Bryant University

HONORS THESIS

Relationship between Classroom Climate, Student Self-Efficacy, and Achievement in the High School Math Classroom

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ABSTRACT

There is a variety of past research regarding the relationship between the mathematics classroom climate and student learning. More specifically, many studies look at how the classroom climate may influence student self-efficacy in math. Furthermore, another quantity of research supports that there is a link between student math self-efficacy and the student's achievement in the particular subject. The goal of this study is to see if students' perceptions of their math classroom climate are related to their self-efficacies towards the subject, which therefore affects their achievement in math. It is hypothesized that there is a relationship between the classroom environment and student self-efficacy; furthermore, it is hypothesized this relationship contributes to student achievement in math. Participants were 83 high school students attending a public suburban school outside of Boston in the winter of 2014. Students completed Fast's measure assessing classroom climate, math self-efficacy and achievement. A significant relationship was found between classroom climate and student self-efficacy, with mastery goal structure being the most significant aspect of classroom climate that contributes to this relationship. A significant relationship was found between self-efficacy and achievement, but boys had higher self-efficacies while girls had higher achievement.

INTRODUCTION:

The academic classroom climate is of increasing interest to educational psychologists and teachers in general. Classroom climate has been defined is "the classroom environment, the social climate, the emotional, and the physical aspect of the classroom," (Bierman, 2011, p.2). While there are many factors that can influence how a student performs in school, the climate that the teacher creates in the classroom for the students through goal-setting, appropriate challenges, and empathy for the students may some major factors contributing to student achievement. Even more interesting is how this could be related to student self-efficacy, which is a student's perceived capability for a specific task or subject, in this case math. Teachers may be able to influence student self-efficacy with the classroom environment that they create. A great deal of research has been done in this subject area in the last 25 years to support the importance of the mathematics climate on student self-efficacy in the subject (Fast et al, 2010; Fresko & Ben-Chaim, 1989; LaRocque, 2008).

Many studies regarding student self-efficacy in mathematics and the environmental effects on their self-efficacy have been conducted. Although this study focuses on public high school students in a suburb outside of Boston, the research that was analyzed ranges across a broad spectrum of ages, geographical locations, and scopes. The following relevant studies include elementary-age children, middle and high school students, and also college students. Studies on this subject area have been done in the United States, Israel, Slovenia, China, and elsewhere. Starting with the very broad topic of environment and narrowing towards the relationship between classroom climate, self-efficacy, and achievement, these dynamic studies will be used to support the relevance of this research topic area and also the upcoming hypothesis.

The Importance of Environment

There are many factors that influence how teachers create learning experiences for children, but the classroom climate is specifically of great importance to student learning. This is an element of the class that the teacher has almost entire control over and should be manipulated in a way that engages students and allows them to rise to their fullest potentials. Fresko and Ben-Chaim focused on 5 different aspects of the classroom learning environment (difficulty, speed, satisfaction, diversity, and inquiry) across 80 junior high mathematics classes in Israel (Fresko & Ben-Chaim, 1989). Measures analyzed classroom environment variables, teacher credential variables, and additional predictor variables, which illustrates the dynamic elements that contribute to creating a learning experience for children. The researchers measured teacher effectiveness by observing whether or not learning was taking place in the classroom, which was defined by the teacher's qualities such as careful planning, good management, and clear explanations. Consequently, their most significant finding was that formal teacher credentials were only marginally relevant to teacher effectiveness (Fresko & Ben-Chaim, 1989). This finding that teacher effectiveness is so crucial in the classroom may indicate that the difference in teacher performance had more to do with the classroom climate they created and less to do with their credentials and other variables. Therefore, credentials may not accurately predict the classroom environment a teacher will create, which emphasizes how important environment can be to students' learning.

