**Research Article**

# The effect of school climate on the math achievements of secondary school students

Hülya Sert Çelik[1], Barış Demir[2*], and Ali Özbek[3]

*Department of Mathematics Education, University of Kocaeli, Turkiye*

| Article Info | Abstract |
|---|---|
| | The purpose of this study is to examine the relationship between school climate and mathematics achievement of secondary school students (grades 5 to 8) in public secondary schools in a district in the Aegean Region. In order to determine students' perceptions of school climate, the "School Climate Scale" developed by Çalık and Kurt (2010) was used. The study aims to determine the effect of school climate on students' mathematics achievement and how this effect shapes students' resilience in the face of the challenges they face. In the study, universal sampling technique was used and 912 secondary school students were accepted as participants. As a result of the analyses, it was found that there was a moderate positive correlation between the academic achievement of secondary school students in mathematics and school climate. |

**To cite this article**

Sert Çelik, H., Demir, B., and Özbek, A. (2024). Games in mathematics education: systematic literature review. *Journal for the Mathematics Education and Teaching Practices, 5*(2), 57-65. DOI: https://doi.org/10.5281/zenodo.14599880

## Introduction

Today's world is in a process of constant transformation, characterised by rapid renewal and numerous social, cultural, economic, political and technological changes. These changes and the new needs arising from them create new challenges and force schools to adopt an ongoing dynamic of transformation, evaluation and adaptation (Cáceres-Correa, 2020, Parody García et all, 2019). Therefore, schools need to fulfil other functions in addition to the main tasks of transferring, reconstructing and developing knowledge. These include, for example, socialising students, teaching them values and healthy habits, helping them to develop self-awareness, and helping them to develop the skills and learning strategies they will need to cope and adapt to the different situations they will face throughout their lives. Although these tasks are not solely the domain of education and are shared by other social institutions, tradition has always placed and continues to place increasing responsibility on schools in this endeavour (Parody García et all, 2019).

Although there is no single widely accepted definition of school climate, the National Centre for School Climate argues that school climate refers to the quality and nature of school life and is based on individuals' perceptions of their school based on their experiences at school. According to these authors, school climate reflects the school's values, goals, rules, habits, interpersonal relationships, teaching and learning practices, and organisational structures. A positive school climate has been shown to be associated with various student and teacher outcomes and is a strong predictor of emotional and behavioural outcomes (Loukas & Robinson, 2004; Roeser, Eccles, & Sameroff, 2000; Wang et all, 2010).

1 Mathematics Teacher, Içmeler I.C.K.K.A Primary School, Muğla, Türkiye. E-mail: hlyasert@gmail.com ORCID: 0000-0002-5021-7449
2 Department of Mathematics Education, University of Kocaeli, Türkiye. E-mail: baris.demir@kocaeli.edu.tr ORCID: 0000-0001-6997-6413
3 School Director, Içmeler I.C.K.K.A Primary School, Muğla, Türkiye. E-mail:  ORCID: 0009-0002-2998-064X

Research shows that positive school climates support resilience and negative school climates can be a risk factor for students, teachers, administrators, parents, and other members of the community (Benard, 2004; Freiberg & Stein, 1999). Research also supports the idea that a decrease in perceptions of school climate (especially in terms of relationships, discipline and clarity of school rules) is associated with increased behavioural problems (Gottfredson, 1989; Wang et al., 2010).

Research examining the relationship between school climate and academic achievement has an important place in the field of education. The research conducted by Thapa, Cohen, Guffey, and Higgins-D'Alessandro (2013) revealed that a positive school climate increases students' commitment to school and academic achievement. Brand, Felner, Shim, Seitsinger, and Dumas (2003) showed that school climate has a direct effect on secondary school students' mathematics and reading achievement. Loukas, Suzuki, and Horton (2006) examined how a safe and supportive school climate positively affects students' academic performance, while MacNeil, Prater, and Busch (2009), in their study on high school students, stated that the quality of relationships between teachers and students significantly affects student achievement. Jia, Konold, and Cornell (2016) evaluated the effects of school climate on maths and English language arts performance and showed that students' perceptions of school climate have direct and indirect effects on academic achievement.

