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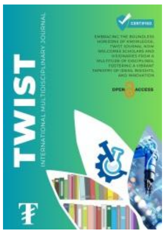

Mediating Effect of School Climate on the Relationship between Mathematical Resilience and Disposition of Senior High School Students

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Abstract

The purpose of this study was to determine the school climate as mediator on the relationship between mathematical resilience and mathematical disposition of senior high school students of public schools in the Division of Island Garden City of Samal. A universal sampling technique was employed, and 205 senior high school students were deemed as respondents in the study. Through non-experimental quantitative mediation analysis utilizing descriptive correlation technique of research, validated questionnaires, mean, Pearson-r, regression techniques and path analysis; results revealed high level of mathematical resilience, mathematical disposition, and school climate. It means that these variables are oftentimes manifested. Results also showed that there is a significant relationship between mathematical resilience, mathematical disposition, and school climate. There was a significant mediating effect of school climate on the relationship between mathematical resilience and mathematical disposition of students. Accordingly, school climate are one of the reasons how mathematical resilience can influence mathematical disposition of the students. It cannot, however, completely account for the relationship of the two variables. Future researchers were recommended to investigate these variables together with other variables not included in this study using other research designs, another set of respondents and location and a wider scope.

Keywords

Mathematical resilience, Mathematical disposition, School climate, Senior high school students, Mediation analysis

INTRODUCTION

The concerning state of mathematical disposition among students prompts a serious attention. A compelling study strongly recommends that "teachers should design learning processes that can improve mathematical disposition" not just acknowledging the issue but underscoring the critical nature of the problem. This recognition has spurred educators globally to address the challenge proactively (Hutajulu et al., 2019).

In Indonesia, students holding unfavorable mathematical dispositions demonstrated limited mathematical capabilities, while those with positive mathematical dispositions exhibited higher mathematical proficiency. Those students with high mathematical dispositions tend to adeptly translate information into visual representations like diagrams, graphs, or tables, utilizing written text to solve problems. On the other hand, students with moderate mathematical dispositions exhibit a more balanced approach (Fitrianna et al., 2018).

Mathematical disposition functions as a valuable tool for gauging students' interest in learning Mathematics. There exists a classification of mathematical disposition that enables teachers to evaluate students' confidence and eagerness to learn math, impacting their achievement, which should commence with a genuine interest and fondness for math lessons (Claudia et al., 2021). Additionally, it plays a role in shaping students' problem-solving abilities in Mathematics. Assessing students' levels of mathematical disposition is crucial as it significantly influences the success of learning Mathematics and can also shape students' characteristics. As students engage in mathematical learning, their disposition evolves (Yustiana et al., 2021).

The mathematical disposition of lower secondary school students positively influences mathematical critical thinking skills. Those students with a favorable disposition are adept at interpreting and confidently expressing mathematical ideas; more than fifty percent of such students demonstrate a positive disposition and can interpret and analyze mathematical problems (Minarti et al., 2020). Furthermore, evaluating and improving school climate proves valuable in supporting children's development of essential skills, knowledge, and disposition necessary for active engagement in a democratic society (Cohen, 2013). Students with high levels of mathematical connection ability levels tend to develop their mathematical disposition more effectively than those with medium and low mathematical connection abilities (Setiawan et al., 2017).

Moreover, students’ low disposition in Mathematics causes students to view Mathematics as difficult to understand, thus affecting Mathematics learning outcomes. Not many students are active because they lack confidence, interest in learning Mathematics, and curiosity about Mathematics (Ulya & Rahayu (2021). It was mentioned in the study of Tamayo (2021) that some students do not like Mathematics that much because of its complexities and exigent nature and some of them have negative perception and attitude towards Mathematics, which resulted to not fully mastering the basics of Mathematics.

However, in a study conducted in Cabanatuan City, students exhibited notably low positive attitudes towards Mathematics. In particular, students regarded Mathematics as their least preferred subject. Despite acknowledging that proficiency in Mathematics could enhance their chances of success, students expressed a general disliking for the subject and did not derive enjoyment from their mathematical classes. Additionally, the research indicated a lack of perseverance among students when faced with challenging Mathematics problems, as they tended to give up easily (Subia et al., 2018).

While many researchers have explored students' mathematical disposition and the influencing factors, the researcher has not yet come across a local study on the school climate as a mediator on the relationship between mathematical resilience and mathematical disposition. As a result, the researcher was interested in determining if there was a significant mediating effect of school climate on the relationship between mathematical resilience and mathematical disposition of Senior High School Students in the Island Garden City of Samal. Furthermore, this study aimed to address the following specific objectives: (1) to determine the level of mathematical resilience of Senior High School Students in terms of value, growth, and struggles; (2) to determine the level mathematical disposition of Senior High Students in terms of confidence, curiosity, flexibility, perseverance, usefulness, appreciation, and metacognition; (3) to determine the level of school climate of Senior High School Students in terms of safety, peer school climate, support, and expectations; (4) to determine the significant relationship between mathematical resilience and mathematical disposition of senior high school students, (5) to determine the significant relationship between mathematical resilience and school climate of senior high school students; (6) to determine the significant relationship between school climate and the mathematical disposition of senior high school students; and (7) to determine the mediating effect of school climate on the relationship between mathematical resilience and mathematical disposition of senior high school students.

