School Climate and Mathematical Disposition of Grade 10 Students

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ABSTRACT

The purpose of this study was to determine which domain of school climate best influences mathematical dispositions of Grade 10 students. Universal sampling technique was used in this study wherein 118 Grade 10 students from the private secondary schools in Barangay Ilang, Davao City, were chosen as the participants. By utilizing a non-experimental quantitative research design, specifically, correlational technique, through the use of a validated questionnaire, mean, Pearson r and regression techniques, it was revealed that the level of school climate of the private secondary schools were high. In the same way, the level of the mathematical dispositions of the Grade 10 students was also high. In addition, it was found out that school climate and mathematical dispositions of the students were significantly and positively related with an r-value of 0.490 and p-value less than 0.05. Findings further revealed that among the four domains of school climate, it was expectations that best influenced the dispositions of the students towards mathematics.

1. INTRODUCTION.

One of the several factors that affect students’ mathematics achievement is their disposition towards mathematics (Anku, 1996). However, students tend to have a negative disposition towards the subject as the misconception that mathematics is a “difficult subject” and that “it is okay not to be good at math” is widely accepted because of the mindset that a person is either born with mathematical ability or not. This misconception affects the student’s attitudes towards learning mathematics and subsequently leads to a negative mathematical disposition (Australian Association of Mathematics Teachers, 2015).

It is imperative to study students’ mathematical disposition as it, either positively or negatively, affects the way students think about themselves as a learner and consequently affects their behavior towards the subject (Mata, Monteiro & Peixoto, 2012; AAMT, 2015). Mathematical dispositions are seen in the way the students approach mathematical tasks – whether with confidence, willingness, perseverance, and interest (National Council of Teachers of Mathematics, 1989). Research shows that students who have a realistic view of their ability are more likely to achieve better while those who lack confidence are more likely to have poor performance in mathematics (Khan, 2007).

Likewise, school climate influences the students’ attitude in school (The New York State Dignity for All Students Act or The Dignity Act, 2014). For this reason, schools may also use climate data to enhance not just intellectual skills but also dispositions that promote academic success (Cohen, McCloskey & Pickeral, 2009).

Locally, in a study conducted in the private colleges and universities in Cabanatuan City, Philippines, it was revealed that college freshmen students had low positive attitudes towards mathematics. Specifically, students found mathematics as their least favorite subject. Although students believed that being good at Mathematics would give them more chances of becoming successful, they still did not like the subject and did not enjoy their mathematics classes. The study further revealed that students did not have perseverance towards the subject as they easily gave up when they could not solve a mathematics problem (Subia, Salangsang & Medrano, 2018).

While many researchers focused their studies on mathematical dispositions of the students and on factors that affect it (Rowe, 1988; Kisunzu, 2008; Atallah, Bryant & Dada, 2010), the researcher had not come across of a study in local setting on the relationship of school climate and students’ disposition towards mathematics. It was for this reason that the researcher was interested to determine if there was a significant relationship between school climate and students' mathematical disposition. As a result, this study can help teachers and school administrators identify the specific factors of their school’s climate which may have a significant influence to their students' mathematical dispositions and use this data to better their mathematics achievement.

The purpose of this study was to determine which domains of school climate best influences mathematical dispositions of Grade 10 students. Specifically, this study had the following objectives: a) to ascertain the level of school climate of private secondary schools in Barangay Ilang as determined by school safety, peer social climate, support, and expectations; b) to describe the level of mathematical dispositions of the students as determined by confidence, flexibility, interest, perseverance, metacognition, usefulness, and appreciation; c) to determine the relationship


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between school climate and mathematical disposition; and d) to
determine which domains of school climate best influences
mathematical disposition.

The following null hypotheses were tested at 0.05 levels of
significance: a) there is no significant relationship between school
climate and mathematical disposition of Grade 10 students; and b)
there is no domain of school climate that significantly influence
mathematical dispositions of the students.

