

Original Article

A Meta-Analysis of the Impact of School Climate on Academic Self-Efficacy Across Gender and Age Groups

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Received: 21 Oct 2024; Revised: 02 Nov 2024; Accepted: 12 Nov 2024

Abstract

Background and Aim: This meta-analysis examines the relationship between school climate and academic self-efficacy as two important constructs in educational psychology.

Materials and Methods: Drawing on 11 empirical studies published between 2011 and 2024, this study aims to provide a comprehensive synthesis of the research on how the school environment influences student beliefs in their academic abilities. The analysis used correlation-based metrics, including Begg and Mazumdar rank correlation and funnel plots, to assess publication bias, with results confirming the absence of bias. Heterogeneity was evaluated using Cochran's Q-test, which indicated significant variability among studies ($Q = 150.967, p < .001$), supporting a random-effects model.

Results: The findings revealed a moderate to strong positive effect size ($r = 0.54$), suggesting that a supportive school climate is significantly associated with higher academic self-efficacy. Effect sizes varied by student demographic, with the strongest effects observed for male students ($r = 0.58$), followed by mixed-sex students ($r = 0.53$) and female students ($r = 0.36$). Additionally, student age accounted for 22% of the variability in the relationship between school climate and self-efficacy, as indicated by regression analyses.

Conclusion: These results highlight the importance of fostering a collaborative and empathetic school environment to enhance students' confidence in their academic capabilities, ultimately contributing to better educational outcomes.

Keywords: Self-Control, Schema, Demographic, Athlete, Swimming

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Please cite this article as:

Afshari, S., Alipour, F., Farid, A. A Meta-Analysis of the Impact of School Climate on Academic Self-Efficacy Across Gender and Age Groups. *Int. J. Appl. Behav. Sci.* 2024;11(4):58-67.

Introduction

Students represent one of the most valuable forms of social capital, serving as the foundation for a nation's future growth and societal development. Achieving sustainable progress and national advancement is linked to transforming students into competent, capable individuals who can meaningfully contribute to their communities (1). Consequently, many societies prioritize the development of effective educational programs and policies aimed at enhancing human capital through formal education (2). Policy makers and education authorities, aligned with national development goals, recognize that education plays a critical role in cultivating a skilled and adaptable workforce (3).

Historically, educational systems primarily focused on the transmission of academic content, with student success measured by grades and academic performance (4). However, in recent decades, there has been a paradigm shift in educational priorities. Rather than focusing solely on academic achievement, modern education now seeks to enhance students' overall competencies, including psychological, social, and academic dimensions (5). Rapid advances in communication technologies, coupled with emerging societal challenges, have prompted educators to equip students with the broader skills needed to thrive in an increasingly complex world. This comprehensive approach to education emphasizes the holistic development of individuals capable of addressing societal needs and contributing to sustainable development (6,7). Among the psychological constructs essential for students' success, academic self-efficacy is particularly noteworthy.

Bandura's social cognitive theory defines self-efficacy as an individual's belief in their ability to complete tasks and overcome challenges. In the academic context, students with high self-efficacy are more likely to approach academic challenges with confidence, perseverance, and a proactive mindset (8). Research consistently underscores the role of self-efficacy in improving academic performance, promoting psychological well-being, and helping students navigate school-related stressors more effectively (9-11).

Self-efficacy is influenced by various factors,

including personality traits, self-esteem, and teacher expectations (12,13). However, beyond these personal factors, school climate has emerged as a powerful contextual predictor of academic self-efficacy. Research found that a supportive school climate characterized by empathy, collaboration, and emotional support enhances students' self-efficacy (14,15). Studies consistently demonstrate that a positive school climate can foster higher confidence in students' academic abilities (16). On the other hand, a negative school climate associated with factors such as stress, fatigue, and boredom (17-19) confirmed the correlation between school climate and self-efficacy in their study on the structural relationships between these variables (20,21). Researchers found that a positive school climate significantly predicted entrepreneurial and academic self-efficacy. Other studies emphasized the predictive power of school climate on students' self-efficacy (22,23). Internationally, research also affirms the link between school climate and self-efficacy (14,15). Given the increasing research on the relationship between school climate and academic self-efficacy, there is a growing need to synthesize these findings systematically. Meta-analysis offers a rigorous quantitative method to consolidate results from various studies, enabling researchers to assess overall effect sizes and gain a comprehensive understanding of the relationship between these two constructs. Through meta-analysis, it becomes possible to reconcile discrepancies in findings and derive more generalized, applicable conclusions. Therefore, the present study aims to conduct a meta-analysis to determine the effect size of the relationship between school climate and academic self-efficacy in student populations. Additionally, this study seeks to explore whether the results are homogeneous or heterogeneous and to assess the extent to which they are influenced by publication bias.