Students' actual perceptions of the classroom climate are as important as the environment that the teacher attempts to create. If students do not perceive their environments in a positive way, it may not be beneficial to the learning process. Additionally, the way students perform

academically may alter their perception of the environment, which is something teachers must keep in mind when trying to create an advantageous learning environment. This was found in a study that examined 4th, 5th, and 6th grade elementary students' perceptions of their classroom environments and how that may impact overall achievement. The researcher found that nearly all students perceived their classroom environments positively (LaRocque, 2008). However, the grades a student received did slightly alter the student's perception. Students with lower grades perceived their classroom as more competitive than students with higher grades, leading them to also view their classes as less cohesive (LaRocque, 2008). These findings illustrate the importance of student perception to teachers because they can try to structure their classrooms in a way that lower-scoring students will feel more comfortable and confident. Furthermore, one study explored the importance of communication in the classroom and found that the quality with which teachers can communicate directly affects students' depth of knowledge and understanding (Huang, Normandia, & Greer, 2005). Both of these studies emphasize how important teacher interactions are to students' perception of the classroom. By creating influential environments, teachers' efforts can not only impact a student's academic year but also future endeavors.

By teachers creating beneficial learning environments that students perceive as useful, students may be so influenced that their future and career choices are affected. It has been shown that some learning environments are so effective that they actually encourage students to pursue careers in mathematics, even if the student encountered that particular environment years before making decisions about career choice. Specifically, a longitudinal study that analyzed over 3,000 children's 7th grade mathematics classroom experiences found that students' perceptions of these

teachers' efforts such as expectations, social support, and teaching for meaning directly correlated with those students interest in pursuing a career in mathematics in 12th grade. Furthermore, the more positive these perceptions were, the more motivated the student was to pursue a math career post 12th grade (Wang, 2012). These conclusions show that not only do students' present environments affect them, but their previous ones do as well. They can be affected so greatly that even one positive experience may cause them to gravitate towards choosing a career in math, which demonstrates how crucial the environment a teacher creates is for his or her students at all levels during a child's academic career.

Similar to middle and high school teachers, college professors may be affecting students' career choices as well. Many college students are undecided in their majors when entering college and can be greatly influenced by their math college classrooms. When analyzing mathematics classrooms of undecided college majors, researchers found that the students' math self-efficacies were positively related to their career choice; those who did choose a path towards a mathematics career had a higher self-efficacy in math than those who did not (Luzzo et al, 1999). Now, if it could be shown that teachers themselves can manipulate the classroom environment to increase student self-efficacy, teachers could be confident that they can positively influence their students' career choices based on these findings. The implication of these studies regarding classroom climate and career choice emphasizes how much the environment a teacher creates cannot only improve a student's year-long experience but also influence his or her decision at some point in the future regarding career choice.

Classroom Environment & Math Anxiety

Unfortunately, in the same way that teachers can manipulate their classrooms to benefit students, they can also create environments that make math learning more difficult. Math anxiety is a very real problem for some students in which anything about math (lectures, homework, tests) causes them to experience anxiety. It is possible that the classroom climate could relate to the likelihood that students experience math anxiety. Stodolsky (1985) found a strong link between students' past experiences in lower elementary school classrooms and their current state of math anxiety. Students with more positive experiences in the younger grades were much less likely to experience anxiety than those who did not have comparable experiences (Stodolsky, 1985). This particular example shows the effect a classroom environment can have on a student's attitude towards math, even years after they experience that environment. If math anxiety can be lowered through the help of teachers manipulating classroom environment, this information should be used accordingly. Teachers should be careful to avoid making math more difficult and stressful for students; rather, they should be altering the classroom climate in a way that increases students' confidence and self-efficacy in the subject.

Self-Efficacy

Bandura defines perceived self-efficacy as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Bandura, 1986, p.1). People can have varying self-efficacy towards different abilities and tasks. The research specifically looked at is focused on self-efficacy towards mathematics. Having high self-efficacy in math means that a student feels confident in his/her ability to be successful in the subject. It also contributes to students approaching difficult tasks; students with

lower self-efficacy would be less likely to take on challenges (Bandura, 1986). This is of interest in the education setting because high self-efficacy can motivate students to approach challenges and raise their confidence in being successful.