These studies emphasise that school climate is not only limited to how students feel, but also has a significant impact on their academic achievement. In this context, this study aims to examine the relationship between secondary school students' mathematics achievement and school climate.

H1: There is a significant relationship between school climate and secondary school students' academic achievement in mathematics courses.

H2: Secondary school students' perceptions of school climate differ according to gender and grade level variables.

## Method

**Model of Research**

In this study, which aims to reveal the relationship between secondary school students' mathematics achievement and school climate, the relational survey model, which is one of the quantitative research methods, was used.

In the study, the relational screening model was used from quantitative research models. The relational screening model is a research model that aims to determine the presence and/or level of change between two or more variables together (Karasar, 2013).

**Research Group**

The research group consists of a total of 912 students studying in secondary schools in Marmaris district of Muğla province in the 2023-2024 academic year and participated in the research voluntarily. Information about the demographic characteristics of the students participating in the study is shown in Table 1.

**Table 1.** Demographic characteristics of the sampled students

| Variable | Groups | n | % |
|---|---|---|---|
| Gender | Female | 463 | 50,8 |
|  | Male | 449 | 49,2 |
| Class Level | 5th grade | 224 | 24,6 |
|  | 6th grade | 339 | 37,2 |
|  | 7th grade | 166 | 18,2 |
|  | 8th grade | 183 | 20,1 |
| Total |  | 912 | 100 |

Of the students included in the sample of the study, 463 (50.8%) were female and 449 (49.2%) were male. When the grade levels of the students were analysed, it was seen that 224 (24.6%) of them were in the fifth grade, 339 (37.2%) were in the sixth grade, 166 (18.2%) were in the seventh grade, and 183 (20.1%) were in the eighth grade.

**Data Collection Tools**

In order to determine students' perceptions of school climate, the "School Climate Scale" developed by Çalık and Kurt (2010) and whose validity and reliability studies were conducted with 482 secondary school students was used. The scale consists of 22 items and is Likert type. Each question in the scale is evaluated by ranking as "Never (1), Rarely (2), Occasionally (3), Mostly (4), Always (5)". The scale has three factors; supportive teacher behaviours (8 items), achievement orientation (4 items) and safe learning environment and positive peer interaction (10 items). Cronbach's alpha internal consistency coefficients were .79 for the first factor, .77 for the second factor, .85 for the third factor and .81 for the whole scale. In this study, Cronbach's Alpha internal consistency coefficients were .824 for the first factor, .685 for the second factor, .797 for the third factor and .867 for the whole scale.

**Data Analysis**

After obtaining informed consent and consent forms, the questionnaires were collected through surveey.com. Since the study was conducted online, participants' responses to the questionnaire were determined according to their most convenient time. The questionnaires were collected after a few weeks so that the participants had enough time to answer the given questionnaire. The responses provided through Surveey.com were downloaded in SPSS form. The results were checked and collected in a master data sheet for analysis and interpretation. Finally, once all the results were collected, they were analysed and interpreted according to the purpose of the study and reliable data was obtained from the feedback from the participants involved in the study.

Preliminary analyses were conducted to examine the properties of the scale used, normality assumption and correlation estimates between the study variables. In order to measure the reliability of the scales, reliability analyses were performed by considering Cronbach Alpha coefficient. Pearson correlation analysis was performed to determine the descriptive statistics of the factors resulting from the factor analyses applied to the scales and the relationships between the variables of the study.