Methods

Research Design

This study employed a meta-analytic approach to systematically identify and synthesize all relevant research on the relationship between school climate and academic self-efficacy. Meta-analysis allows the integration and analysis of validated data from multiple

studies, enabling researchers to draw comprehensive and precise conclusions regarding a given topic. This methodology is based on a structured process involving four key stages: 1) identifying the relevant studies for analysis; 2) reviewing and interpreting the findings presented in these studies; 3) evaluating the methods, approaches, and results of the studies to assess their validity and relevance; and 4) synthesizing and integrating the findings into a cohesive body of knowledge (24). In this meta-analysis, the units of analysis are the studies themselves rather than individual participants. This approach enables the aggregation of findings across multiple studies, transcending the limitations of individual research efforts to uncover broader patterns and relationships between constructs. By synthesizing these results, meta-analysis facilitates the identification of new insights and explanations regarding the relationships between key variables, providing a more comprehensive understanding of the subject matter.

Study Identification and Inclusion

To systematically identify and include relevant studies for this meta-analysis, a comprehensive search strategy was employed across domestic and international databases. The search covered studies published between 2011 and 2024 that investigated the relationship between school climate and academic self-efficacy. The databases searched included the Scientific Information Database (SID), the Private Iranian Journals Database, and the Noor Specialized Journals Database for Persian-language research. In addition, international databases such as Google Scholar, APA PsycNet, Springer, Frontiers, and Science Direct were used to capture relevant studies from global sources. The search strategy utilized the following keywords to ensure a broad approach: "school climate" and "academic self-efficacy" for domestic studies and "self-efficacy" and "school atmosphere" for international studies. Boolean operators such as "AND" and "OR" were used to combine and refine search terms.

For inclusion in the meta-analysis, studies were required to meet specific criteria. Only research published between 2011 and 2024 that directly examined the relationship between school climate and academic self-efficacy was considered. Furthermore, studies needed to provide sufficient statistical data,

such as correlation coefficients, to facilitate the calculation of effect sizes. It included peer-reviewed journal articles, as well as master's and doctoral theses that were accessible through digital databases or academic libraries. Studies that did not provide the necessary data for effect size computation or had methodological limitations undermining their validity were excluded. Additionally, studies based on duplicated findings, such as articles from previously analyzed theses, were excluded to avoid redundancy. The selection process was designed to maintain high methodological quality, ensuring that only rigorous and reliable studies were included.

The search process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, ensuring transparency and replicability in study selection. After applying the inclusion and exclusion criteria, 11 studies were deemed suitable for inclusion in the meta-analysis. These studies formed the foundation for the subsequent data synthesis and analysis presented in this study.

Computation of Effect Size

In this meta-analysis, effect size was computed using the correlation coefficient (r), commonly employed in correlational meta-analyses. The effect sizes were derived from the statistical results reported in each study, converting various test statistics (e.g., t -values, p -values, F -scores) into correlation coefficients where necessary. For studies that directly provided correlation coefficients, these values were extracted and used for further analysis. The effect sizes were interpreted based on Cohen's (25) guidelines, with values of 0.10, 0.30, and 0.50 representing small, medium, and large effects, respectively. This classification enabled a standardized interpretation of the relationship between school climate and academic self-efficacy across different studies. Studies were reviewed carefully to confirm that they reported sufficient data for effect size calculation to ensure the inclusion of only reliable and valid ones. The meta-analysis aggregated the effect sizes from individual studies, producing an overall measure of the strength of the relationship between the two variables. This process allowed for a more comprehensive understanding of how school climate influences academic self-efficacy across various educational settings.