Bandura lists four contributing factors to self-efficacy: mastery experiences, vicarious experiences, social persuasion, and emotional state. Bandura believes that mastery experiences are how people create their strongest sense of self-efficacy. These are experiences that show people they can complete the task successfully, so they believe that they would be able to be successful again (Bandura, 1986). Vicarious experiences are also a source of self-efficacy; watching people of similar skill level complete a task makes a person also feel like they could be competent at the task (Bandura, 1986). For example, if a math student sees a peer complete a difficult problem on the board, it will make that student feel as though he/she could also correctly solve the problem. Social persuasion is another source of self-efficacy, and it occurs when peers, mentors, or anyone surrounding a person trying to complete a task encourages them and tells them that they can do it (Bandura, 1986). This increases self-efficacy because it increases positive thinking, and the person begins to believe that they can complete the task. Lastly, emotional states can affect self-efficacy. Positive thinking can increase self-efficacy, but too much stress can debilitate people and lessen their self-efficacy (Bandura, 1986). Therefore, mastery experiences, vicarious experiences, social persuasion, and emotional states all interact to influence self-efficacy.

Classroom Environment & Math Self-Efficacy

Following the research on how the classroom environment can positively or negatively affect a student's experience in learning math, it is important to analyze how this environment

could be shaped specifically in a way that improves student self-efficacy in the subject. Although many variables contribute to molding a student's attitude and experience in a subject, there are many approaches teachers can take to adapt their environments in ways that better suit students and in turn increase their self-efficacy. For example, Ozgen and Bindak (2011) examined high school students' self-efficacies towards math in relation to their own beliefs about variables existing between students such as: gender, school type, class level, math degree, parents' educational status, and the importance given to math classes within families. Despite all of these extraneous variables, their most significant finding was that students' self-efficacies regarding their own math-literacy is not concrete and can be changed, especially through the help of teachers (Ozgen and Bindak, 2011). This is again illustrating how, although many variables make up a student's experience in math, classroom climate is one of the most important and also one of the few variables that teachers can directly influence. Ozyurek had similar findings in a study that involved 590 Turkish high school math students which led him to conclude that teachers can manipulate students' perceptions of math in ways that can help them succeed (Ozyurek, 2005). These examples reveal how powerful teachers can be if they work to improve their students' learning environment. Ultimately, they can shape the way the students view mathematics and their ability to be successful in it.

There are three specific classroom climate variables that I am interested for the purposes of this study: teacher mastery goal structure, teacher challenge, and teacher caring. Teacher mastery goal structure is defined as the way that teachers promote overall understanding and improvement from students in the math classroom; teacher challenge examines to what extent teachers motivate students to give their fullest potential; and teacher caring is the level which

teachers empathize with students and work to understand them at a personal level while also valuing their opinions (Fast, 2010). It will be important to see how students' perceptions of these variables in particular shape student self-efficacy, and there have already been studies finding that they do.

Levpušček and Zupančič analyzed both parental involvement and teacher behavior as contributing elements towards math students' motivation. When considering teacher influence, the researchers found that academic support contributed positively to achievement while academic pressure was related positively to student self-efficacy. Furthermore, perceptions about teachers' goals positively contributed to students' motivation (Levpušček & Zupančič, 2009). This is the first time a specific variable of interest, teacher mastery goal structure, has been mentioned in a study. These findings support that students perception of goals which the teachers idealize for them is related to the students' motivation in math, which will be specifically important to consider during my study.

Mastery goal structure, teacher challenge, and teacher caring are the three aspects of classroom climate specifically assessed in this study. These variables have previously been found to significant influence math self-efficacy in 4^{th}, 5^{th}, and 6^{th} grade students (Fast et al, 2010). In other words, the teacher's mastery goal structure, level of challenge, and amount of care shown directly relates to the students' self-efficacy. It is crucial that teachers realize the elements of their classroom climate that may be able to influence student self-efficacy because it can allow them to increase self-efficacy in their students. Additionally, researchers concluded that the students who perceived these classrooms as having the three previously mentioned positive attributes had higher levels of math self-efficacy than those who did not perceive their

environment in that way (Fast et al, 2010). These findings were used as the basis for the upcoming hypothesis.