This study is anchored on the propositions of Cohen et al (2009)
and the Organisation for Economic Co-operation and Development
(2013). The latter states that the dispositions of the students
towards learning mathematics are strongly influenced by the rules
and practices at school, teacher-student relations, and expectations
(OECD, 2013), which are determinants of school climate (Zander,
2012). Furthermore, this proposition is taken as a framework of
the study since it shows the important role of school climate in
developing the students’ disposition necessary for learning
mathematics.

In support to the proposition above, it was stated that
comprehensive school climate data can be used by schools not just
to promote meaningful staff, family, and student engagement but
also to develop both the dispositions of the students and their
social-emotional competencies which contribute to student success
both in school and in life (Cohen et al, 2009).

The conceptual framework used in this study is illustrated in
Figure 1. The independent variable is school climate determined by
four indicators, to wit: school safety, peer social climate, support
and expectations (Zander, 2012). School safety refers to how safe
students feel in classes, outside around the school and when
travelling between home and school; peer social climate refers to
the relationship of the students in the school; support refers to the
help and encouragement that the students get from the teachers,
school personnel, parents, and other students; and finally,
expectations refers to how strongly students feel or know about the
things that are expected from them by their parents, teachers and
school.

The dependent variable is mathematical disposition which is
determined by the following seven indicators: confidence, flexibility,
interest, perseverance, metacognition, appreciation and usefulness
(Kisunzu, 2008). Confidence refers to how confident the students
are in using mathematics in problem solving, communicating ideas
and reasoning; flexibility refers to the students’ ability to be flexible
in exploring mathematical ideas and trying different ways and
techniques in solving mathematical problems; interest refers to how
interested the students are in performing mathematical tasks;
perseverance refers to the level of resilience or persistence in
analyzing and finding a way to solve mathematical problems;
metacognition refers to the level of inclination of the students in
monitoring and reflecting on their own thinking and performance in
mathematics; appreciation refers to the level of how the
students acknowledge and appreciate the role of mathematics in
their culture and how valuable math is as a tool and as a
language; and finally, usefulness refers to the level of how the
students see and understand the role and importance of
mathematics as applied in situations and everyday experiences.

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Climate</td>
<td>Mathematical Dispositions</td>
</tr>
<tr>
<td>School Safety</td>
<td>• Confidence</td>
</tr>
<tr>
<td>Peer Social Climate</td>
<td>• Flexibility</td>
</tr>
<tr>
<td>Support</td>
<td>• Interest</td>
</tr>
<tr>
<td>Expectations</td>
<td>• Perseverance</td>
</tr>
<tr>
<td></td>
<td>• Metacognition</td>
</tr>
<tr>
<td></td>
<td>• Appreciation</td>
</tr>
<tr>
<td></td>
<td>• Usefulness</td>
</tr>
</tbody>
</table>

Figure 1. Conceptual framework showing the variables of the
study

2. RESEARCH METHOD

This research utilized a quantitative, non-experimental research
design specifically correlational design. It is a quantitative research
design in the sense that the researcher employed measurement
and observation to test the hypotheses by collecting data through
surveys which were analyzed through the use of statistical
procedures (Creswell, 2009). This research design was suitable for
this study since its objective was to ascertain the influence of school
climate on the students’ mathematical dispositions. In addition, it
was non-experimental in the sense that the variables in this study,
school climate and mathematical disposition of Grade 10 students,
were examined in their natural settings, thus, they were not
manipulated nor changed (Belli, 2008).

Furthermore, correlational design was used to describe, explore,
and explain the degree and strength of relationship between school
climate and mathematical dispositions of the students. In general,
this study has independent and dependent variables. Correlational

technique was utilized in such a way that the effect of the
independent variable was observed on the dependent variable
without manipulating the independent variable. This study was
conducted in Davao City, Philippines, particularly in the two private
secondary schools in Barangay Ilang.