MATERIALS AND METHODS

Research Design

This research utilized non-experimental quantitative research design using descriptive correlation quantitative designs to collect information about variables without altering the environment or manipulating any variables, so they do not look at possible cause and effect. Unlike observational techniques, these methods do not involve comparison groups (Baker, 2017). Quantitative research may be used to determine the relationships between variables or expected outcomes from the question being researched (Rutberg & Bouikidis, 2018; Polit & Beck, 2008). Additionally, this research utilized correlation to investigate the relationship between variables such as mathematical resilience, mathematical disposition, and school climate, using the survey questionnaires to gather the fundamental data.

Furthermore, this study utilized path analysis to assess causal models, investigating the relationships between a dependent variable and two or more independent variables. Using this method, one can approximate the magnitude and significance of causal connections between variables (Crossman, 2020). In this study, school climate may function as a mediator of the school climate between the relationship of mathematical resilience and mathematical disposition. A mediating variable plays a significant role in better understanding the relationship between two variables and provides an elaborate view of the research (Sidhu et al., 2021).

School climate may function as a mediator when variations in the perceived mathematical resilience and mathematical disposition account for the variations in school climate; variations in school climate significantly account for the variations in mathematical disposition, and the direct link between mathematical resilience and mathematical disposition is no longer significant. The interest of this study is to investigate the relationship between mathematical resilience and mathematical disposition, a relationship between Mathematical disposition and school climate, the relationship between school climate and mathematical disposition, and the mediating effect of school climate on the relationship between mathematical resilience and mathematical disposition in the Division of Island Garden City of Samal.

Research Locale

This study was conducted across public senior high schools of the Division of Island Garden City of Samal. The schools are strategically located in Samal District. Island Garden City of Samal is one of the cities of the province of Davao del Norte, Davao Region, Mindanao, Philippines. Island Garden City of Samal is separated from mainland Mindanao by a body of water. Samal District is one of the three districts in Island Garden City of Samal, where the study was conducted. The schools that participated included a mix of urban, suburban, and rural schools from diverse geographic areas of the island and were fairly represented by the two hundred five (205) public senior high school students.

Research Respondents

This research utilized Universal sampling technique where all the members of four schools in the research locale of the study were taken as respondents. Universal sampling where not all the people in the population have the same probability of being included in the sample and each one of the, the probability of being selected is unknown (Ramoso & Ortega-Dela Cruz, 2019).The researcher opted to used universal sampling technique to select respondents from the senior high school students who are enrolled in a Mathematics subject because they are the ones who were able to provide the useful information to test the hypothesis in this research. In school A, there were 20 grade 11 students and only 15 students responded to the survey. In school B, there were 27 grade 11 student students and only 20 students responded to the survey. In school C, there were 55 grade 11 students and only 50 students responded to the survey. Lastly in school D, there were 200 grade 11 students and only 120 students responded to the survey.

Research Instruments

This study utilized three sets of adapted modified questionnaires from three different studies. Expert validators validated the three sets of adapted modified questionnaire. Additionally, the researcher also conducted a pilot test to test the validity and reliability of the adapted questionnaires and the overall result of Cronbach's Alpha was 0.952. The design of the survey questionnaire was in a comprehensive form with the help of the expert validators to provide the respondents with ease and comfort in answering each of the question and understand the study's objectives. The first set of questionnaires dealt with mathematical resilience with three attitudinal dimensions of value, growth, and struggles (Kooken et al., 2013). The item was distributed to the following attitudinal dimensions: value (8 items), growth (7 items), and struggles (8 items). This 23-item survey utilized a 5-point Likert scale (from Strongly Disagree to Strongly Agree).

The second set of instruments was used to measure the mathematical disposition of students. The questionnaire was adapted from the study of Ulia and Kusmaryono (2013). There were seven indicators: Confidence, Flexibility, Usefulness, Perseverance, Curiosity, Appreciation, and Metacognition. On this variable, the indicator is composed of the following items: confidence (5 items), flexibility (5 items), usefulness (5 items), perseverance (5 items), curiosity (5 items), appreciation (5 items), and metacognition (5 items). With a total of 35 items and utilized a 5-point Likert scale (from Strongly Disagree and Strongly Agree).

The third set of questionnaires dealt with school climate with subscales of safety, peer social climate, support, and expectation (Zander, 2012). The items were distributed to the following subscales: safety (13 items), peer social climate (11 items), support (14 items), and expectation (16 items). This 54-item survey utilized a 5-point Likert scale (from Strongly Disagree to Strongly Agree).

Ethical Considerations

This section presents the ethical considerations that the researcher observed. It constitutes a vital role as it promotes the research goal of gaining originality of information and avoiding errors. It is a global requirement that ensures the means to protect the rights of other researchers and participants, guarantee public accountability, and maintain the confidentiality and privacy of information in the study. This is in compliance with the Department of Science of Technology- Philippine Health Research Ethics Board (DOST-PHREB) mandate. The HCDC-Research Ethics Committee (HCDC-REC) follows the mandate of DOST-PHREB through the nine elements: social value, informed Consent and Assent, risks, benefits and safety, justice, transparency, qualification of the research, adequacy of facilities, and community involvement. The researcher, therefore, ensures the scientific integrity of the procedure through compliance with these elements.

Data Gathering Procedures

Asking for Permission to Conduct the Study

With the approval of the thesis adviser to conduct the study, the researcher requested a letter of endorsement from the Vice President of Academic Affairs (VPAA) of Holy Cross of Davao College after procuring the Certificate of Approval from the Research Ethics Committee (REC). The researcher then wrote a letter seeking approval from the School Division Superintendent of Island Garden City of Samal and approval from the school principals where the study was conducted.