Student Self-Efficacy and Achievement

Similar to the way student classroom environment has been shown to affect the student's self-efficacy, this state of self-efficacy has been linked to student achievement. This area of study has been of ongoing interest to educational psychologists. Collective and individual self-efficacy have both been studied as determinants of student achievement. Self-efficacy has been defined by Bandura, but collective efficacy in an educational setting is defined as how students view the efficacy of the entire classroom (Pina-Neves, Faria, & Raty, 2013). These researchers found that individual efficacy was the strongest influence to student math achievement, but collective efficacy was a strong influence to boys and students in public schools. They also found a weak positive correlation between collective and individual efficacy (Pina-Neves, Faria, & Raty, 2013). This is implying that individual self-efficacies may increase the overall classroom (collective) efficacy, and vice versa. This makes seeing that if many students have high self-efficacies in math then they most likely see the entire classroom with a positive efficacy towards the subject, too.

Just as classroom climates have been studied to see if they influence both math self-efficacy and math anxiety, there has been research done to see if this link also exists with student achievement. If students have anxiety towards math when taking tests or doing any work for that matter, it would seem likely that they would achieve lower scores than if they were in a more relaxed state. In a study of 372 eighth grade students, Hafner found an association between math anxiety and negative attitudes towards math (Hafner, 2008). Furthermore, he found that low self-

efficacy seemed to be a cause of math anxiety, which resulted in lower achievement in math (Hafner, 2008). This shows that teachers could have a very strong ability to raise student achievement. If they can positively influence the students' attitudes, which decreases math anxiety, achievement should increase as well.

Almost any study looking to find a relationship between self-efficacy and achievement looks to Bandura's work, especially in their research phase and in understanding exactly what self-efficacy is, at least defined by Bandura. Phan's study of this was based around the aspects that Bandura claims influences self-efficacy actually did so in children under the age of 12. In the end, he only found that enactive performance accomplishment and vicarious experiences influenced the students' self-efficacies (Phan, 2012). This is inconsistent with Bandura's theory that verbal persuasion and emotional state also influences student self-efficacy. These two factors, enactive performance accomplishment and vicarious experiences, were also found to indirectly influence achievement via self-efficacy (Phan, 2012). However, Phan was most interested with the teaching applications of this finding. Because children depended mostly on their own previous successes or failures when developing their self-efficacies, it seems important that teachers keep this in mind when implementing strategies that will aid self-efficacy.

More specifically, the research on math self-efficacy and the link to achievement in math is especially interesting. As an aspiring math teacher, I find it important for math teachers to understand the ways that they can influence their students' self-efficacies in math in positive ways, and it is even more crucial if this can in turn aid the students' achievement. The ways that students perceive their abilities in math have been seen to be influenced by classroom social dynamics (Lewis et al, 2012). More specifically, this study found that teacher caring in particular

positively influenced both student self-efficacy and performance. The confidence boost given by teachers caring about their students caused students to be able to complete difficult problems (Lewis et al, 2012). This is particularly interesting because in a smaller, previously conducted study I came across the same findings: teacher caring was the most influential element towards increasing study self-efficacy(Lewis et al, 2012). This study took that finding one step further and said that it also influences student achievement.

The relationship classroom climate has with student learning and even more specifically self-efficacy is apparent from past research. Across a wide range of ages, cultures, and locations, the classroom climate seems to be important to students' experiences in math in one way or another. Even more research suggests that this importance can reflect on students' self-efficacy and therefore their achievement in mathematics. However, most of this research has been conducted with respect to younger students, which is why I am looking to see if these relationships exist in high school students. Therefore, I constructed my research method with regards to adolescents.

This study sets out to answer two questions: is there a relationship between the classroom climate a teacher creates and student self-efficacy; does this relationship influence the student's achievement in the class? Based on the above supporting evidence, I believe that there is a relationship between classroom climate, student self-efficacy, and achievement in high school math students; students who perceive their environment positively will have higher self-efficacies and therefore higher achievement in math than those who do not.

METHOD

Participants

This study was conducted at a public high school a half hour outside of Boston. Eighty-three students were recruited for this study. The sample consisted of 45 males and 38 females. Of the 83 students, 43 were statistics students, and 40 were advanced algebra students. All were juniors and seniors in high school from a middle class Boston suburb.