**Table 2.** Descriptive statistics for the scores obtained from the scale and sub-dimensions used for students

| Variables | n | $\bar{x}$ | ss | Skewness | Kurtosis |
|---|---|---|---|---|---|
| Supportive Teacher Behaviours | 912 | 3,53 | ,760 | -.319 | -.107 |
| Success Orientation | 912 | 3,87 | ,717 | -.729 | .422 |
| Safe Learning Environment and Peer Communication | 912 | 3,42 | ,720 | -.112 | -.558 |
| School Climate Total | 912 | 3,54 | ,595 | -.232 | -.351 |
| Maths course success grade | 912 | 74,4 | 11,3 | -,700 | .317 |

According to Table 2, the mean total school climate score of secondary school students was found to be 3.54 with a standard deviation of .595. Among the sub-dimensions of school climate, the mean score of 'supportive teacher behaviours' was 3.53 with a standard deviation of .760; the mean score of 'achievement orientation' was 3.87 with a standard deviation of .717; the mean score of 'safe learning environment and positive peer interaction' was 3.42 with a standard deviation of .720. It was found that the skewness coefficients were between - .729 and - .112 and the kurtosis coefficients were between .558 and .422, and since these values were in the appropriate range (- 2 and +2) for parametric tests, the data showed normal distribution (George & Mallery, 2010).

**School Climate & Math Achievment**

The findings related to the first hypothesis of the study "There is a significant relationship between school climate and academic achievement of secondary school students towards mathematics courses" are given in Table 3.

**Table 3.** Correlation Analysis Results of the Relationship between Students' Academic Achievement Grade in Mathematics and School Climate Perceptions Sub-Dimension Scores

| Variables | $\overline{X}$ | SS | r | p |
|---|---|---|---|---|
| Maths Academic Achievement Grade | 74,40 | 11,33 | ,515** | ,000 |
| Support Teacher Behaviour | 3,53 | ,760 | | |
| Maths Academic Achievement Grade | 74,40 | 11,33 | ,510** | ,000 |
| Success Orientation | 3,87 | ,717 | | |
| Maths Academic Achievement Grade | 74,40 | 11,33 | ,432** | ,000 |
| Safe Learning Environment and Peer Interaction | 3,42 | ,720 | | |
| Maths Academic Achievement Grade | 74,40 | 11,33 | ,588** | ,000 |
| School Climate | 3,54 | ,595 | | |

When Table 3 is analysed, there is a statistically significant moderate positive relationship between school climate and mathematics achievement (p=.000; r = 0,588**). As a result of the analysis conducted to determine the relationship between students' mathematics academic achievement grade and their perceptions of school climate in terms of supportive teacher behaviours, achievement orientation, safe learning environment and positive peer interaction; a statistically significant positive relationship was found in terms of scores. Accordingly, it can be said that as school climate perceptions increase, mathematics achievement increases.

**Secondary School Students' Perceptions of School Climate and Demographic Variable Analyses**

The findings related to the second hypothesis of the study "Secondary school students' perceptions of school climate differ according to gender and grade level variables" are given in Table 4 and Table 5.

**Gender Factor**

**Table 4.** Comparison of secondary school students' school climate and sub-dimension scores according to gender

| | Gender | x̄ | ss | t | p |
|---|---|---|---|---|---|
| **Supportive Teacher Behaviours** | Female | 3,54 | ,740 | .523 | .781 |
| | Male | 3,52 | ,782 | | |
| **Success Orientation** | Female | 3,87 | ,691 | .290 | .772 |
| | Male | 3,86 | ,744 | | |
| **Safe Learning Environment and Peer Communication** | Female | 3,39 | ,726 | -.997 | .319 |
| | Male | 3,44 | ,713 | | |
| **School Climate** | Female | 3,53 | ,591 | -.355 | .723 |
| | Male | 3,55 | ,601 | | |

*p> .05*

When Table 4 is analysed, according to the t-test results, it is found that students' school climate and school climate sub-dimensions scores do not differ according to gender and in other words, there is no significant difference between the scores.