Administration and retrieval of informed consent and assent

Upon the approval of SDS and the school principal, the researcher will administer the inform consent to the parents or legal guardian. The researcher will explain thoroughly the contents, ethical considerations, benefits, and data privacy act of the study to the parents or legal guardian. After gathering the parent's inform consent, the researcher administered the assent form for the respondents of the study, the respondents who tick the box with "YES" means they agree to participate in the research. No students will be forced to join the said study. After this, the researcher will double-check all informed consent and will be collected and stored in a separate folder for confidentiality.

Administration and Retrieval of Questionnaire

After retrieving the informed consent and assent forms through Google Forms, the researcher asked for help from the respective grade 11 advisers or teachers to disseminate the questionnaires through Google Forms. The respondent's responses to the survey were based on their most convenient time since the study was conducted online. Once the data being collected is enough, the researcher changed the Google form setting from accepting responses to not accept responses.

Gathering and Tabulation of Data

The questionnaires were gathered and retrieved a few weeks after the distribution of the said questionnaire so the respondents had enough time to answer the questionnaire given. Responses through the Google Form were downloaded in the form of Google Sheets. The results were checked and tallied in a master datasheet for analysis and interpretation. Finally, after all the results were tallied, these were analyzed and interpreted based on the purpose of the study, and reliable data was obtained from the feedback of the respondents concerned in the study.

Data Analysis

The following statistical tools were utilized for a more comprehensive interpretation and analysis of the data.

Mean

The mean represents the total sum of all the values divided by the total number (Kaliyadan & Kulkarni, 2019). It was used to determine the level of mathematical resilience, mathematical disposition, and school climate to answer problems 1, 2, and 3.

Pearson Product-Moment Correlation of Coefficient

This tool involves the measurement of association, or relationship, or correlation between two variables to ascertain whether they are positively or negatively related, or not related in any way (Obilor & Amadi, 2018). It was utilized to determine the significant level of the relationship between mathematical resilience and mathematical disposition, mathematical resilience and school climate, and school climate and mathematical disposition.

Path Analysis

Path analysis is theoretically utilized because, unlike other techniques, it forces us to specify relationships among the independent variables. This emphasis leads to the development of a model showing causal mechanisms through which independent variables produce both direct and indirect effects on dependent variables. Path analysis has two main requirements: (1) all causal relationships between variables must go in one direction only, and (2) the variable must have a clear time ordering since on variable cannot be said to cause another unless it precedes it in time (Crossman, 2019).

A mediational analysis took students' mathematical resilience (Growth, Value, and Struggle) as the independent variable; Mathematical disposition (Confidence, Curiosity, Flexibility, Perseverance, Usefulness, Appreciation, and Metacognition) as dependent variable; and School climate (Safety, Peer Social Climate, Support, and Expectation) as a mediating variable.

RESULTS AND DISCUSSION

This section presents the analyses and interpretations of the data gathered by the researcher. Discussions are presented categorically based on the order of the objectives in the first chapter.

Level of Mathematical Resilience of Senior High School Students

The level of mathematical resilience of senior high school students in terms of Value, Growth, and Struggle is shown in Table 1. In particular, among the three indicators in the mathematical resilience of grade 11 senior high school students, respondents perceived that *Struggle* has the highest mean score of 4.27 or *very high*, meaning the student's mathematical resilience always manifests. This further implies that struggling with Math is always a common experience for everyone, including mathematicians, individuals in math-related fields, and people in their peer groups. It was perceived that it is normal to encounter difficulties while working with math problems. Students also believed that Struggle is an essential part of the learning process and does not indicate wrongdoing in Mathematics. Making mistakes is necessary to improve and become skillful in Math.

Table 1 Level of Mathematical Resilience of Senior High School Students

Indicators	Mean	Descriptive Level
Value	4.22	Very High
Growth	2.33	Low
Struggle	4.27	Very High
Overall	**3.60**	**High**

This finding supports the idea of Livy et al. (2018), which emphasizes the belief of students that Struggle is intrinsic to wrongdoing in Mathematics. This means that students benefit from engaging in complex problems, taking risks, and persisting through challenges, even if they wait to solve them. Permatasari (2016) stated that Struggle is a natural part of the learning process. It refers to a student's effort to expand their understanding of mathematical concepts that challenge but fall because of student capabilities.

The second highest indicator is the *Value* with a mean score of 4.22 or very high, which means that the student's mathematical resilience is always manifested. This further signifies that Mathematics always plays a crucial role in students' future, life's work, and study decisions. It significantly contributes to achieving their goals, helps them understand complex topics in their field, and supports things that matter to them (Perales, 2019; Dahiya, 2014). As perceived by the respondents, succeeding in life without math would be challenging. Additionally, Mathematics develops vital thinking skills essential for success in any career (Aksu & Koruklu, 2015).

The lowest Indicator is *Growth*, which gained a mean of 2.33 or described as low. Based on the data result, students perceived that anyone can learn Math; however, the respondents also believed that to learn much math, being a mathematical enthusiast is a prerequisite (Perales, 2019). In addition, math ability is fixed and unchangeable (Rhodes et al., 2023; Al-Mutawah, 2018; Szabo & Andrews, 2017). Intelligence is a determining factor in math proficiency (Soares et al., 2015)

The overall mean level of students' mathematical resilience had a mean of 3.60 or described as high. This means that mathematical resilience is oftentimes manifested as the respondents' perceived positive attitude toward learning that allows them to succeed in what can be a challenging endeavor, learning Mathematics. This finding is coherent with the researchers' findings (Jufrida et al., 2019; Soleymani & Rekabdar, 2016; Colomeischi & Colomeischi, 2015; Mahanta, 2014).

