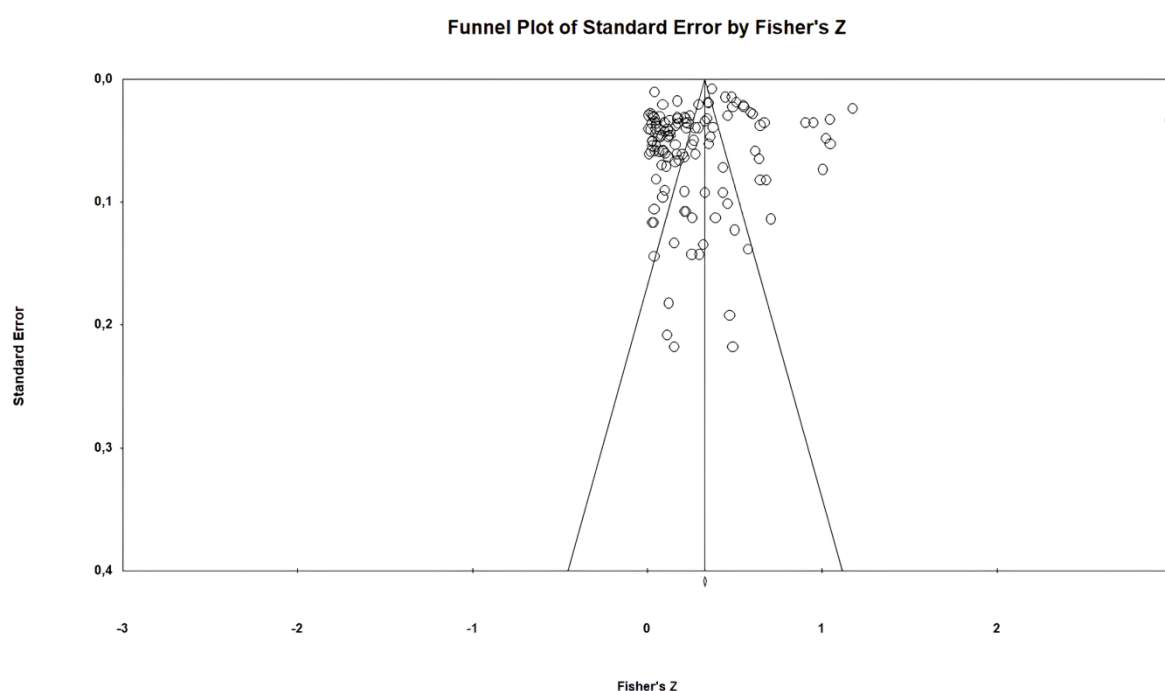
several studies. However, since a sufficient number of similar variables in different studies were not provided, they could not be included in the current meta-analysis. In the current study, the publication year range, the publication type, and school-level variables were used for the moderator analysis.

To ensure the reliability of the meta-analysis, including at least 30 studies investigating the relationships between the variables addressed. The current analysis was conducted using data from 62 publications that provided values for these relationships. The reliability of coding is also an important issue in meta-analysis. The coding was evaluated by field experts and necessary corrections were made upon their suggestions. The following criteria were applied to ensure the validity, reliability, and quality of the meta-analysis (L'Abbé, Detsky & O'Rourke, 1987):

- A list of codes was created.
- A detailed review of the literature was conducted.
- Inclusion and exclusion criteria were determined.
- A heterogeneity test was conducted
- Appropriate statistical methods were used to combine the results of the studies included in the analysis.

#### **2.4. Test of Publication Bias**

Publication bias is based on the hypothesis that all research on the subject under investigation has not been published. Studies reporting no significant relationships or a low level of relationship are often not deemed worthy of publication, which negatively affects the overall effect size and the relevant value increases biasedly (Borenstein et al., 2009). The excess of this situation resulting from missing data can also negatively affect the total impact level of meta-analysis studies. The existence of publication bias in meta-analyses can be examined with the help of some statistical methods. One of these methods is the funnel plot method. The publication biases of the studies were examined and presented in the funnel chart in Figure 2.



**Figure 2.** Funnel plot for publication bias

As shown in Figure 2, there is no evidence of a risk of publication bias in the studies included in the meta-analysis. The fact that the funnel plot is asymmetrical indicates publication bias. In particular, the concentration of studies at the bottom of the funnel on the same side of the line determining the overall effect size indicates the possibility of publication bias. In the absence of publication bias, studies are expected to be distributed symmetrically on both sides of the line showing the overall effect size (Borenstein et al., 2009). Accordingly, studies included in the current analysis are located in the upper region of the figure, close to the overall effect size, and are distributed symmetrically. Although no data regarding publication bias was found in the funnel plot, Classical Fail-Safe N analysis, another publication bias determination method, was also performed in the study. The findings of the analysis are presented in Table 3.