Measure

In Fast's 2010 study, the researchers used items borrowed from Karabenick & Maehr's "SMQ" measure, which was developed to aid research efforts in STEM fields. Fast's study also analyzed how classroom environment and math self-efficacy affects student achievement but in elementary school children, so it also seemed fitting for this study. The measure analyzes 4 subsclaes: math self-efficacy, perceptions of teacher mastery goal structure, perceptions of teacher challenge, and perceptions of teacher caring. There were 3-4 questions asked on each of the previously mentioned areas of interest, all ranked on a likert scale (1 being strongly disagree and 7 being strongly agree). In addition to completing the measure, students were required to include their age, gender, and their semester grade up until that point. A copy of this measure can be found in Appendix A.

Procedure

A class visit was coordinated with the head of the school's math department, and 4 classes, 2 statistics and 2 advanced algebra, were surveyed. Participants had already turned in parental consent forms and were then given their own consent forms. They were briefed on the study before beginning and given the option to not participate. Once questions were answered,

the surveys were passed out. When the students finished the survey they were instructed to approach the teacher's desk single file so that he or she could write their semester grade at the end of the semester. Grades were retrieved privately and at the end of the survey process in order to avoid student math anxiety and to promote confidentiality.

Analyses

Analyses were broken down based on the type of variable and the relationships that were of interest. First, averages and standard deviations were calculated for the quantitative variables. Once data was collected from all 83 participants, 4 averages were calculated for each participant (one regarding the questions concerning the dependent variable and 3 regarding the questions concerning each independent variable). In the excel document and further analyses, X1 = "mastery goal structure," X2 = "teacher challenge," X3 = "teacher caring," and Y = self-efficacy. The data was entered into excel along with each student's grade in the class, which was measured on a 1 to 100 scale. Furthermore, data was collected for categorical variables, which are teacher (levels 1, 2, or 3) and gender (levels 1 or 2). For teachers, the levels of "1" "2" and "3" each represent a different teacher to remain anonymous. For gender, 1 is male and 2 is female. The overall means can be found in Appendix B, table 1. The means broken down by teacher and by gender can also be found in Appendix B in tables 2 and 3, respectively.

RESULTS

Following mean and standard deviation calculations, I looked at correlations between these different variables, X1, X2, X3, and Y. The overall correlations can be found in Appendix C, Figure 1, and the correlations by gender can be found in Appendix C, Figure 2. Mastery goal structure was found to be positively correlated with teacher challenge ($r = .69$, $p =<.0001$),

teacher caring (r = .551, p = <.0001), and self-efficacy (r = .315, p = .035), in males. Teacher challenge and teacher caring (r = .557, p = <.0001) were also positively correlated in males. Similar correlations were found in females. However, mastery goal structure and self-efficacy were not correlated, but self-efficacy and class grade were positively correlated (r = .331, p = .043).

Next, one-way ANOVA's were run of all quantitative by categorical variables. There was a significant difference found between mastery goal structure by teacher, F(2, 82) = 4.56, p =.013. This difference was specifically seen between teacher number one and teacher number 3. There was also a significant difference found between grade and teacher, F(2,82) = 8.74, p = <.0001. This difference was seen between teachers 1 and 2 (m = 5.826 and 5.364, respectively). There was also a difference between 2 and 3 (m = 5.364 and 4.819 respectively). These results are entirely outlined in Appendix D, Figure 1.

Many regressions were run in order to predict self-efficacy (Y) and its relationship with the three elements of classroom climate perception: teacher mastery goal structure (X1), teacher challenge(X2), and teacher caring(X3). Furthermore, categorical variables such as gender, grade, teacher, and math class were sometimes included in the models as well. Furthermore, a stepwise regression was then run with the same variables and the addition of the math class variable to see how each independent variable specifically affected the dependent variable of self-efficacy. The three significant variables found in the stepwise regression were mastery goal structure, math class, and gender, with respective p-values of .04, .028, and .01.

When broken down by gender, the regression was highly significant for males F(4,44) = 3.51, p=.015. However, it was not significant for females F(4,37) = .86, p=.494. The most

significant models I found involved gender, grade, and self-efficacy. With self-efficacy and gender as the independent variables and class grade as the response variable, $F(2, 82) = 7.54$, $p = <.0001$. With class grade and gender as the independent variables and self-efficacy as the response variable, $F(2, 82) = 5.32$, $p=.0007$. All regression data can be found in Appendix E.