Level of Mathematical Disposition of Senior High School Students

The second objective of this study was to determine the level of mathematical disposition of Senior High School students of four public secondary schools. Table 2 provides the answer to this objective.

Table 2 Level of Mathematical Disposition of Senior High School Students

Indicators	Mean	Descriptive Level
Confidence	3.65	High
Curiosity	3.71	High
Flexibility	4.10	High
Perseverance	3.32	Moderate
Usefulness	4.26	Very High
Appreciation	3.72	High
Metacognition	3.65	High
Overall	**3.60**	**High**

The level of mathematical resilience of senior high school students in terms of Confidence, Curiosity, Flexibility, Perseverance, Usefulness, Appreciation, and Metacognition is shown in Table 2. In particular, among the seven indicators in the mathematical disposition of senior high school students, respondents perceived that *Usefulness* has the highest mean score of 4.26. It was described as *very high*, meaning the student's mathematical disposition always manifested. This further implies that the math learned in school directly relates to everyday life, enabling students to effectively make informed decisions and manage various aspects of their lives (Gupta, 2019; Chau, 2018; Rangel et al., 2016; Dahiya, 2014). Additionally, having good math skills opens up better work opportunities, as employers across different industries highly value mathematical proficiency (Morze et al., 2022; Wu et al., 2018; Rizki & Priatna, 2019; Vintere & Zeidmane, 2014). Further, the interdisciplinary nature of Mathematics allows for the application of math ideas in various subjects and disciplines, enhancing understanding and holistic learning (Stillman et al., 2023; Blyumin, 2022; Sala Sebastià, 2021; Stepanov, 2021; Karali, 2021; Williams & Roth, 2019).

The second highest indicator is *Flexibility*, with a mean score of 4.10 or *high*, which means that students' mathematical resilience is oftentimes manifested. This further implies that learning Mathematics in more than one way is important (Khanal, 2019; Abramovich, 2017; Fuson et al., 2014). Students appreciate teachers presenting different problem-solving methods and unfamiliar problems (Jäder, 2019; Felmer & Perdomo-Díaz, 2016; Maker et al., 2015; Andresen, 2015). Moreover, oftentimes, students select representations suited to the particular mathematical task at hand (Putri et al., 2020; Irenika et al., 2019; Sandoval & Possani, 2016).

The third highest indicator is *Appreciation*, with a mean score of 3.72 or *high*, meaning that the student's mathematical resilience is oftentimes manifested. This further implies the significance of Mathematics in personal, societal, and intellectual contexts (Gabdrakhmanova et al., 2020). Oftentimes, students perceive that Mathematics is important to them and society (Ryan et al., 2020). Solving problems helps them understand the world in which they live (Dick & Pilgrim, 2019; Gofurova, 2020; Meikle, 2016). Further, Mathematics is an important discipline and a human creation (Struppa, 2022; Berry III, 2021).

The fourth highest indicator is *Curiosity*, with a mean score of 3.71 or *high*, which means that a student's mathematical resilience is oftentimes manifested. This further signifies the student's Mathematics perspective and engagement with the subject. Students perceived Mathematics as interesting since it makes sense to them (Witzke, 2020; Sussman, 2019). Oftentimes, students work on problems during math classes. Moreover, solving real-life math problems is interesting because it allows them to be creative (Bennevall, 2016; Andresen, 2015; Căprioară, 2015). Students also examine different problem-solving approaches and note their similarities and differences (Meikle, 2016).

The fifth highest indicators are Confidence and Metacognition, both gaining a mean of 3.65 or *high*, which means that both indicators are oftentimes manifested. Based on the data result, it is perceived that students oftentimes can figure out how to solve math problems (Gofurova, 2020), feel comfortable trying new ways to solve math problems (Zhang et al., 2019), ask for help if students are confused while solving a math problem (Kress, 2017). Students are confident in their abilities to question other's mathematical arguments and their own (Rizki & Surya, 2017). On the other side, in terms of Metacognition, students oftentimes think about the method they used to solve a math problem and check whether it is suitable (Isroil et al., 2017), begin thinking about a plan of action before solving a math problem (Van Steenbrugge, & Norqvist, 2016); notice they use a method that they have used before when they are solving math problems (Rahmah & Saputro, 2021); and it is important for them to reflect on thinking and learn from mistakes in solving problems (Meikle, 2016).

The lowest indicator described as moderate is *Perseverance*, which obtained a mean of 3.32 or sometimes manifested, indicating a closer data set. The data revealed that students occasionally but persistently do Mathematics-related tasks despite difficulties or delays in achieving success (Keller et al., 2021; Nurcahyono et al., 2019; Roche et al., 2013). Students also occasionally spend a long time working through complex problems, controlling their impulses, staying focused on the task, avoiding distractions, and controlling their emotions (Xu, 2013).