**Table 3.** Results of the Classical Fail-Safe N analysis

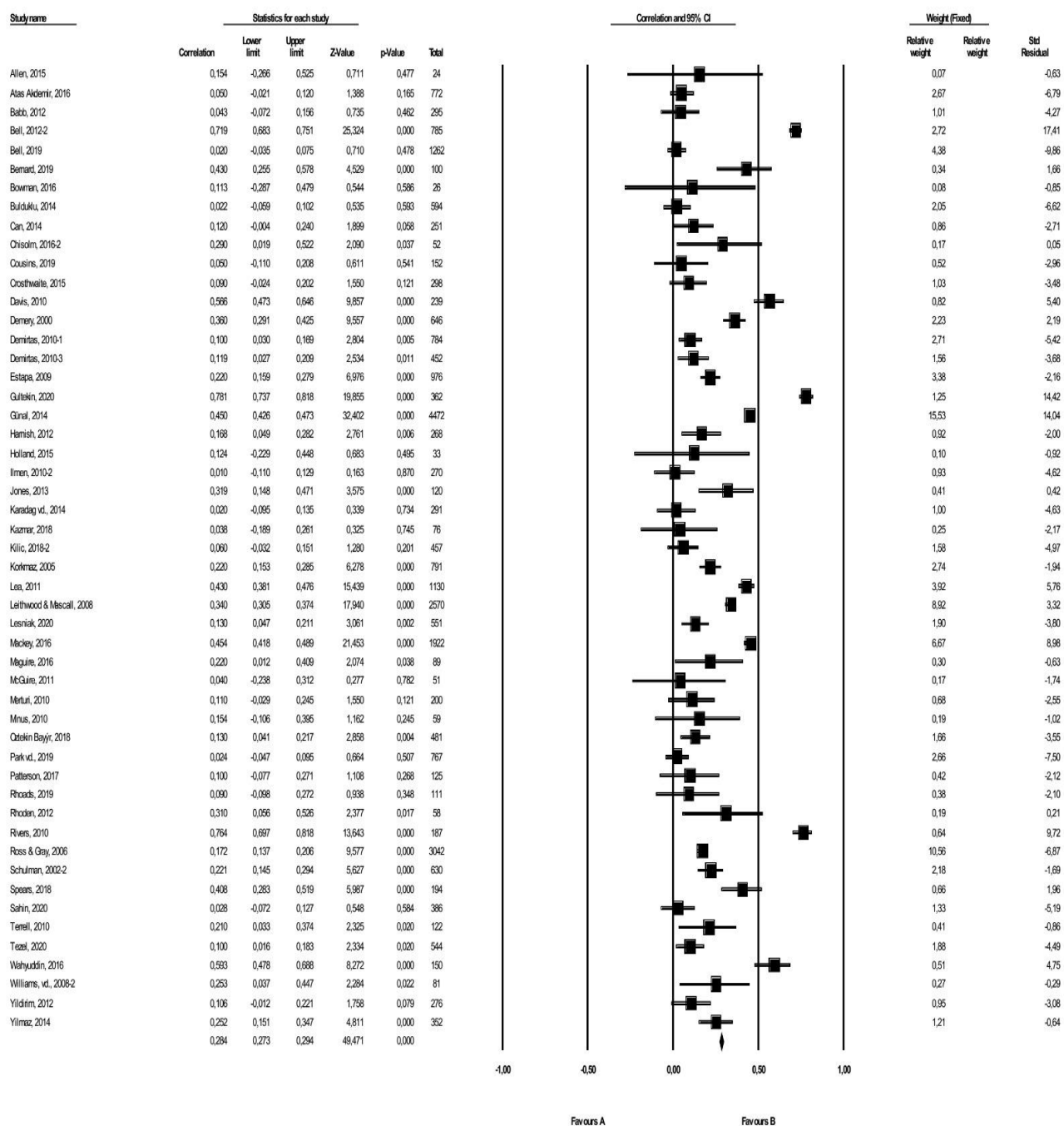
| <b>The Strength of the Meta-analysis</b>        |       |
|---|-------|
| Z-value   | 85.80 |
| p-value   | .00   |
| Alpha value                                     | .05   |
| Z value for the Alpha value                     | 1.95  |
| N   | 123   |
| p>number of studies required for alpha analysis | 85603 |

If the p-value in the analysis is less than the alpha value, it indicates that the research is strong, meaningful, and reliable. The p-value (.00) found in the current study was determined to be smaller than the alpha value (.05). As can be seen in Table 2, 85603 studies that are contrary to the research findings examined should be included in the analysis to invalidate the result of the study. In light of these results, the current study was reliable and there was no publication bias.

### 3. Results

The meta-analysis first started with the analysis of data regarding the relationship between principal leadership and academic achievement. The distribution of effect sizes regarding the effect of the school principal's leadership on student achievement is given in the forest chart in Figure 3.