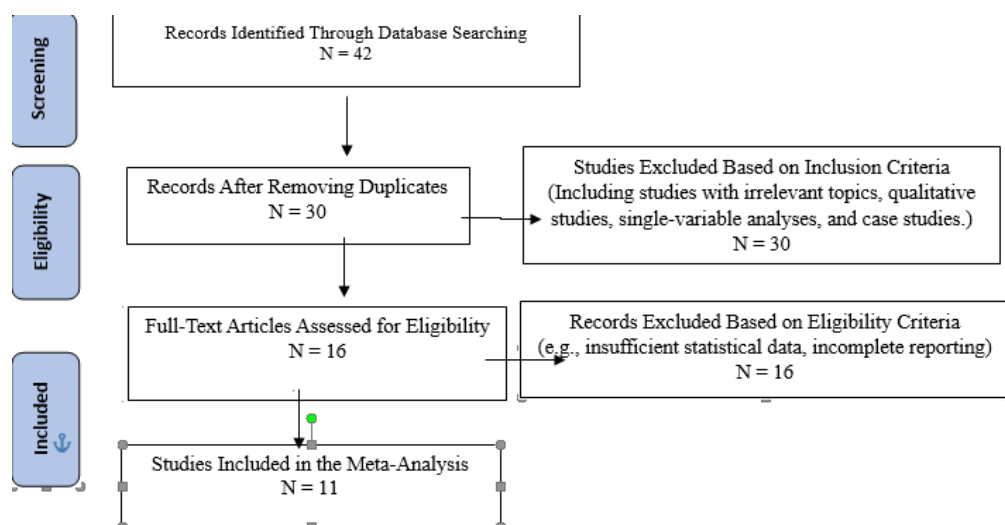


Figure 1. The flowchart of selection process.

Results

In this section, 11 studies published between 2011 and 2024 were selected for the final meta-analysis, as presented in Table 1. These studies examined the relationship between school climate and academic self-efficacy, with effect sizes calculated and evaluated for bias factors.

The overall effect sizes across the selected studies indicate a significant positive relationship between school climate and academic self-efficacy. As shown in Table 1, the effect sizes ranged from 0.16 to 0.87, with studies reporting moderate to strong correlations. Gender differences were also observed, with studies involving male students tending to report higher effect sizes, as evidenced in Ashrafi (23).

The bias factors, as indicated by the statistical values, confirm the robustness of the findings across studies, with all p -values being significant at the 0.01 level. This consistency across various samples and contexts suggests that the positive influence of school climate on academic self-efficacy is a generalizable phenomenon applicable across different student populations.

Heterogeneity of the Included Studies.

One of the critical steps in meta-analysis is the assessment of heterogeneity, which determines whether the variation in effect sizes across studies is higher than is expected by chance. In this meta-analysis, Cochran's Q statistic and the I^2 statistic were

used to evaluate heterogeneity, as presented in Table 2, which reports the heterogeneity related to the relationship between school climate and academic self-efficacy. Based on the results of Cochran's Q test ($Q = 150.967$, $df = 10$, $p < 0.001$), we can reject the null hypothesis of homogeneity with 99% confidence, confirming that the included studies exhibit significant heterogeneity. The significance of the Q statistic indicates that the effect sizes across the studies are not consistent and vary beyond what would be expected by chance alone. However, because Cochran's Q is sensitive to the number of included studies and its power to detect heterogeneity increases with more effect sizes, the I^2 statistic was also calculated to provide a complementary measure. The I^2 value ranges from 0 to 100% and reflects the percentage of total variation across studies that can be attributed to heterogeneity rather than chance. In this meta-analysis, an I^2 of 93.376% indicates that approximately 93% of the variability in effect sizes is due to genuine heterogeneity between the studies. This high heterogeneity suggests that the relationship between school climate and academic self-efficacy may differ across various student groups and contexts. Given the significant heterogeneity, it is appropriate to divide the sample into subgroups—such as male students, female students, and mixed-gender groups—to analyze the effect size within each subgroup separately. This subgroup analysis allows a clearer understanding of how the relationship between school climate and academic self-efficacy may differ across different populations.