Universal sampling method was used in determining the
participants of the study which was composed of all Grade 10
students, both male and female, from the two private secondary
schools in Barangay Ilang, Davao City. Among all students in junior
high school, Grade 10 students were chosen considering their level
of maturity, understanding and exposure to mathematics lessons.
The total number of participants was 118 students.

The survey questionnaire used as an instrument in the study
was composed of two parts. The first part was adapted from
Student Connection Survey (SCS) which was collaboratively
developed by the American Institutes of Research and a large urban
public school district in the United States of America. SCS was
composed of four indicators, namely safety, expectations, support
and peer social climate (Zander, 2012). The survey questionnaire
had 39 items. A five-point Likert Scale was utilized in scoring each
of the items which ranged from Strongly Disagree to Strongly Agree.
The original questionnaire was modified to contextualize the school
setting. The modified questionnaire was validated by experts and
pilot testing was conducted which resulted to an alpha coefficient
of .919, suggesting that the items had relatively high consistency.
The second part of the survey was the Mathematical Disposition Survey (MDS) which pertained to mathematical disposition of grade 10 students adapted from Kisunzu (2008). It was composed of 26 items that measured seven constructs, namely confidence, interest, perseverance, flexibility, metacognition, appreciation, and usefulness. The original questionnaire was modified to contextualize the school setting. Each item was scored using a five-point Likert Scale which ranged from Strongly Disagree to Strongly Agree. Just as the first part, the modified questionnaire was also validated by experts and pilot tested with an alpha coefficient of .963 which implied that the items had relatively high internal consistency.

3. RESULT AND ANALYSIS

3.1 Level of School Climate

The overall level of school climate of the private schools in Barangay Ilang is High as shown in Table 1. In fact, three of four domains have High level ratings. Among the high-level rated indicators were expectations, support and peer social climate while school safety was rated Moderate level. This means that the Grade 10 students oftentimes manifested the positive characteristics of school climate described in the questionnaire. This conforms to the pronouncement of the Center for Social and Emotional Education (2010) that the school where there is a positive school climate is a place where people, both students and staff, feel socially, emotionally, and physically safe. It is a place where students and their families, educators and school staff are engaged and respected.

Table 1. Level of School Climate of Private Secondary Schools in Barangay Ilang

<table>
<thead>
<tr>
<th>Indicators</th>
<th>SD</th>
<th>Mean</th>
<th>Descriptive Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expectations</td>
<td>0.63</td>
<td>3.79</td>
<td>High</td>
</tr>
<tr>
<td>Support</td>
<td>0.59</td>
<td>3.55</td>
<td>High</td>
</tr>
<tr>
<td>Peer Social Climate</td>
<td>0.49</td>
<td>3.41</td>
<td>High</td>
</tr>
<tr>
<td>School Safety</td>
<td>0.47</td>
<td>3.35</td>
<td>Moderate</td>
</tr>
<tr>
<td>Overall</td>
<td>0.42</td>
<td>3.52</td>
<td>High</td>
</tr>
</tbody>
</table>

Among the four domains, expectations got the highest rating. The data shows that it is oftentimes manifested that teachers in these schools have high expectations on the students by encouraging students to share their ideas about things that they are studying in class, requiring them to explain their answers, assigning homework and challenging tasks, discussing different interpretations of things they read, connecting the lessons to real-life situations, and giving students more-advanced assignments. Students also believe that during their class before lunch, the topics are still interesting and challenging, that it really makes them think and that they do not feel bored during this class.

This is in consonance with the statement of Zander (2012) that high academic expectation on students is an essential component of a positive school climate. In fact, the results of this study is similar to the findings of the study he conducted with middle high school students in which expectations got the highest rating among all the domains of school climate. Moreover, the high-level result for this domain can be viewed as a manifestation of the statement of Lehr (2004) that school staff expects students to be successful in school.