As shown in the Table above, the level of mathematical disposition of senior high school students gets an overall mean of 3.60 or high, indicating a closer data set. This means that mathematical disposition is oftentimes manifested as the respondents connect and appreciate Mathematics, which is a tendency to think and act positively (Maulyda et al., 2022; Prasetyo et al., 2017; Mahanta, 2014). It can be deduced that this disposition is oftentimes good as the students like challenges and are involved directly in solving problems (Marisa et al., 2023; Gilbertson, 2019; Stockero et al., 2014). In this light, students' mathematical disposition is high in terms of the seven domains: Confidence, Curiosity, Flexibility, Perseverance, Usefulness, Appreciation, and Metacognition.

Level of School Climate of Senior High School Students

The third objective of this study was to determine the level of school climate of Senior High School students of four public secondary schools. Table 3 provides the answer to this objective.

Table 3 Level of School Climate of Senior High School Students

Indicators	Mean	Descriptive Level
Safety	3.97	High
Peer School Climate	3.34	Moderate
Support	3.79	High
Expectations	4.07	High
Overall	**3.79**	**High**

The level of school climate of senior high school students in terms of safety, peer school climate, support, and expectations is shown in Table 3. In particular, among the four indicators in the school climate of senior high school students, respondents perceived that *expectations* have the highest mean score of 4.07. It was described as *high*, which means that the school climate is oftentimes manifested. This signifies that respondents oftentimes perceived that the educational landscape thrives on dynamic pedagogical practices that bridge theoretical learning with practical application. The school atmosphere oftentimes encourages a culture of open expression; students are invited to share ideas and engage in discussions about the subject content.

This finding supports several studies (Ceelen et al., 2021; Emiola-Owolabi et al., 2021; Gimenez & Thomas, 2015), which highlighted that dynamic pedagogical practice bridges theoretical learning with practical application. Trinidad et al. (2020) also found that students perceived engaging and effective practices as those that involved personal participation, aided retention ideas, and reinforced learning through independent work. On the other hand, students are also invited to share ideas and engage in discussions about the subject content (Newell & Orton, 2018). Several studies found that students who engaged more deeply with each other's ideas and provided detailed explanations of their thinking achieved higher learning gains (Franke et al., 2015; Webb et al., 2014).

Furthermore, the school oftentimes sets high academic standards, mandating unwavering commitments in subjects like math, science, and foreign languages. Students are encouraged to take advanced classes and are supported in pursuing professional certification courses. The school also oftentimes values research and presentation skills, evidenced by assignments involving extensive papers and formal presentations, cultivating students' abilities to synthesize information and communicate their ideas persuasively. Within this intellectually stimulating environment, students encounter captivating and thought-provoking topics that foster a culture of critical thinking and active engagement with the learning journey.

The result above was supported by the study conducted by the Centre of Study for Policies and Practices in Education (CEPPE) (2013), which espoused that schools emphasize rigorous academic standards in subjects such as math, science, and foreign languages in different OECD countries. Likewise, students are also encouraged to take advanced classes and are supported in pursuing professional certification courses (Becker et al., 2023). As Sadler et al. (2014) cited, advanced coursework in high school increases students' interest in STEM careers. Taking advanced math and science classes sparks students' Curiosity in these fields and motivates them to pursue related college majors and careers.

On the other hand, Borshchevskaya (2013) emphasized that schools should give importance to research and presentation skills in high school. Providing high school students the opportunity to take on the role of researchers helps them gain a deeper understanding of the research process and skills involved (Torres & Mouraz, 2021). Lastly, an engaging learning environment provides opportunities for problem–solving and real-world applications (Bicer, 2021).

The second highest indicator is *safety,* with a mean score of 3.97 or *high*, which means that students' school climate is oftentimes manifested. This further implies that the respondents' perceptions oftentimes highlight a strong sense of safety and positive social dynamics. Crime and violence concerns are minimal, with students feeling secure due to the presence of security personnel. This feeling of safety extends to various aspects of campus life, from classrooms to hallways, with students expressing comfort and security during their activities. Due to this sense of security, the absence of teasing, bullying, or threats contributes to a supportive atmosphere where students can flourish and stay longer on campus.

The result above was corroborated by the study of Williams et al. (2018), who found that students generally feel safe at school. Students who feel safer at school tend to report positive relationships with teachers and students (Williams et al., 2018; Lenzi et al., 2017). Schools that focus on enhancing the school environment, facilitating student belongingness, and reducing bullying can promote students' sense of safety (Williams et al., 2018). The increased feelings of safety of some students and students with positive views of the officers were associated with the presence of security measures like security officers (Theriot & Orme, 2016).

Moreover, the respondents oftentimes perceived that the school environment fosters a culture of respect among students. Most students exhibit mutual concern and a reluctance to demean others, creating an atmosphere of camaraderie and cooperation. Positive social interactions are oftentimes perceived as a hallmark of the school, as students not only get along well but also take good care of them and treat each other with respect. These perceptions reflect a positive and nurturing educational setting characterized by safety, social harmony, and mutual regard.

This finding supports the ideas of Grimova and Van Schalkwyk (2016) and Johnson (2016), who found that students perceived respect as politeness, equality, and mutual care between students and teachers. Students report feeling respected when teachers show interest in them, treat them fairly, and allow them freedom of choice.