Table 1. Characteristics of Selected Studies, Including Effect Sizes and Bias Factors.

Study No.	Researchers	Title	Sample Size	Effect Size (r)	Bias Factors	p-Value	Gender
1	Zysberg&Schwabsky (14)	School Climate, Academic Self-Efficacy, and Student Achievement	1641	0.52	23.326	0.01	Mixed
2	Booth et al. (15)	Adolescents' Perception of School Climate and Academic Self-Efficacy	717	0.49	14.264	0.01	Male
3	Zarbakhsh et al. (16)	The Relationship Between School Climate and Academic Motivation with Academic Self-Efficacy	300	0.51	9.698	0.01	Female
4	Mahna et al. (17)	Structural Relationships Between Perception of School Climate, Achievement Goals, and Academic Self-Efficacy	380	0.51	10.926	0.01	Mixed
5	Amiri (20)	The Role of School Climate and Emotional Intelligence in the Academic Self-Efficacy of Female Technical High School Students in Mashhad	335	0.16	2.941	0.01	Female
6	Farahbakhsh et al. (21)	The Effect of School Climate on Academic Self-Efficacy Mediated by Classroom Management Style	360	0.61	13.395	0.01	Mixed
7	Askari et al. (22)	A Causal Model of Academic Engagement and Self-Efficacy Through Perception of School Climate in Gifted Students	300	0.52	9.932	0.01	Mixed
8	Ashrafi (23)	The Relationship Between Perception of School Climate and Academic Optimism with Creative Academic Self-Efficacy	150	0.87	16.163	0.01	Male
9	Shabani et al. (26)	Predicting Academic Self-Efficacy Based on School Climate, Academic Engagement, and Emotional Competency in Female Secondary Students	112	0.48	5.460	0.01	Female
10	Nazari et al. (27)	School Climate and Academic Self-Efficacy of Students	320	0.53	10.507	0.01	Mixed
11	Türkoğlu et al. (28)	The Role of School Climate in the Effect of Self-Efficacy on Student Engagement	340	0.57	11.887	0.01	Male

Table 2. Heterogeneity Statistics for the Relationship Between School Climate and Academic Self-Efficacy.

Q Statistic	Degrees of Freedom (df)	p-value	I ² (%)
150.967	10	< 0.001	93.376

Publication Bias Hypothesis

As an essential step in this meta-analysis, publication bias was assessed to ensure the validity of the

synthesized results. Publication bias can occur when published studies with significant or positive results are overrepresented while studies with null or insignificant

results remain unpublished. This selection bias can distort the overall conclusions of a meta-analysis and potentially undermine the reliability of its results. Ensuring that all relevant research, regardless of outcome, is included in the meta-analysis is crucial for drawing accurate and generalizable conclusions.

We employed three standard approaches to assess the potential for publication bias: the funnel plot, Begg and Mazumdar's rank correlation test, and Rosenthal's fail-safe N. The results of these tests, detailed below, provide insight into the presence (or absence) of bias in selecting studies included in this meta-analysis.

Funnel Plot

Figure 2 presents the funnel plot for the current meta-analysis. Funnel plots are used to visually inspect the presence of publication bias by plotting effect sizes against sample sizes. In a meta-analysis with minimal publication bias, the plot should resemble an inverted funnel, with the studies symmetrically distributed around the pooled effect size. In this analysis, most studies cluster near the top of the plot, indicating higher precision and larger sample sizes. Additionally, the symmetry of the funnel plot suggests that publication bias is not a major concern in this meta-analysis, as studies of varying effect sizes and precision appear to be well-balanced.