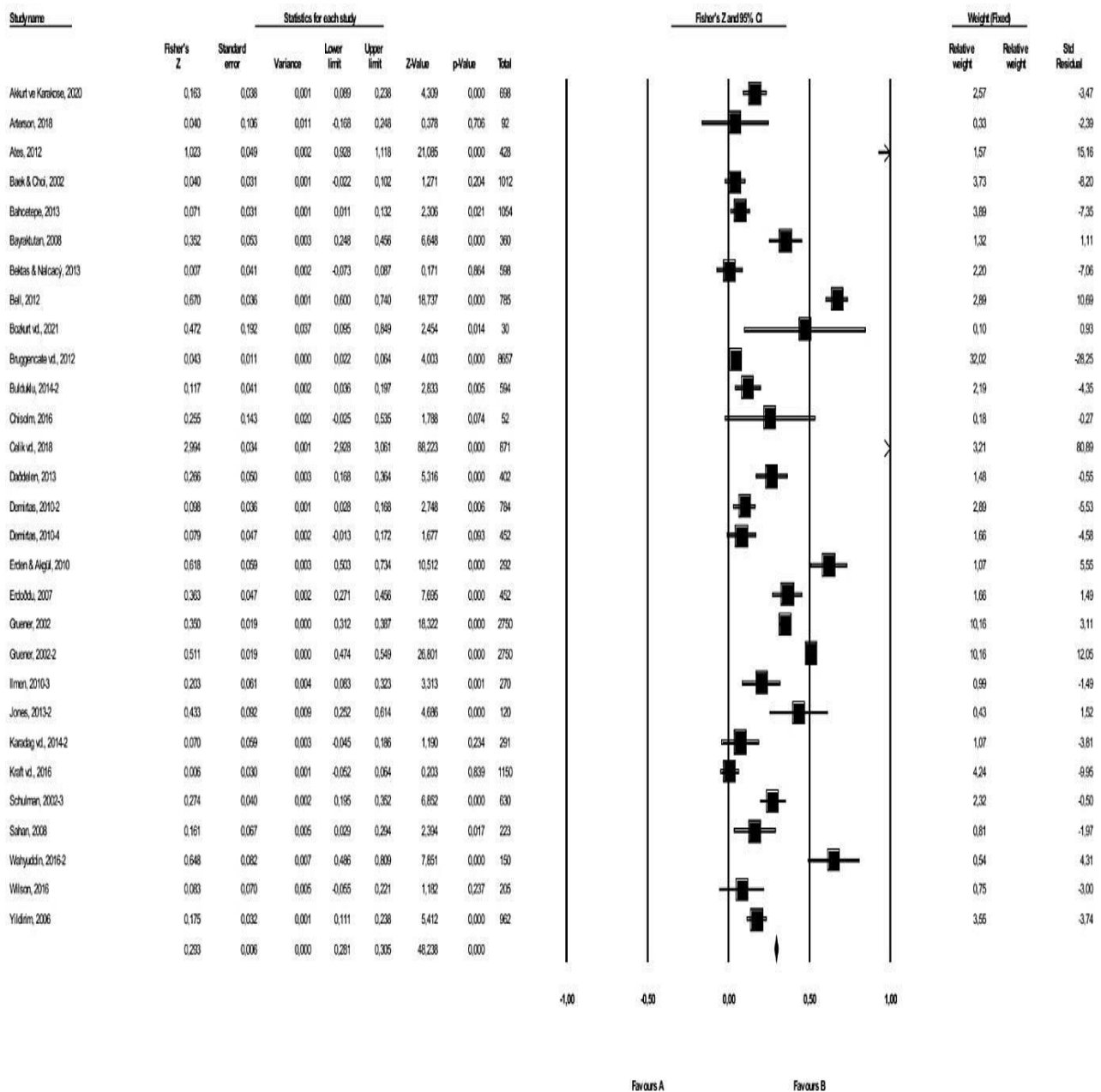




**Figure 3.** Forest plot showing the distribution of effect sizes regarding the effect of the principal leadership on student achievement

The calculated effect sizes presented in Figure 3 show that the smallest effect size is .010 and the largest effect size is .781. The fact that the calculated effect size is 51 indicates that principal leadership affects student achievement positively.