The third highest indicator is the *support,* with a mean score of 3.79 or *high*, which means that students' school climate is oftentimes manifested. This further signifies that a supportive and caring environment is oftentimes evident. Feedback from teachers contributes to improving assignments, while students have access to extra beyond regular classes. The equitable application of rules by adults fosters a sense of fairness, though concerns about adults being busy do arise. In addition, the school oftentimes values students' well-being, offering various avenues for support and communication. Counselors play a role in planning for post-high school life, and students are comfortable discussing academic and personal issues with both parents and adults. These interactions extend beyond school concerns, showing the holistic approach to students' needs. When faced with challenges, students oftentimes find responsive teachers who prioritize understanding and improvement, reinforcing the atmosphere of care and support within the educational setting.

This finding supports the idea of several researchers (Malik & Bashir, 2021; Mičić, 2019) who found out those students who view their school as caring report greater life satisfaction and school satisfaction. Gasser et al. (2018) similarly found that students who experience emotional support from teachers are more likely to view those teachers as caring and just. It was also found out that students value relational justice and expect teachers to apply rules evenly and explain them well (Mazzoli Smith et al., 2018).

The lowest indicator described as moderate is the *peer school climate,* which obtained a mean of 3.34 or sometimes manifested. The data revealed that respondents sometimes exhibit thoughtful responses to anger, contribute equitably in group projects, and persevere in the face of challenging problems. Disagreements are sometimes addressed through constructive conversations, and a commitment to completing homework is sometimes evident. While a tendency to fight back when insulted or to view cheating as acceptable occasionally arises, the prevailing attitude also sometimes leans towards trying their best, maintaining integrity in school work, and sometimes striving for excellence even when tasks lack intrinsic interest.

The result of the study was supported by various studies (Grazia & Molinari, 2021; Voight & Nation, 2016) about peer school climate in secondary schools that show mixed results. As cited by Trinter and Garofalo (2013), students in secondary schools persevere in their efforts to analyze and solve challenging problems; however, some students may likely not persist on challenging problems after experiencing failure due to their fixed mindset (Shena et al., 2016). When students find tasks intrinsically interesting, they tend to be more motivated to strive for excellence and engage, but when they lack intrinsic appeal, the opposite will happen (Rodríguez et al., 2020; Pullen et al., 2018).

As shown in the Table above, the level of school climate of senior high school students gets an overall mean of 3.79 or higher. This means that school climate is oftentimes manifested as the respondents generally perceived that the school climate should encompass a dynamic educational environment where theoretical learning seamlessly integrates with practical applications. It should foster open expression and encourage students to share ideas while maintaining high academic standards that promote both personal Growth and intellectual excellence (Kanika et al., 2019; Hebib & Žunić-Pavlović, 2018; Singh, 2014). Oftentimes, safety and support should prevail, creating a nurturing atmosphere where students feel secure, respected, and empowered to strive for their best while engaging in meaningful interactions with peers and educators (Radu et al., 2022; Preeti, 2020; Themane & Osher, 2014). It can be deduced that this disposition is oftentimes good as the students like challenges and are involved directly in solving problems. Students' school climate is high regarding the four domains: safety, peer school climate, support, and expectations.

Significance of the Relationship between Mathematical Resilience and Mathematical Disposition of Senior High School Students

Shown in Table 4 is the relationship between mathematical resilience and the mathematical disposition of senior high school students. It also provides the answer to this objective.

Table 4 Significance of the Relationship between Mathematical Resilience and Mathematical Disposition of Senior High School Students

	Mathematical Disposition			
	r	**p-value**	**Decision on H_o**	**Interpretation**
Mathematical Resilience	.743	.000	Reject	Significant

Table 4 reveals a strong positive correlation between the mathematical resilience and mathematical disposition of senior high school students, with an overall r-value of .743 with a p-value of less than $\alpha = 0.05$. Therefore, the null hypothesis is rejected. This implies that as students' mathematical resilience increases, the mathematical disposition of the students also experiences a significant improvement (Rohmah et al., 2020; Prabawanto, 2019; Chisholm, 2017). Students with higher mathematical resilience tend to have better mathematical dispositions (Fitria et al., 2022). This further signifies that the students have to maintain or improve further its mathematical resilience to maintain their connection with their mathematical disposition.

Significance of the Relationship between Mathematical Resilience and School Climate of Senior High School Students

The fifth primary objective of this study was to establish the significance of the relationship between mathematical resilience and the school climate of senior high school students. The findings of this study are presented in Table 5, providing a comprehensive overview of the observed results and outcomes.

Table 5 Significance of the Relationship between Mathematical Resilience and School Climate of Senior High School Students

	School Climate			
	r	**p-value**	**Decision on H_o**	**Interpretation**
Mathematical Resilience	.638	.000	Reject	Significant

Table 5 reveals a moderate positive correlation between the mathematical resilience and school climate of senior high school students with an overall r-value of .638 with a p-value of less than $\alpha = 0.05$. Therefore, the null hypothesis is rejected. This implies that as students' mathematical resilience increases, the school climate of the students also experiences a major development. This further signifies that the students have to improve further its mathematical resilience to maintain their connection with their school climate. Several studies (Prabawanto, 2019; Maharani & Bernard, 2018; Neshila, 2018) have mentioned that mathematical resilience is positively associated with school climate.

Significance of the Relationship between School Climate and Mathematical Disposition of Senior High School Students

The sixth primary objective of this study was to establish the significance of the relationship between school climate and the mathematical disposition of senior high school students. The findings of this study are presented in Table 6, providing a comprehensive overview of the observed results and outcomes.