DISCUSSION

Implications

It was predicted that there was a significant difference between classroom climate and student self-efficacy based on the literature, and these results were also found in this study. It was found that classroom climate does affect student self-efficacy. The three aspects of classroom climate that were looked at were mastery goal structure, teacher challenge, and teacher caring. Mastery goal structure was the only factor that seemed to directly affect student self-efficacy. This shows that students can perceive the organization and layout of the class and that this perception can affect student self-efficacy in the subject. Therefore, teachers who have challenging but attainable goals for students may be able to set these students up for success in the high school math classroom.

The second part of this research question considered if and how student self-efficacy influenced achievement. The findings confirmed a relationship found in many studies: students with higher self-efficacies had higher grades. However, it was found that females have significantly higher grades than males, while males have higher levels of self-efficacy. This may imply that girls need more support and encouragement than boys. Furthermore, boys may have higher self-efficacy because of societal expectations that they do well in math. The fact that these results did not find self-efficacy as a predictor of achievement contradicts most literature. These

conflicting findings call for further research into gender differences in terms of self-efficacy and achievement in math.

Initially, gender differences were not a main concern of this study. However, after discovering these findings, it is clear that a deeper look into gender differences is needed. The literature shows that boys and girls differ in the math classroom in many ways. For example, boys may perform better than girls in math because of their higher participation rates in the classroom (Van de Gaer, Pustjens, Van Damme, & De Munter, 2008). This relates to the consideration of societal influence on boys performing better than girls in math; if boys are feeling more confident in the subject, they could feel more comfortable participating. Furthermore, gender differences have been found in classroom perception, achievement goals, and performance in math (Gherasim, Butnaru, & Mairean, 2013). All of these findings are relevant to the results of this study and support the gender differences that were found. However, Merritt found that there may not be any significant differences in math anxiety and achievement between boys and girls (Merritt, 2012). The fact that these findings conflict with others in this topic area further support the need for more research in this area.

Limitations

While this study was conducted as soundly as possible, limitations did exist. Working with a young population has its challenges, especially with high school students. It was early in the morning, and the students were at the end of their semester, possibly causing them not to care much about the study. Because it was conducted before the actual end of the semester, the grades were not complete. While they were pretty accurate, the grades do not reflect the students' final grades on their transcripts, as they had not taken finals yet. Lastly, there is somewhat of a bias as

to who took these classes. Advanced algebra is taken by all students, but statistics is an elective. Typically, the students who take statistics are not the most skilled in math. Furthermore, the teacher who directed the statistics classes is preferred by athletes, causing many of these students to be football players. The dynamic of this classroom was affected by this bias, which could also have effected students' perception of the classroom climate.

The findings of this study both added to the research field and also left room for further studies to be done in the subject area. The finding that mastery goal structure influenced self-efficacy was very consistent with past research. However, the finding of self-efficacy not being a predictor of achievement conflicted with past research. Therefore, due to conflicting findings in both this study and existing research, further research is needed. These studies should look into gender differences in both self-efficacy and achievement in the high school math classroom. Most importantly, however, is that the results can be considered in the classroom in order to create productive and motivating environments for students. It is clear that mastery goal structure is crucial in influencing student self-efficacy; teachers should keep this in mind when leading their classrooms. Lastly, the gender differences found should motivate teachers to aid their female students in ways that will allow them to raise their self-efficacy. While the hypothesis was only somewhat supported, these findings can certainly be useful in future research, the classroom, and beyond.

APPENDIX A

Please indicate to the degree of which you agree with the following statements, 1 being strongly disagree and 7 being strongly agree.

"I'm sure that I can learn everything taught in math."

1 2 3 4 5 6 7

"I'm sure that I can do even the hardest work in my math class."

1 2 3 4 5 6 7

"Even if a new topic in math is hard, I'm sure that I can learn it."

1 2 3 4 5 6 7

"I'm sure that I can figure out the answers to problems my teacher gives me in class."

1 2 3 4 5 6 7

"My teacher thinks really understanding the material is the main goal of the class."