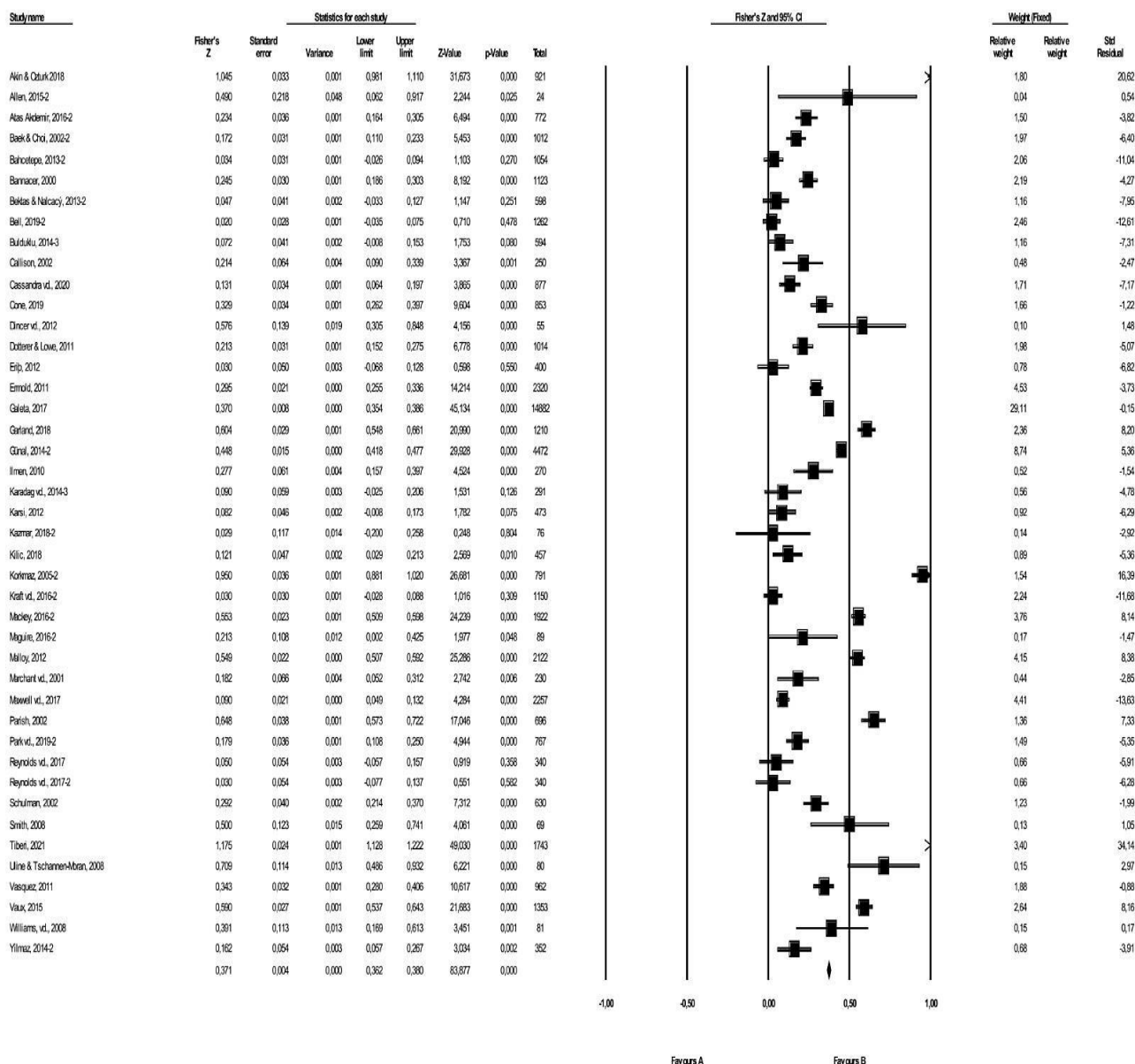
The forest plot showing the distribution of effect sizes regarding the effect of teacher leadership on student achievement is given in Figure 4.



**Figure 4.** Forest plot showing the distribution of effect sizes regarding the effect of teacher leadership on student achievement

The calculated effect sizes presented in Figure 4 show that the smallest effect size is .006 and the largest effect size is 2.994. The fact that the calculated effect size is 29 and positive indicates that teacher leadership positively affects academic achievement.

Figure 5 shows the forest chart showing the distribution of effect sizes regarding the effect of the organisational climate in school on student achievement.



**Figure 5.** Forest plot showing the distribution of effect sizes regarding the effect of school climate on academic achievement

As shown in Figure 5, the smallest effect size calculated is .020 and the largest effect size is 1.175. The fact that the calculated effect size is 43 and positive indicates that school climate affects student achievement positively.

The effect sizes of the studies included in the analysis are calculated using the random effects model, and the results are given in Table 4.

**Table 4.** Meta-analysis results on the influence of leadership and school climate on academic achievement

| Country | k   | ES   | 95% Confidence interval |       | Q         | p     |
|---------|-----|------|-------------------------|-------|-----------|-------|
|         |     |      | Lower                   | Upper |           |       |
| The USA | 63  | .324 | .253                    | .396  | 3094.040  | 0.000 |
| Türkiye | 46  | .287 | .134                    | .441  | 8284.784  | 0.000 |
| Others  | 14  | .240 | .133                    | .347  | 979.803   | 0.000 |
| General | 123 | .300 | .237                    | .363  | 12769.726 | 0.000 |

The results of the analysis presented in Table 4 show that the effect sizes calculated for the influence of leadership and school climate on student achievement were .324 for the USA, .287 for Türkiye, and .240 for other countries. The effect size found for Türkiye can be interpreted as weak and for the USA as medium. When all countries are evaluated together, the effect size is calculated as .300, which indicates a moderate effect. The p values (.000) show that the effect size distributions of the studies are heterogeneous. Therefore, the moderator analysis was conducted using the random effects model. The moderator analysis included the publication year range, publication type, and school-level variables. The results of the moderator analysis are presented in Tables 5 and 6. In particular, Table 5 shows the results regarding the effects of principal leadership, teacher leadership, and school climate on academic achievement by country.