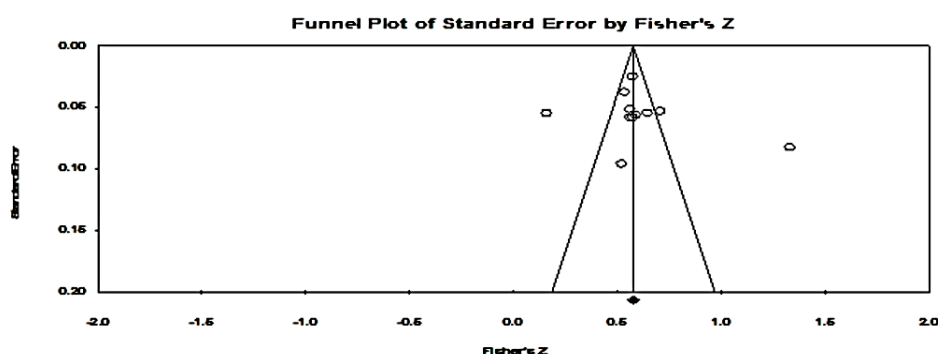


Figure 2. Funnel Plot of Effect Sizes from the Included Studies.

Table 3. Begg and Mazumdar's Rank Correlation Coefficient.

Tau	Z	One-tailed p-value	Two-tailed p-value
0.062	0.81	0.37	0.45

Table 4. Rosenthal's Classical Fail-Safe N.

Z (Observed Studies)	p (Observed Studies)	Alpha	Z Alpha	Number of Missing Studies Required for p > 0.05
12.08	< 0.001	0.05	1.95	1383

Begg and Mazumdar's Rank Correlation Test

To supplement the visual inspection of the funnel plot, Begg and Mazumdar's rank correlation test was conducted to statistically evaluate the symmetry of the effect size distribution. The results are presented in Table 3. As shown in Table 3, Kendall's Tau value of 0.062, with corresponding p-values of 0.37 (one-tailed) and 0.45 (two-tailed), indicates no significant correlation between study precision and effect size. These findings align with the symmetry observed in the funnel plot, confirming the absence of substantial publication bias in the data.

Rosenthal's Fail-Safe N

In addition to the rank correlation test, Rosenthal's fail-safe N was calculated to estimate the number of additional null-result studies (i.e., studies with zero effect size) that would need to be included to render the overall effect non-significant. The results are displayed in Table 4. According to Table 4, an additional 1,383 studies with zero effect size would be required to bring the combined p-value above the conventional threshold of 0.05. This result suggests that the findings of this meta-analysis are robust and unlikely to be overturned by the inclusion of missing studies. The high fail-safe N further strengthens the validity of the conclusions drawn from this analysis.

Effect Size Calculation

Figure 3 illustrates that in only one study, the correlation between school climate and academic self-efficacy is smaller than 0.30, while in 10 studies, the correlation exceeds 0.30. Since a correlation greater than 0.30 indicates a stronger relationship, we can conclude that the relationship between school climate and academic self-efficacy is generally strong and direct across the studies. After confirming the assumptions of the meta-analysis, both fixed-effect and random-effects models were calculated, with the results reported in Table 5.

The fixed-effect model assumes homogeneity across studies, while the random-effects model assumes heterogeneity among the included studies. In this meta-analysis, both models were calculated. The fixed-effect model yielded an effect size of 0.52, while the random-effects model produced an effect size of 0.54. Both models were statistically significant ($p < 0.001$), indicating that the relationship between school climate and academic self-efficacy is robust and significant under each modeling approach. Also, The selection of the random-effects model suggests that the effect size may vary across different populations, implying that there is no single “true” effect size but rather a distribution of effect sizes across different contexts. Based on this, we explored the relationship between school climate and academic self-efficacy across various subgroups, including male students, female students, and mixed-gender groups, to observe the effect size within each subgroup.

As shown in Table 6, the average effect sizes for

school climate on academic self-efficacy in mixed-gender, male, and female groups were 0.53, 0.58, and 0.36, respectively, all significant at the $p < 0.01$ level. These results indicate a stronger relationship between school climate and academic self-efficacy in the male group compared to the female group.