**Class Level Factor**

**Table 5.** Comparison of secondary school students' school climate, school climate sub-dimensions scores according to grade level

| Variables | Class | x̄ | ss | F | p |
|---|---|---|---|---|---|
| **Supportive Teacher Behaviors** | 5th grade | 3,66 | ,667 | 5,088 | 0,002* |
| | 6th grade | 3,55 | ,735 | | |
| | 7th grade | 3,48 | ,720 | | |
| | 8th grade | 3,38 | ,909 | | |
| **Success Orientation** | 5th grade | 4,02 | ,709 | 5,101 | 0,002* |
| | 6th grade | 3,85 | ,691 | | |
| | 7th grade | 3,81 | ,670 | | |
| | 8th grade | 3,76 | ,791 | | |
| **Safe Learning Environment and Peer communication** | 5th grade | 3,56 | ,725 | 6,113 | 0,000* |
| | 6th grade | 3,36 | ,660 | | |
| | 7th grade | 3,47 | ,766 | | |
| | 8th grade | 3,29 | ,747 | | |
| **School Climate** | 5th grade | 3,68 | ,553 | 7,626 | 0,000* |
| | 6th grade | 3,52 | ,543 | | |
| | 7th grade | 3,53 | ,598 | | |
| | 8th grade | 3,41 | ,696 | | |

*p> .05*

According to the results of the analyses conducted to determine whether the school climate and school climate sub-dimensions scores of secondary school students differ according to the grade level, it is seen that all of the school climate and school climate sub-dimensions scores differ significantly according to the grade level. According to the results of the Tukey test conducted to determine the source of this difference, it was found that the school climate scores of the 5th grade students were significantly higher than the sixth, seventh and eighth grade students.

## Conclusion and Discussion

The findings reveal that there is a moderate positive correlation between secondary school students' academic achievement in mathematics and school climate. This means that as the students' perception of academic achievement in mathematics course increases, their total school climate scores also increase. Gündoğan (2019), Asaroğlu (2019), Karadağvd (2016) and Özer (2022) found in their research that students who see themselves academically successful in school climate and its sub-dimensions have higher scores, while students with low academic achievement have lower school climate perception scores. These results are similar to the results of our study.

Secondary school students' total school climate scores and school climate sub-dimensions scores did not differ significantly according to their gender. In some studies in the literature, no difference was found in school climate scores according to gender (Erarslan, 2018; Pehlivan, 2020; Özer, 2022). These results are similar to the findings of our study. On the other hand, contrary to our findings, some studies found that school climate scores differed in favour of female students according to gender (Çınkır & Kepenekçi, 2003; Dönmez & Taylı, 2018; Özdemir et al., 2010; Özgenel et al., 2018).

Secondary school students' total school climate scores and school climate sub-dimensions scores differed significantly according to their grade levels. As the grade level increases, the perceived school climate scores decrease. When the literature was examined, studies showing that students' perceptions of school climate decreased as the grade level increased were found (Way & Reddy, 2007; Wang et al., 2010; Özer, 2022; Özgenel et al., 2018). These results are in parallel with the findings of our study. It is thought that the psychological, physiological and emotional changes brought

by the adolescence period, in addition to the anxiety caused by the entrance exam from secondary school to high school, and the pressure of parents and teachers on children may negatively affect students' perception of school climate (Özer, 2022).

The current research was conducted using only quantitative findings. This issue can be repeated with a mixed design or qualitative data with a sample group at different levels. In addition, intervention studies can be conducted for both teachers and students by adding different variables.

## References

Asaroğlu, H. (2019). *Teolojik Din Eğitimi Yaklaşımı: Johannes Hofinger Orneği* (Master's thesis, Bursa Uludag University (Turkey).

Benard, B. (2004). Resiliency: What we have learned. *San Francisco*.

Brand, S., Felner, R., Shim, M., Seitsinger, A., & Dumas, T. (2003). Middle school improvement and reform: Development and validation of a school-level assessment of climate, cultural pluralism, and school safety. *Journal of educational psychology*, *95*(3), 570.

Cáceres-Correa, I. (2020). Educación en el escenario actual de pandemia. *Utopía y Praxis Latinoamericana*, *25*(5), 11-12.

Cogaltay, N., Yalçın, M., & Karadag, E. (2016). Educational leadership and job satisfaction of teachers: a meta-analysis study on the studies published between 2000 and 2016 in Turkey. *Eurasian Journal of Educational Research*, *16*(62).