**Table 5.** Meta-analysis results on the effects of principal leadership, teacher leadership, and school climate on student achievement by country

| Variable             | Country         | k  | ES   | 95 % Confidence Interval |       | Heterogeneity Test |      |
|----------------------|-----------------|----|------|--------------------------|-------|--------------------|------|
|                      |                 |    |      | Lower                    | Upper | Q <sub>b</sub>     | p    |
| Principal Leadership | USA             | 32 | .303 | .012                     | .235  | 5.860              | .053 |
|                      | Türkiye         | 15 | .124 | .206                     | .399  |                    |      |
|                      | Other countries | 4  | .293 | .026                     | .613  |                    |      |
|                      | Total           | 51 | .229 | .158                     | .300  |                    |      |
| Teacher Leadership   | USA             | 9  | .298 | .149                     | .446  | .969               | .616 |
|                      | Türkiye         | 17 | .426 | .001                     | .852  |                    |      |
|                      | Other countries | 3  | .215 | .029                     | .401  |                    |      |
|                      | Total           | 29 | .276 | .164                     | .388  |                    |      |
| School Climate       | USA             | 22 | .368 | .228                     | .509  | 2.327              | .312 |
|                      | Türkiye         | 14 | .296 | .114                     | .479  |                    |      |
|                      | Other countries | 7  | .219 | .089                     | .349  |                    |      |
|                      | Total           | 43 | .290 | .205                     | .374  |                    |      |

The results in Table 5 show that in the context of the USA, the effect sizes of variables influencing student achievement respectively belong to the school climate, principal leadership, and teacher leadership, while for Türkiye, teacher leadership, school climate, and principal leadership affect student achievement respectively. When evaluated from the USA perspective, it can be said that the examined variables affect student achievement to a similar extent. For Türkiye, it can be said that the effect of teacher leadership on student achievement is higher than the effect of principal leadership (.426 > .124). This may have resulted from higher expectations from teachers to increase student achievement in Türkiye. When evaluated for all countries, the order of effect sizes is school climate, teacher leadership, and principal leadership. These results indicate that it is important for school principals and teachers to demonstrate leadership and strive to create an open school climate. The heterogeneity test results, on the other hand, show that country-based differences do not cause heterogeneity in the effect sizes calculated ( $p > .05$ ).

The results regarding the effects of leadership and leadership types on student achievement are given in Table 6.

**Table 6.** Meta-analysis results regarding the influence of leadership style on student achievement

| Leadership Types            | k  | ES   | 95 % Confidence Interval |       | Heterogeneity Test |      |
|-----------------------------|----|------|--------------------------|-------|--------------------|------|
|                             |    |      | Lower                    | Upper | Q <sub>b</sub>     | p    |
| Leadership (Overall)        | 15 | .293 | .170                     | .417  | 2,536              | .771 |
| Supportive Leadership       | 15 | .246 | .137                     | .356  |                    |      |
| Instructional Leadership    | 11 | .176 | .028                     | .325  |                    |      |
| Distributed Leadership      | 9  | .218 | .077                     | .358  |                    |      |
| Transformational Leadership | 8  | .410 | .082                     | .737  |                    |      |
| Other Leadership Types      | 7  | .233 | -.027                    | .493  |                    |      |
| Total                       | 80 | .246 | .185                     | .306  |                    |      |

The results in Table 6 indicate that the most effective leadership type for student achievement is transformational leadership (.410) followed by overall leadership, supportive leadership, distributed leadership, and instructional leadership, respectively. These results underline the significance of principals' and teachers' practising transformational leadership to enhance student academic achievement. The results of the heterogeneity test show that leadership types do not cause a significant heterogeneity in the effect sizes of variables influencing student achievement ( $p = .771$ ).

The results of the meta-analysis regarding the publication year range as a moderator variable are presented in Table 7.

**Table 7.** The results of the meta-analysis regarding the publication year range as a moderator

| Variables            | Publication Year Range | k  | ES   | 95 % Confidence Interval |       | Heterogeneity Test |      |
|----------------------|------------------------|----|------|--------------------------|-------|--------------------|------|
|                      |                        |    |      | Lower                    | Upper | Q <sub>b</sub>     | p    |
| Principal Leadership | 2000-2007              | 4  | .246 | .161                     | .331  | .513               | .774 |
|                      | 2008-2014              | 24 | .273 | .174                     | .372  |                    |      |
|                      | 2015-2023              | 23 | .217 | .102                     | .333  |                    |      |
| Teacher Leadership   | 2000-2007              | 6  | .286 | .144                     | .428  | .328               | .849 |
|                      | 2008-2014              | 15 | .279 | .140                     | .419  |                    |      |
|                      | 2015-2023              | 8  | .584 | -.449                    | 1.617 |                    |      |
| School Climate       | 2000-2007              | 7  | .387 | .153                     | .622  | 1.151              | .562 |
|                      | 2008-2014              | 17 | .268 | .174                     | .362  |                    |      |
|                      | 2015-2023              | 19 | .331 | .185                     | .478  |                    |      |
| Total                | 2000-2007              | 17 | .319 | .220                     | .418  | .730               | .694 |
|                      | 2008-2014              | 56 | .274 | .211                     | .338  |                    |      |
|                      | 2015-2023              | 50 | .320 | .179                     | .460  |                    |      |

The heterogeneity test results in Table 7 indicate that the moderator variable of the publication year range does not cause a significant heterogeneity in the effect sizes of variables influencing student achievement. This suggests that the publication year range does not cause any variation in the effect size values and the results of the examined studies are consistent with each other.

The results of the meta-analysis regarding the publication type as a moderator variable are given in Table 8.