Likewise, support also got a high-level rating from the students. The findings revealed that students oftentimes feel that their teachers really care about them and that they are supportive in a way that they help them improve their work if they do poorly in their assignments, help them work after an excused absence, and give them feedback about their tasks. In addition, students also feel that teachers notice whenever they have difficulty understanding something. Furthermore, data show that students believe that school staffs are fair in applying the same rules to all the students. This manifestation of support among the teachers and school staff is in accord with The Dignity Act (2014) which stated that it is important that students feel that they have a strong connection to the teachers and school personnel, and that they get the support they need from the school.

Another domain of school climate with High rating is the peer social climate which indicates that it is oftentimes manifested. This high-level result can be viewed as a manifestation of the pronouncement of the Center for Social and Emotional Education (2010) that the learning process is relational and this is the reason why relationship among the students is considered as one of the key aspects of school climate. Moreover, data revealed that most students in these schools do their best even when the tasks are difficult or even when the tasks are not interesting and that they participate in group projects and never give up when they cannot solve a problem easily. This finding supports the study of Osher et al (2008) revealing that students who have strong interpersonal skills are more likely to cope with stressful situations, collaborate with other students in a group, and achieve their goals.

Finally, the only domain of school climate with Moderate rating is school safety. This implies that school safety, in general, is sometimes manifested. On one hand, data reveal that students feel safe in their classes, at school and in the hallways and bathrooms of the school. Findings also show that students in these schools get along very well with others, treat each other with respect and that they really care about each other. This is in accord with the pronouncements of The Dignity Act (2014) and the Center for Social and Emotional Education (2010) which stated that school safety is determined by the students feeling of physical, emotional and social safety, that they are fairly treated and that the school itself is safe and orderly.

On the other hand, data revealed that students in these schools feel that sometimes, it is not safe outside around school and that sometimes they worry about crime and violence in school. Likewise, bullying in the schools is sometimes manifested as there are students who are teased, threatened, and/or bullied. This is parallel to the findings of the studies in the research summary of Center for Social and Emotional Education (2010) which revealed that many students fear in coming to school everyday because they experienced violence and have become victims of bullying.

3.2 Level of Mathematical Dispositions of Grade 10 Students

The second objective of this study was to unearth the level of mathematical dispositions of the students. The data shown in Table 2 reveals the overall level of mathematical dispositions of Grade 10 students as High which denotes that a positively characterized mathematical disposition is oftentimes manifested. In fact, all of its seven indicators were rated with High level. This manifestation agrees with the pronouncement of Harris et al (1999) that for
mathematics teaching to be effective, it should not only involve mathematical concepts and procedures but should also involve developing students’ dispositions towards the subject.

### Table 2. Level of Mathematical Dispositions of Grade 10 Students

<table>
<thead>
<tr>
<th>Indicators</th>
<th>SD</th>
<th>Mean</th>
<th>Descriptive Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility</td>
<td>0.65</td>
<td>4.10</td>
<td>High</td>
</tr>
<tr>
<td>Usefulness</td>
<td>0.82</td>
<td>4.07</td>
<td>High</td>
</tr>
<tr>
<td>Appreciation</td>
<td>0.71</td>
<td>4.03</td>
<td>High</td>
</tr>
<tr>
<td>Interest</td>
<td>0.72</td>
<td>3.89</td>
<td>High</td>
</tr>
<tr>
<td>Perseverance</td>
<td>0.69</td>
<td>3.84</td>
<td>High</td>
</tr>
<tr>
<td>Metacognition</td>
<td>0.59</td>
<td>3.73</td>
<td>High</td>
</tr>
<tr>
<td>Confidence</td>
<td>0.63</td>
<td>3.62</td>
<td>High</td>
</tr>
<tr>
<td>Overall</td>
<td>0.56</td>
<td>3.90</td>
<td>High</td>
</tr>
</tbody>
</table>

Meanwhile, flexibility greatly contributed to the High level of students’ mathematical disposition as it was rated nearly Very High which implies that it is oftentimes manifested. This result is indicative of students believing that it is important to learn more than one way of solving math problems and they like it when their math teachers show them more than one way of solving those problems. Also, students like it when their math teacher gives them math problems that they have not seen before. This affirms the statement of Wong (2008) that students need to learn multiple techniques and methods as well as to choose among these methods in order to accurately and efficiently solve math problems. Furthermore, the result is in consonance with the statement of Beyranveand (2016) which states that for the students to better understand math, teachers need to present examples and encourage alternative solutions.