1 2 3 4 5 6 7

"My teacher thinks it's important to understand the material, not just memorize it."

1 2 3 4 5 6 7

"My teacher thinks how much you improve in math is really important."

1 2 3 4 5 6 7

"My math teacher accepts nothing less than my full effort."

1 2 3 4 5 6 7

"When I've figured out how to do a math problem, my teacher gives me more challenging work."

1 2 3 4 5 6 7

"My math teacher doesn't let me get away with doing easy work."

1 2 3 4 5 6 7

"My math teacher pushes me to take on challenging work."

1 2 3 4 5 6 7

"My math teacher makes sure that the work I do really makes me think."

1 2 3 4 5 6 7

"My math teacher takes a personal interest in students."

1 2 3 4 5 6 7

"My math teacher cares about how I feel."

1 2 3 4 5 6 7

"My math teacher listens to what I have to say."

1 2 3 4 5 6 7

"I feel that my math teacher will go above and beyond to help students."

1 2 3 4 5 6 7

Year:_____

Gender: M F

Math Class:_____

To be filled out by teacher:

Numerical Average: _____

Is this a semester or term average? Please circle ONE:

Semester Term

APPENDIX B

Table 1: Overall Means & Standard Deviations

Variable	Mean	Standard Dev.	Min	Max
Goal	5.485	1.259	1.5	7.0
Challenge	4.843	1.173	2.0	7.0
Caring	4.958	1.478	1.0	7.0
Self-Efficacy	4.780	1.420	1.0	7.0
Grade	83.670	9.940	51.0	100.0

Table 2: Means & Standard Deviations by Teacher

	Teacher	Mean	Std. Dev.
Mastery Goal Structure	1	5.826	0.826
	2	5.364	1.491
	3	4.819	1.557
Teacher Challenge	1	4.971	1.085
	2	4.784	1.317
	3	4.611	1.219
Teacher Caring	1	5.134	1.414
	2	4.625	1.586
	3	4.944	1.509
Self-Efficacy	1	4.558	1.433
	2	5.000	1.472
	3	5.042	1.310
Grade	1	81.720	8.670
	2	90.550	8.620
	3	79.940	10.650

APPENDIX B

Table 3: Means & Standard Deviations by Gender

	Gender	Mean	Std. Dev
Mastery Goal Structure	1	5.406	1.293
	2	5.579	1.228
Teacher Challenge	1	4.967	1.198
	2	4.697	1.142
Teacher Caring	1	5.089	1.416
	2	4.803	1.553
Self-Efficacy	1	5.056	1.289
	2	4.454	1.513
Grade	1	80.960	10.810
	1	86.890	7.770

APPENDIX C

Figure 1: Variable Correlations by Gender (Male)

	X1	X2	X3	Y
X2	0.690 0.000***			
X3	0.551 0.000***	0.557 0.000***		
Y	0.315 0.035**	0.235 0.120	0.038 0.806	
Average	0.223 0.141	0.125 0.412	0.135 0.377	0.250 0.098

Cell Contents: Pearson correlation
P-Value

Figure 2: Variable Correlations by Gender (Female)

	X1	X2	X3	Y
X2	0.648 0.000***			
X3	0.411 0.010**	0.612 0.000***		
Y	0.177 0.289	0.081 0.630	0.028 0.866	
Average	0.091 0.587	-0.086 0.608	-0.076 0.649	0.331 0.043*

Cell Contents: Pearson correlation
P-Value

APPENDIX D

Figure 1: One-Way ANOVA - mastery goal structure (IV) and teacher (DV)

```
Source   DF      SS    MS     F      P
Teacher   2   13.30  6.65  4.56  0.013*
Error    80  116.63  1.46
Total    82  129.93

S = 1.207   R-Sq = 10.24%   R-Sq(adj) = 7.99%


                          Individual 95% CIs For Mean Based on
                          Pooled StDev
Level   N   Mean  StDev  -----+---------+---------+---------+----
1      43  5.826  0.826                          (-------*------)
2      22  5.364  1.491              (---------*----------)
3      18  4.819  1.557  (----------*-----------)
                          -----+---------+---------+---------+----
                             4.50      5.00      5.50      6.00

Pooled StDev = 1.207
```