Moderator Variable

Given the results of Cochran's Q test, which indicated significant heterogeneity across the included studies, it was necessary to investigate potential moderator variables that could explain this variance. A moderator analysis was conducted with age groups selected as the moderator variable to address the heterogeneity observed. The goal was to determine whether age influences the relationship between school climate and academic self-efficacy and to quantify the extent to which this variable accounts for the variance across the studies. A meta-regression model was used to assess the moderating effect of age on the relationship between school climate and academic self-efficacy. The results of the regression analysis are shown in Table 7.

The results of the ANOVA in Table 8 are of particular importance. Since the p-value is less than 0.001, age significantly moderates the relationship between school climate and academic self-efficacy. To quantify how much of the variance in school climate is explained by age, we can divide the total Q statistic (365.57) by the model Q statistic (81.27). This calculation yields 22%, indicating that approximately 22% of the variance in school climate across the studies can be attributed to differences in the age of the participants.

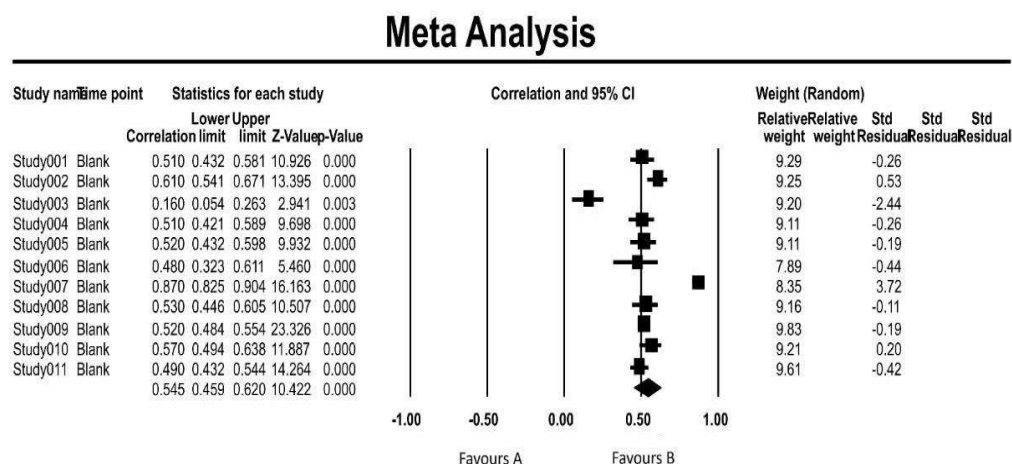


Figure 3. Summary of Meta-Analysis Results for the Included Studies.

Table 5. Effect Size for Academic Self-Efficacy.

Model	Number of Effect Sizes	Effect Size	Lower Bound	Upper Bound	Z-value	p-value
Fixed	11	0.52	0.50	0.54	40.49	< 0.001
Random	11	0.54	0.49	0.62	10.42	< 0.001

Table 6. Effect Size for School Climate on Academic Self-Efficacy (Random-Effects Model by Subgroup).

Group	Number of Effect Sizes	Effect Size	I ² (%)	Lower Bound	Upper Bound	Z-value	p-value
Mixed	5	0.53	92.65	0.50	0.56	32.34	< 0.001
Male	3	0.58	97.42	0.54	0.62	22.98	< 0.001
Female	3	0.36	92.86	0.29	0.42	10.22	< 0.001

Table 7. Meta-Regression Results.

Parameter	Point Estimate	Standard Error	Lower Bound	Upper Bound	z-value
Slope	0.008	0.001	0.006	0.010	9.01
Intercept	-0.701	0.040	-0.780	-0.610	-16.74
Tau ²	0.05				

Table 8. Analysis of Variance (ANOVA).

	Q	Df	p-value
Model	81.27	1	< 0.001
Residual	275.29	16	< 0.001
Total	365.57	17	< 0.001

Discussion

The present meta-analysis examined the relationship between school climate and academic self-efficacy. The findings revealed an overall effect size of 0.55, indicating a strong, significant, and direct relationship between the two variables. These results suggest that a positive school climate has a crucial role in enhancing students' academic self-efficacy. An enriching school environment fosters students' belief in their abilities to succeed academically, thus promoting their self-efficacy. Other positive outcomes may be seen in school, as self-efficacy - the belief in one's ability to exert control over events that affect one's life to manage one's functioning and environmental demands - plays a significant role in stress responses and adaptive coping with threatening situations (29).