**Table 8.** The results of the meta-analysis regarding the publication type as a moderator variable

| Variables            | Publication Type | k  | ES   | 95 %Confidence Interval |       | Heterogeneity Test |      |
|----------------------|------------------|----|------|-------------------------|-------|--------------------|------|
|                      |                  |    |      | Lower                   | Upper | Q <sub>b</sub>     | p    |
| Principal Leadership | Dissertation     | 41 | .260 | .178                    | .343  | 1.288              | .256 |
|                      | Article          | 10 | .187 | .092                    | .282  |                    |      |
| Teacher Leadership   | Dissertation     | 12 | .246 | .118                    | .373  | 1.431              | .232 |
|                      | Article          | 17 | .450 | .140                    | .761  |                    |      |
| School Climate       | Dissertation     | 24 | .346 | .231                    | .461  | .518               | .472 |
|                      | Article          | 19 | .285 | .163                    | .406  |                    |      |
| Total                | Dissertation     | 77 | .285 | .223                    | .347  | .383               | .536 |
|                      | Article          | 46 | .328 | .208                    | .448  |                    |      |

The heterogeneity test results presented in Table 8 show that publication type as a moderator variable does not cause significant heterogeneity in the effect sizes of variables influencing student achievement ( $p > .05$ ). This suggests that the results of the examined studies are consistent with each other, and publication type is not a significant moderator.

The results of the meta-analysis regarding the school level as a moderator variable are given in Table 9.

**Table 9.** The results of the meta-analysis regarding the school level as a moderator variable

| Variables            | School Level | k  | ES   | 95 % Confidence Interval |       | Heterogeneity Test |       |
|----------------------|--------------|----|------|--------------------------|-------|--------------------|-------|
|                      |              |    |      | Lower                    | Upper | Q <sub>b</sub>     | p     |
| Principal Leadership | Primary      | 16 | .348 | .211                     | .486  | 6.061              | .109  |
|                      | Secondary    | 17 | .171 | .072                     | .270  |                    |       |
|                      | High school  | 13 | .275 | .090                     | .459  |                    |       |
|                      | Mixed        | 5  | .120 | -.044                    | .284  |                    |       |
| Teacher Leadership   | Primary      | 3  | .252 | .015                     | .489  | 3.001              | .392  |
|                      | Secondary    | 12 | .187 | .105                     | .269  |                    |       |
|                      | High school  | 9  | .673 | -.030                    | 1.377 |                    |       |
|                      | Mixed        | 5  | .286 | .133                     | .440  |                    |       |
| School Climate       | Primary      | 9  | .487 | .265                     | .709  | 12.784             | .005* |
|                      | Secondary    | 22 | .318 | .219                     | .416  |                    |       |
|                      | High school  | 7  | .166 | .109                     | .223  |                    |       |
|                      | Mixed        | 5  | .183 | -.078                    | .444  |                    |       |
| Total                | Primary      | 28 | .382 | .258                     | .506  | 6.337              | .096  |
|                      | Secondary    | 51 | .239 | .178                     | .301  |                    |       |
|                      | High school  | 29 | .383 | .116                     | .650  |                    |       |
|                      | Mixed        | 15 | .193 | .082                     | .305  |                    |       |

The heterogeneity test results in Table 9 indicate that school level as a moderator variable does not cause heterogeneity in the effect sizes of principal and teacher leadership ( $p > .05$ ). This suggests that the results of the studies included in the analysis are consistent with each other, and school level is not a significant moderator in the leadership-student achievement relationship. However, the effect of school climate on student achievement was found to differ significantly according to the school level ( $p < .05$ ). The results suggest that the effect of school climate on student achievement is particularly higher in primary schools than in high schools. Thus, it has been concluded that improving

the quality of the school climate, especially in primary schools, is very important in improving academic achievement.

#### 4. Discussion

The current study investigated the influence of leadership and organizational climate in schools on student achievement comparatively in the USA and Turkish context. Using the meta-analysis method, the analysis was conducted using data gathered from 90 publications and the results regarding the influence of leadership and school climate on student achievement was determined to be moderate for the USA context and small for Turkish context. When all countries are evaluated together, principal leadership, teacher leadership, and school climate were found to affect student achievement significantly and at a moderate level. In the USA educational context, school climate was found to have a greater effect on student achievement than principal and teacher leadership. In the Turkish context, however, teacher leadership had a greater influence on student achievement than principal leadership and the organizational climate of the school. When evaluated from the USA perspective, it can be concluded that these three variables affect student achievement to a similar extent rate.

PISA research, which evaluates the knowledge and skills acquired by students, draws attention to the significance of family and student-related characteristics, as well as teacher and school-related factors in students' academic achievement (OECD, 2019). In addition, school and teacher-related factors were observed to be more effective on students' academic achievement as supported by recent research as well (Lipesa, 2018; Sugg, 2013; Wenner & Campbell, 2017). Teachers, students, and school principals all play a significant role in ensuring school effectiveness and student achievement. Teachers have expectations regarding student performance, and students determine school effectiveness with the quality of their learning and achievement. Principals are particularly significant in enhancing student achievement both by practicing leadership and creating a learning-friendly climate at school (Balci, 2013). Beyond their individual skills, organizational characteristics are also effective in academic achievement (Yıldırım, 2012). Therefore, the smooth functioning of the organizational structure in a school and achieving a desired level of student success are possible not with the participation of only one or a few of the stakeholders, but with the holistic participation of all stakeholders, particularly the teachers, students, and their parents.