Donmez, S., & Tayli, A. (2018). Examining the perception of school climate, school engagement and quality of school life in secondary school students. *Adnan Menderes University Faculty of Education Journal of Educational Sciences*, *9*(2), 1-17.

Erarslan, A. (2018). Strengths and weaknesses of primary school English language teaching programs in Turkey: Issues regarding program components. *Eurasian Journal of Applied Linguistics*, *4*(2), 325-347.

Freiberg, J. H., & Stein, T. A. (1999). The role of school and classroom climate in elementary school learning environments. *School climate: Measuring, improving, and sustaining healthy learning environments*, 11-29.

George and Mallery (2010). SPSS for windows a step by step: A Simple Guide and Reference

Gottfredson, D. C. (1989). Developing effective organizations to reduce school disorder. *Strategies to reduce student misbehavior*, 87-104.

Gündoğan, A. (2019). SCAMPER: Improving creative imagination of young children. *Creativity studies*, *12*(2), 315-326.

Jia, Y., Konold, T. R., & Cornell, D. (2016). Authoritative school climate and high school dropout rates. *School Psychology Quarterly*, *31*(2), 289.

Karasar, N, (2013). *Bilimsel araştırma yöntemi*. Ankara: Nobel yayıncılık

Kepenekçi, Y. K., & Çınkır, Ş. (2003). Öğrenciler arası zorbalık. *Kuram ve Uygulamada Eğitim Yönetimi*, *34*(34), 236-253.

Kurt, T., & Çalık, T. (2010). Okul iklimi ölçeği'nin (OİÖ) geliştirilmesi. *Eğitim ve Bilim*, *35*(157).

Loukas, A., & Robinson, S. (2004). Examining the moderating role of perceived school climate in early adolescent adjustment. *Journal of Research on adolescence*, *14*(2), 209-233.

Loukas, A., Suzuki, R., & Horton, K. D. (2006). Examining school connectedness as a mediator of school climate effects. *Journal of research on adolescence*, *16*(3), 491-502.

MacNeil, A. J., Prater, D. L., & Busch, S. (2009). The effects of school culture and climate on student achievement. *International Journal of leadership in Education*, *12*(1), 73-84.

Özgenel, Ç. F., & Sorguç, A. G. (2018). Performance comparison of pretrained convolutional neural networks on crack detection in buildings. In *Isarc. proceedings of the international symposium on automation and robotics in construction* (Vol. 35, pp. 1-8). IAARC Publications.

Parody, L. M., Santos, M. J., Alcalá del Olmo, M. J., & Isequilla, E. (2019). The educational challenge of the twenty-first century: Relevance of the cooperation between family and school. *Espiral. Cuader-nos del profesorado, 12*(24), 19–29. https://doi.org/10.25115/ecp.v12i24.2284 ]

Roeser, R. W., Eccles, J. S., & Sameroff, A. J. (2000). School as a context of early adolescents' academic and social-emotional development: A summary of research findings. *The elementary school journal*, *100*(5), 443-471.

Stijnen, T., Hamza, T. H., & Özdemir, P. (2010). Random effects meta-analysis of event outcome in the framework of the generalized linear mixed model with applications in sparse data. *Statistics in medicine*, *29*(29), 3046-3067.

Thapa, A., Cohen, J., Guffey, S., & Higgins-D'Alessandro, A. (2013). A review of school climate research. *Review of educational research*, *83*(3), 357-385.

Wang, H., Bi, N., Saito, Y., Wang, Y., Sun, X., Zhang, J., & Yang, Z. (2010). Recent changes in sediment delivery by the Huanghe (Yellow River) to the sea: Causes and environmental implications in its estuary. *Journal of Hydrology*, *391*(3-4), 302-313.

Way, N., Reddy, R., & Rhodes, J. (2007). Students' perceptions of school climate during the middle school years: Associations with trajectories of psychological and behavioral adjustment. *American journal of community psychology*, *40*, 194-213.