Table 6 Significance of the Relationship between School Climate and Mathematical Disposition of Senior High School Students

	Mathematical Disposition			
	r	**p-value**	**Decision on H_o**	**Interpretation**
School Climate	.843	.000	Reject	Significant

Table 6 shows a strong positive correlation between the school climate and the mathematical disposition of senior high school students, with an overall r-value of .834 and a p-value of less than $\alpha = 0.05$. Therefore, the null hypothesis is rejected. This implies that as students' school climate improves, the mathematical disposition of the students also experiences significant improvement. This further signifies that the students have to maintain or improve their school climate to maintain their connection with the students' mathematical disposition.

The result of the study affirms the findings of the study of Genuba and Colita (2019), highlighting a significant positive correlation between a student's school climate and their mathematical dispositions. This also supports the Organization for Economic Cooperation and Development (2013) proposition that the students' dispositions toward learning Mathematics are influenced by the rules and practices at school, teacher-student relations, and expectations, which are determinants of school climate.

Mediating Effect of School Climate on the Relationship between Mathematical Resilience and Mathematical Disposition of Senior High School Students

Provided in Table 7 is the mediating effect of school climate between mathematical resilience and mathematical disposition of senior high school students.

Using Path Analysis, the result showed that path MR (Mathematical Resilience) to MD (Mathematical Disposition), MR (Mathematical Resilience) to SC (School Climate), and SC (School Climate) to MD (Mathematical Disposition) were all significant. The result denotes that school climate shows partial mediation to the relationship between mathematical resilience and mathematical disposition.

The process of mediation analysis involves three steps for the third variable to be considered as a mediator. Presented in Table 7 are the steps that were categorized as Steps 1 to 3. In Step 1, it presents the significant direct effect of mathematical resilience on mathematical disposition. In Step 2, mathematical resilience exhibits a significant direct effect towards school climate, the mediator (M). Meanwhile, Step 3 presents the analysis result, which suggests that school climate significantly predicts the mathematical disposition of senior high school students. Full mediation will be attained if the effect of the independent variable on the dependent variable fails to be statistically significant at the conclusion of the analysis. It implies that the mediator variable is the mediating variable for all effects.

Table 7 Mediating Effect of School Climate on the Relationship between Mathematical Resilience and Mathematical Disposition

Step			Estimate	Std. Error	p	Decision on Ho	Interpretation
Mathematical resilience	→	Mathematical Disposition	1.049	.066	<.001	Reject	Significant
Mathematical Resilience	→	School Climate	.998	.084	<.001	Reject	Significant
School Climate	→	Mathematical Disposition	.561	.039	<.001	Reject	Significant

Additionally, when the regression coefficient is significantly reduced on the last step and stays significant, and only partial mediation is attained, it suggests that a portion of mathematical resilience is mediated by school climate, while other components are either directly influenced or indirectly affected by factors not involved in the paradigm. Furthermore, as observed in step 3 (denoted as c'), the influence of mathematical resilience on mathematical disposition was even reduced after being mediated by school climate. With this, partial mediation occurred due to the fact that the effect was found to be significant at $p<0.05$.

Additionally, the computed effect size for the mediation test seen between three variables is shown in the figure. The effect size determines the extent of the effect of mathematical resilience on mathematical disposition, which can be associated with the indirect path. The total effect value of 1.049 is attributed to the beta of mathematical resilience towards mathematical disposition. The indirect effect value of 0.998 is the Value obtained from the original beta between mathematical resilience and mathematical disposition that now passes through school climate to mathematical disposition (a*b, where "a" denotes the path MR→SC and "b" pertains to a path between SC → MD).

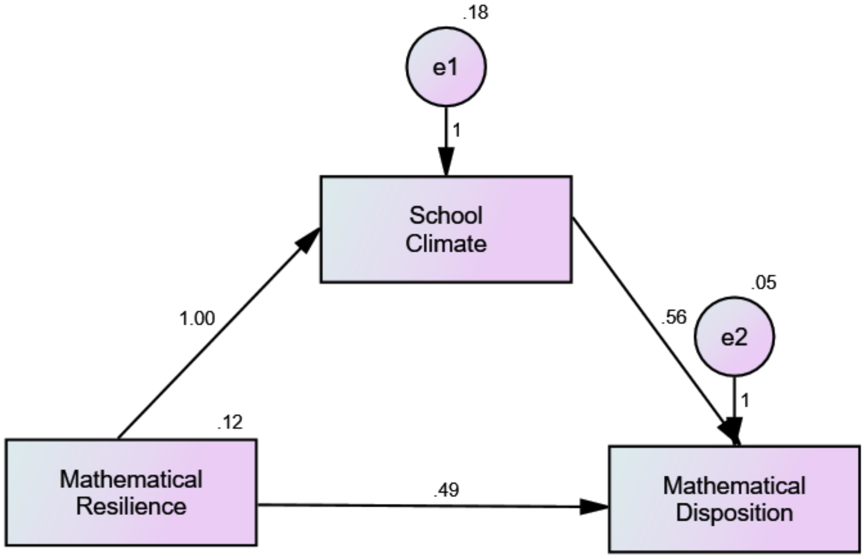

Fig. 1 Path Analysis showing the variables of the study

Since it is only partial mediation, it could not be claimed that school climate is the very reason mathematical resilience can influence mathematical disposition. This indicates that school climate is only one of the reasons mathematical resilience can influence mathematical disposition.