Despite some variance between countries, an overall analysis of the results indicated that school climate was the most prominent among the variables analyzed in affecting the academic achievement of students, particularly in the USA context. Karadağ et al.'s (2016) study lends support for this result, showing that school climate affects student achievement at a moderate level. In Macneil et al.'s (2009) research, it was determined that school climate was also highly positive in schools characterized by high academic achievement. A similar study revealed that school climate has a significant function in determining the quality of instruction and student learning (Brennan, 2015). The findings of Goddard et al.'s (2015) study also support these results indicating that a positive school climate supports students' academic achievement. Similarly, the findings of Cohen et al.'s (2009) study suggest that a positive school climate is required to enhance teacher motivation, which is also a significant variable in student achievement.

Teacher leadership was found to be the second most significant variable that affects student achievement despite some variety between countries. In the Turkish context, for instance, teacher leadership was found to be the most significant variable affecting academic achievement while in the USA context, teacher leadership followed school climate. Higher expectations from teachers regarding student achievement could be one reason why teacher leadership was the most effective factor in Türkiye. The critical role of the teacher in student achievement is also emphasized by the results from the International Teaching and Learning Survey (TALIS) (OECD, 2019). In another meta-

analysis study conducted by Hattie (2009), it was concluded that the most effective factor in student achievement after genetic factors was the teacher. Similar findings were found in Heck and Hallinger's (2009) study and it was concluded that teacher quality and effectiveness mattered in academic achievement. Wenner and Campbell (2017) emphasize the importance of teacher leadership in increasing student academic achievement in their studies. Similarly, Becker and Luthar (2002) concluded that teacher leadership was particularly effective in the achievement of disadvantaged students. Harris and Lambert (2003) point out the importance of teacher leadership in improving the quality of teaching and student achievement while Harris and Muijs (2005) state that teacher leadership is critical in ensuring the continuous improvement of schools.

Principal leadership was also found to be a significant variable affecting students' academic achievement. As underlined by Haris (2004), principal leadership has a significant effect on student achievement from a variety of perspectives. In a study conducted in Finland De Maeyer et al. (2007) revealed principal leadership had an indirect effect on academic achievement by creating a positive learning climate in school. Similarly, Gamage et al. (2009) state that academic achievement can be leveraged by strengthening the organization in terms of curriculum, instruction, and accountability. Different studies conducted on principal leadership have concluded that there are important relationships between principal leadership and student learning (Cotton, 2003; McLaughlin & Talbert, 2001; Waters et al., 2004).

Several reasons might be considered to explain why the results regarding the effects of leadership and school climate on student achievement differ between the USA and Turkey. It is noteworthy that there are some important differences in the training of educational leaders in both countries. While the training of educational leaders and school administrators in the USA is structured within the framework of certain standards, in Turkey, basic functional standards for the training of educational leaders are not defined in a legal legislation (Özdemir, Köse & Kavgacı, 2014). With the standard development movements that started in the 1990s in the USA, certain standards were developed to indicate the required knowledge and capabilities of school leaders. Among these, the standards established by the Interstate Leadership Licensure Concorcium (ISLLC) were the most prominent and significant (Peterson, 2002). Many states in the USA have started to base their training of educational leaders on these standards (Murphy & Neil, 1998). It is accepted by many states in the USA that schools cannot offer effective education without effective leaders (CCSSO, 2008). In the USA and Turkey, assumptions regarding the structure and management of schools and, therefore, the training of school leaders and administrators, in the words of Senge (2004), may differ from each other. Legal studies on training school administrators in Turkey have not gone beyond a declaration of good will, and the studies have been continued for a short time or have remained as recommendations. Based on this, it can be said that training school administrators has not been defined as a priority for the Turkish national education system. In education policy documents, a planned and scientific approach has not yet been adopted regarding the selection of school administrators. (Karakose et al., 2024a; Özdemir et al., 2014; Papadakis et al., 2024; Receptoğlu & Kılınc, 2014). In such a case, it is also difficult to say that school administration is perceived as a profession that requires expertise by policymakers in the Turkish national education context.

Another significant finding of the current study was that transformational leadership was the most effective type of leadership on academic achievement, followed by supportive, distributed, and instructional leadership. As suggested by Babaoğlu et al. (2017), one of the important factors in student achievement is the leadership of the school principal. Cravens and Huff (2007) found in their study that the principal's leadership behavior had a positive effect on the success of all students, particularly the disadvantaged students. The current study adds to these results by revealing that transformational leadership particularly mattered in supporting student academic success compared to other leadership types. This suggests that both the principal and teachers should engage in



transformational leadership acts to leverage student achievement and school effectiveness. Valentine and Prater (2011) support this conclusion evidencing that transformational leadership positively affected students' academic achievement, not by means of their relationship with students but by means of their relationship with teachers. Similarly, Allen et al. (2015) emphasize that transformational leadership should be advocated to support the teaching-learning process at school. Leithwood and Sun (2012) state in their study that transformational leadership increases students' reading and mathematics achievement by affecting teacher attitudes. Bagget (2008), on the other hand, regards student achievement as one of the indirect outcomes of transformational leadership while Karakose et al. (2023) showed that transformational leadership was mostly included in research focusing on student achievement due to expected direct and indirect associations between the two variables.