Moreover, results revealed a high-level rating on the usefulness of mathematics. Data convey that students often believe that knowing how to solve math problems is important in finding a good job and that the math concepts they learn in school are important in everyday life. They also believe that people who know how to do math have better job opportunities. Similarly, appreciation was also rated with High level indicating that it is oftentimes manifested. Specifically, data revealed that students see Mathematics as an important subject, thus, it is valuable in our society. They further believe that solving math problems helps them understand the world and that the subject is more important to them than it is to other people. This High level of appreciation and usefulness is contrary to the result of the study of Wilkins and Ma (2003) which found out that there was a negative change on the beliefs of the secondary students about the social importance of mathematics.

Another indicator with high-level rating is interest which means that it is oftentimes manifested. Results expose that students like learning math in school which indicates their belief that it is an interesting subject because it makes sense to them and that solving math problems allow them to be creative. On one hand, this result is parallel to the findings of TIMSS 2015 which showed that most of the students included in the study liked mathematics. On the other hand, the result opposes the statement of the Technical University of Munich (2013) that many secondary students lose interest in mathematics. It is plausible, however, that this high-level rating on students’ interest is due to the fact that teacher expectations was also high thus, supporting the study of Wentzel (2002) where it was found out that teacher expectations predicted the level of students’ interest.

Perseverance, just like the rest of the indicators, was also rated with High level. Data further shows that students understand that solving math problems requires patience. Oftentimes, students work on difficult problems until they find a solution. It is also revealed that students like working on math problems even when they take long to solve and that they do not easily give up when a math problem is difficult.

Though second from the bottom, metacognition was also rated with High level and it is perceived to be manifested oftentimes. Based on the data, it reveals that students notice it when they use different methods in solving math problems. Students believe that it is important to think about what works and what does not in solving math problems. Hence, students find themselves thinking about the method they are using to solve a math problem and checking whether it is a good method. In addition, when students solve math problems, they begin thinking about a plan of action before they start solving.

Finally, the least-rated indicator of the level of mathematical dispositions is confidence. However, it was still rated with High level and was perceived to be manifested oftentimes just as the other indicators. Data reveals that most of the time, students ask for help whenever they are confused while solving a math problem. Students feel that they are comfortable trying new ways of solving math problems and they believe that they do not find it difficult to solve math problems. This is parallel to the statement of Khan (2007) that students’ confidence in their ability to do math strongly influence their engagement in mathematics and their subsequent achievement.

### 3.3 Significance on the Relationship between School Climate and Mathematical Disposition

The test of correlation unveiled a positive relationship between school climate and mathematical disposition of Grade 10 students as shown in Table 3. This indicates that the latter has a positive association with the former. The data further revealed a positive relationship between and among the indicator variables. This means that the independent variable, school climate, with its indicators school safety, peer social climate, support and expectations were positively correlated with the dependent variable, mathematical dispositions, with all its indicators also, namely: confidence, flexibility, interest, perseverance, metacognition, usefulness and appreciation. This implies that school climate and mathematical disposition of the students go together. That is, high level of school climate promotes a high level of students’ mathematical disposition.

### Table 3. Significance on the Relationship between School Climate and Mathematical Disposition of Grade 10 Students

<table>
<thead>
<tr>
<th>School Climate</th>
<th>Confidence</th>
<th>Flexibility</th>
<th>Interest</th>
<th>Perseverance</th>
<th>Metacognition</th>
<th>Usefulness</th>
<th>Appreciation</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.90</td>
<td>3.62</td>
<td>3.84</td>
<td>3.73</td>
<td>3.65</td>
<td>3.89</td>
<td>4.07</td>
<td>3.90</td>
</tr>
</tbody>
</table>

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The above statement affirms the results of the study conducted by the Organization for Economic Co-operation and Development (2013) which stated that students’ dispositions towards learning mathematics is greatly influenced by the policies and practices at school, specifically, students’ exposure to mathematics problem, teachers’ practices, teacher-student relations, and disciplinary climate in the classroom.