In the mediation study, the initial step of Baron and Kenny's mediation guidelines (1986) procedure that there is a correlation between the independent variable, mathematical resilience, and the dependent variable, mathematical disposition, was established. Further, the second step was again established in this study since there is a significant relationship between the independent variable, mathematical resilience, and the mediating variable, school climate. Finally, testing the hypothesis in this study was again established due to the significance of the mediating variable, school climate to the dependent variable, mathematical disposition. Since all three steps were significant, only partial mediation took place. Nevertheless, this is a positive result since the mediating variable still impacts the relationship between the independent and dependent variables

This study aimed to contribute to the literature regarding potential indirect, mediating variables for the relationship between mathematical resilience and mathematical disposition. Distinctively, the school climate was investigated as a potential mediating construct to explain how mathematical resilience affects mathematical disposition. While full mediation was not found in the study, significant and vital effects were shown in consonance with the studies of Colita and Genuba (2019) and Joy and Obiagaeri (2019) that may be of help in the development of the existing research on mathematical resilience and mathematical disposition. It has also been found out also that expectation, as one of the domains of school climate, has the strongest influence on mathematical disposition (Colita & Genuba, 2019).

Moreover, as manifested in the results, the school climate can be used as a mediator to enhance the mathematical resilience to improve the students' mathematical resilience that ascertained a necessary part for the disposition in Mathematics and results in outstanding Mathematics achievement. Further, the Ecological Model of Mathematical Resilience of Lee and Johnston-Wilder (2017) also support the result that emphasizes the role of teachers, parents, and students in fostering mathematical resilience in which teachers' beliefs in their student abilities and Appreciation of their commitment to solving problems, impliedly part of the school climate, are likely to provide a positive experience and to develop mathematical resiliency.

The **summary** of findings of the study is as follows:

The overall mean score of the mathematical resilience of senior high school students in terms of value, growth, and struggles was interpreted to be a high level. This means that student's mathematical resilience is oftentimes manifested.

On the other hand, the overall mean score of the mathematical disposition of senior high school students in terms of confidence, curiosity, flexibility, perseverance, and usefulness was interpreted to be a high level. This means that student's mathematical disposition oftentimes manifested.

Further, the overall mean score of the school climate of senior high school students in terms of safety, peer school climate, support, and expectation was interpreted to be a high level. This means that school climate is oftentimes manifested.

Moreover, Pearson r showed a significant relationship between the mathematical resilience and mathematical disposition of senior high school students. This allowed the researcher to reject the hypothesis. This means that increased mathematical resilience improves the students' mathematical disposition or vice-versa.

There is also a significant moderate positive relationship between the mathematical resilience of students and school climate. This means that as the mathematical resilience of the students improves, the school climate will improve.

Further, there is a significant strong positive relationship between school climate and mathematical disposition. This means that as the school climate improves the students' mathematical disposition increases.

Lastly, the path analysis showed that school climate partially mediates the relationship between mathematical resilience and the mathematical disposition of senior high students. This means that school climate cannot be claimed as the very reason how mathematical resilience can influence mathematical disposition. This also indicates that school climate is only one of the reasons how mathematical resilience can influence mathematical disposition.

CONCLUSION

Based on the findings of the study, the conclusion below was derived:

There is significant mediating effect of school climate on the relationship between mathematical resilience and mathematical disposition of Grade 11 Senior High School Students. This conclusion aligns with the assertion of ecological system theory of Bronfenbrenner (1975) as cited by Crawford (2020) that human development is a product of the interaction between the growing human organism and the environment they are in.

RECOMMENDATIONS

Based on the findings and conclusion, recommendations are provided for various stakeholders. It is recommended that the Department of Education officials may integrate resilience education into the math curriculum, promoting a positive school climate and emphasizing high academic standards for senior high school students. Considering the partial mediation of school climate in the relationship between mathematical resilience and disposition, the integration of comprehensive social-emotional learning (SEL) programs in Mathematics education is further suggested. This includes enhancing resilience, fostering positive mathematical disposition, and improving overall school climate, with additional emphasis on teacher training, research, evaluation, and an interdisciplinary approach to SEL implementation.

It is also recommended that school principals may organize professional development for math teachers, encouraging collaboration in reviewing the curriculum's relevance, and promoting the integration of SEL practices into Mathematics instruction.

Additionally, it is recommended that Mathematics teachers may provide differentiated instruction, offer extracurricular activities, and integrate SEL into math lessons for positive disposition development.

Equally, parents are encouraged to support their children's mathematical resilience by tackling challenging problems together, promoting a growth mindset, avoiding negative comments, and seeking additional help if needed.

Students on the other hand are advised to embrace challenges, seek assistance when necessary, actively participate in problem-solving activities and extracurricular programs, and dedicate consistent time to math practice.

Furthermore, future researchers are encouraged to explore the interactions between mathematical resilience, school climate, and mathematical disposition. Longitudinal studies are suggested to assess the long-term effects of interventions on students' disposition and achievement. Researchers are also recommended to explore policy implications, consider additional variables, and use diverse research designs, respondents, locations, and a broader scope for a more comprehensive understanding.

Finally, it is recommended that analogous studies shall be undertaken incorporating alternative variables to represent human development, the maturation of the human organism, and the environment, with a specific focus on examining the mediating influence of the latter. This effort aims to either reinforce or challenge the hypotheses and assertions of ecological systems theory. Additionally, to further substantiate, verify, or refute the obtained results, it is suggested that this study be replicated among diverse respondent groups and in different study locations, using the same set of variables and indicators.

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DECLARATION OF CONFLICT

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