Furthermore, the meta-analysis identified heterogeneity across the included studies, particularly when comparing different student groups mixed-gender, male, and female students. Given this heterogeneity, the random-effects model was deemed appropriate, and the analysis demonstrated that the relationship between school climate and academic self-efficacy was strongest in the mixed-gender group.

This finding underscores the importance of considering group characteristics when examining the influence of school climate on self-efficacy, as the impact may vary across different demographic contexts.

The current results align with several existing studies. Researchers found that school climate is a factor in fostering self-efficacy, suggesting that a supportive and collaborative school environment strengthens students' belief in their academic abilities (14). Similarly, they emphasized that school climate is a strong predictor of self-efficacy, noting that a positive school climate enhances students' attitudes toward their capabilities (30). According to these studies, school climate increased engagement, creativity, and teamwork, ultimately improving self-efficacy.

A key insight from this meta-analysis is the role of school climate in shaping students' perceptions of their academic abilities. A supportive and collaborative environment within the school can foster motivation, creativity, and a sense of belonging, all of which contribute to the development of academic self-efficacy. In contrast, a rigid, authoritarian school climate may suppress students' enthusiasm and hinder their ability to explore and develop their capabilities, leading to lower self-efficacy. This notion is supported by Zarbakhsh et al. (16), who argued that school climate is a significant determinant of individual behavior and learning outcomes.

Additionally, a collaborative school environment was found to enhance students' interactions with both peers and teachers. This fosters a sense of community and belonging, which, in turn, promotes higher motivation to achieve academic goals. Such motivation is fundamental for success in school settings because it enables students to overcome challenges and persist in pursuing their goals (31). As Bandura has argued, motivated individuals exhibit greater self-efficacy, particularly in stressful situations, and individuals with lower motivation are more prone to feelings of helplessness and are less likely to persevere when faced with challenges. Therefore, a positive school climate not only enhances academic motivation but also improves self-efficacy, which contributes to overall academic success. This relationship was further confirmed by Salimi et al. (32), who demonstrated the positive role of academic motivation in enhancing self-efficacy.

Another finding from this study is the stronger relationship between school climate and academic self-efficacy among male students compared to female students. The results suggest that male students showed higher self-efficacy than their female counterparts when provided with an environment conducive to participation and empathy. It may reflect broader trends in academic settings, where male students tend to report a higher degree of academic self-efficacy. Also, we found that male students demonstrate higher self-efficacy than female students, particularly in school settings. However, it is essential to note that conflicting evidence exists, and further research is needed to explore the nuances of these gender differences in self-efficacy. Additionally, the larger sample sizes in studies focused on male students compared to those on female students may have contributed to this observed difference, warranting further investigation (33).

This meta-analysis also revealed that 22% of the between-group variance in effect sizes can be attributed to the age of the participants, highlighting the role of age as a moderator in the relationship between school climate and self-efficacy. These findings are consistent with the longitudinal study conducted by Booth et al. (15), which examined the role of school climate on the self-efficacy of 717 ethnically diverse students from 2009 to 2011. Their

results showed that the relationship between school climate and self-efficacy varies as students' progress through different grade levels. This change over time mirrors the results of the present study, suggesting that age plays an essential role in shaping how students experience and respond to school climate in terms of their self-efficacy.

Conclusion

In conclusion, the findings of this meta-analysis underscore the critical role of school climate in shaping students' academic self-efficacy. A positive school climate creates an environment that fosters personal growth, motivation, and collaboration, all of which contribute to the development of self-efficacy. To maximize students' academic potential, school administrators and educators must prioritize the cultivation of a school climate that promotes interaction, shared knowledge, and a sense of community. By doing so, schools can provide the necessary foundation for enhancing students' belief in their abilities, ultimately leading to greater academic success.

Acknowledgments

This review paper was supported by the Shahid Madani University of Azarbaijan

Conflict of Interest

The authors declare no conflict of interest.

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