Moreover, the regression analysis shows that school climate predicts mathematical dispositions of the students. It is further revealed in Table 4 that 35.6% of the mathematical dispositions of the students was attributed to the indicators of school climate specified in this study. However, if the indicators of school climate are taken as single entities, only expectations can predict mathematical dispositions of students. The other three domains, namely support, peer social climate and school safety, do not predict mathematical dispositions. This data implies that high level of expectations promotes a high level of student mathematical disposition.

The results affirm the statement of OECD (2013) that teachers can help students develop their potential in mathematics by holding high expectations. This is also corollary to the study of Wentzel (2002) that expectation predicts students’ interest, a determinant of disposition towards learning the subject. The results also support the fact presented in the studies of Good (1981) and Zander (2012) that teachers’ expectations are related with student achievement.

<table>
<thead>
<tr>
<th>School Climate (Indicators)</th>
<th>Mathematical Disposition</th>
<th>β</th>
<th>B</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Safety</td>
<td></td>
<td>.168</td>
<td>.143</td>
<td>1.383</td>
<td>.169</td>
</tr>
<tr>
<td>Peer Social Climate</td>
<td></td>
<td>-.007</td>
<td>-.006</td>
<td>-.058</td>
<td>.954</td>
</tr>
<tr>
<td>Support</td>
<td></td>
<td>-.051</td>
<td>-.054</td>
<td>-.500</td>
<td>.618</td>
</tr>
<tr>
<td>Expectations</td>
<td></td>
<td>.642</td>
<td>.567</td>
<td>5.825</td>
<td>.000</td>
</tr>
</tbody>
</table>

R² = .356
F = 15.625
p = .000

4. CONCLUSION

Conclusions are drawn based on the results of the study. The study concludes that the overall level of school climate of the private secondary schools in Barangay Ilang was high, as well as its indicators, namely expectations, support, and peer social climate. The only domain in moderate level was school safety. Furthermore, the overall level of mathematical disposition of the students was high which was indicative of the high levels among all seven domains of mathematical disposition of the students.

Moreover, the findings opposed the theoretical assumption of no significant relationship between school climate and mathematical disposition of the students. Contrary to the assumption, the study concludes that the school climate and the student mathematical disposition were positively related. That is, change in the level of school climate affects the level of mathematical disposition. This supports the proposition of OECD (2013) that the dispositions of the students towards learning mathematics are influenced by the rules and practices at school, teacher-student relations, and expectations which are determinants of school climate.

Finally, the findings of the study did not affirm that no domain of school climate significantly influence mathematical disposition. It further concludes that expectations best influences mathematical dispositions of the students. Thus, it can be inferred that by holding high expectations on students, teachers can help enhance their potentials in mathematics. Lastly, future researchers may conduct a similar study on a different setting to discover new knowledge and add to the limited literature on the relationship of school climate and mathematical dispositions of secondary students.

5. Acknowledgements

I am extremely grateful for the wonderful people who helped me, in one way or another, in the realization of this academic paper.

Pursuing a dream was never an easy journey especially when the road was difficult and one needed to be loaded with tons of hard work and perseverance. Thus, I am eternally indebted to my family for the love, inspiration and support as well to the school heads and teachers of the private schools in Barangay Ilang for accommodating me and granting me permission to conduct and complete this study in their schools;

Finally, I am eternally grateful to the Almighty God for the gift of life, love, wisdom, good health and for all the blessings and support He showered upon me. I acknowledge Him as the source of everything including this professional attainment that I have just received. All glory and honor to Him who marvelously directed my path and allowed me to attain my goals and gave me this wonderful achievement.

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