Supportive leadership was found to be the second leadership type that affected student achievement to a significant extent. Accordingly, it can be concluded that school principals' displaying supportive leadership is likely to enhance student academic achievement not only by leveraging teachers' commitment to school but also by enhancing students' feeling of belonging and efficacy beliefs (Hoy & Hannum, 1997). Several studies have also evidenced that principals' exhibiting supportive leadership behavior can enhance school effectiveness and student academic achievement significantly (Goddard et al., 2001; Hoy et al., 1992; Hoy & Sabo, 1998; Karakose et al., 2025b; Tarter, et al., 1995; Tschannan-Moran & Hoy, 2000; Yilmaz, 2015).

In addition to transformation and supportive leadership, distributed leadership was found to have a significant influence on student academic achievement. According to Hallinger (2011), distributed leadership is a very powerful factor in realizing the school's vision of increased effectiveness while Goldsmith (2010) states that distributed leadership could leverage student academic achievement although it is not easy to practice. Harris (2004), who examined the relationship between distributed leadership and school effectiveness, emphasized that successful leaders are those who share the responsibility for providing high-quality instruction and better student results. Similarly, Chen (2007) concluded in his study that school principals and teachers working together and collaboratively have a positive effect on student achievement.

Although instructional leadership was found to have a weaker effect on student academic achievement, it still had a statistically significant effect, which was also supported by prior evidence. For instance, in his analysis of 130 doctoral dissertations on instructional leadership produced between 1983 and 2010, Hallinger (2011) determined that there were strong positive relationships between instructional leadership and student learning. In their meta-analysis study investigating the effect of instructional leadership on academic achievement including studies published between 1986-1996, Witziers et al. (2003) found that instructional leadership behaviors of primary school principals affected student academic achievement. In another study conducted by Quinn (2002), it was concluded that the instructional leadership role of the principal had significant contributions to the academic achievement of students. Similarly, Janarette and Sherrets (2007) emphasised that school principals were effective in student academic achievement when they fulfilled their instructional leadership roles. Karakose et al. (2024b) also underlined the indirect effect of principal instructional leadership on student achievement, particularly by enhancing teacher self-efficacy and collective teacher efficacy.

The moderator analysis in the current study showed that publication year range, publication type, and school level were not significant moderators in the relationship between leadership, school climate, and academic achievement. Similar to our finding, Karadağ et al. (2016) found in their meta-analysis that the publication type was not a statistically significant moderator in the leadership-student achievement relationship, while the publication year range was. Accordingly, they stated that the moderating effect of the publication year range was higher starting from the 1990s. On the other

hand, Şimşek and Özaslan (2021) concluded in their meta-analysis study examining students' academic achievement that there was a significant difference in favor of articles, thus publication type could be a significant moderator. As for the school level, it was found to be a significant moderator of the relationship between school climate and student achievement while it did not moderate the relationship between leadership and student academic achievement. The results particularly indicated that organizational climate in primary schools had a greater influence on student achievement compared to high school context. Şimşek and Özaslan (2021) supported our finding indicating that school climate was a significant moderator, but identified that it had a greater influence in the secondary school context.

## 5. Conclusions

The findings of the current study underlined that the country context can significantly impact the relationship between leadership, organizational climate in schools, and student academic achievement. The results also underline that both principal leadership and teacher leadership as well as the school climate had a greater influence on academic achievement. In addition, the effect of transformational, supportive, distributed, and instructional leadership on student achievement was clearly evident, in this respective order. These results suggest that principal leadership, teacher leadership, and positive school climate mattered in facilitating student learning and enhancing their academic achievement. School principals and teachers should be aware of their significant role in supporting the academic achievement of students and should put greater effort into fulfilling their responsibilities to create a positive school climate that supports academic achievement. From this perspective, particular attention should be given to the inequalities and differences in academic achievement between students as well as identifying the teacher and principal-related factors underlying these inequalities. With this purpose, awareness-raising activities should be integrated into professional development activities and the significance of leadership skills should be emphasized. In addition to these on-site initiatives, the literature on the influence of leadership and school climate should be supported by evidence from both quantitative and qualitative studies as well as by more cumulative analysis of results presented by studies from a variety of contexts.

Based on the current research findings, we recommend that programs should be developed to train school principals as leaders in the Turkish education system, which currently does not implement a specific school leadership program. It would also be useful to determine and implement criteria that measure the leadership skills of school principals and teachers during the selection process so that they can be more effective in creating a positive school climate to enhance student achievement. In addition, feedback loops should be created in schools to monitor student achievement, and continuous monitoring of organizational factors affecting school principals' and teachers' performance should be employed so that constant improvement can be realized. Finally, policies and guidelines should be developed to ensure school effectiveness by means of successful school leadership.

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The studies indicated with “\*” are the studies included in the meta-analysis.

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