Figure 2: One-Way ANOVA - grade (IV) and teacher (DV)

```
Source   DF      SS     MS     F      P
Teacher   2  1453.2  726.6  8.74  0.000***
Error    80  6647.1   83.1
Total    82  8100.2

S = 9.115   R-Sq = 17.94%   R-Sq(adj) = 15.89%


                            Individual 95% CIs For Mean Based on
                            Pooled StDev
Level   N    Mean   StDev  ---------+---------+---------+---------+
1      43  81.721   8.669         (----*-----)
2      22  90.545   8.623                          (-------*-------)
3      18  79.944  10.652  (--------*-------)
                            ---------+---------+---------+---------+
                                  80.0      85.0      90.0      95.0

Pooled StDev = 9.115
```

APPENDIX E

Figure 1: Multiple Regression - gender, classroom climate (IV's) and self-efficacy (DV)

```
The regression equation is
Y = 4.41 - 0.674 Gender + 0.305 X1 + 0.059 X2 - 0.122 X3

Predictor     Coef  SE Coef      T      P
Constant    4.4106   0.8715   5.06  0.000
Gender     -0.6735   0.3105  -2.17  0.033*
X1          0.3051   0.1647   1.85  0.068
X2          0.0585   0.1908   0.31  0.760
X3         -0.1221   0.1280  -0.95  0.343


S = 1.37065   R-Sq = 11.4%   R-Sq(adj) = 6.8%

Analysis of Variance

Source          DF       SS     MS     F      P
Regression       4   18.762  4.690  2.50  0.049*
Residual Error  78  146.538  1.879
Total           82  165.300
```

Figure 2: Stepwise Regression - gender, teacher, class (IV's) and self-efficacy (DV)

```
Alpha-to-Enter: 0.15  Alpha-to-Remove: 0.15


Response is Y on 6 predictors, with N = 83


Step            1      2      3
Constant    3.384  1.922  2.669

X1           0.25   0.33   0.37
T-Value      2.08   2.68   3.05
P-Value     0.040*  0.009  0.003

Class               0.70   0.82
T-Value             2.24   2.70
P-Value            0.028*  0.008

Gender                    -0.77
T-Value                   -2.64
P-Value                   0.010*

S            1.39   1.36   1.31
R-Sq         5.09  10.68  17.90
R-Sq(adj)    3.92   8.45  14.78
Mallows Cp   10.6    7.4    2.5
```

APPENDIX E

Figure 3 – Multiple Regression – class, classroom climate (IV's) and self-efficacy (DV)

```
The regression equation is
Y = 1.80 + 0.999 Class + 0.562 X1 + 0.043 X2 - 0.278 X3


Predictor     Coef  SE Coef      T      P
Constant     1.796    1.068   1.68  0.100
Class       0.9993   0.3787   2.64  0.012*
X1          0.5624   0.2094   2.69  0.010*
X2          0.0431   0.2133   0.20  0.841
X3         -0.2782   0.1578  -1.76  0.085


S = 1.16302   R-Sq = 26.0%   R-Sq(adj) = 18.6%

Analysis of Variance

Source          DF      SS     MS     F      P
Regression       4  19.007  4.752  3.51  0.015*
Residual Error  40  54.104  1.353
Total           44  73.111

Predictor        Coef  SE Coef      T      P
Constant       64.374    5.204  12.37  0.000
Gender          7.071    2.081   3.40  0.001**
Self-Efficacy  1.8812   0.7346   2.56  0.012*


S = 9.22966   R-Sq = 15.9%   R-Sq(adj) = 13.8%


Analysis of Variance

Source          DF       SS      MS     F      P
Regression       2  1285.29  642.65  7.54  0.001**
Residual Error  80  6814.93   85.19
Total           82  8100.22
```

APPENDIX E

Figure 4: Multiple Regression between gender, grade (IV's) and self-efficacy (DV)

```
The regression equation is
Self-Efficacy = 2.64 - 0.841 Gender + 0.0403 Grade

Predictor     Coef  SE Coef      T      P
Constant     2.636    1.266   2.08  0.040
Gender     -0.8408   0.3118  -2.70  0.009**
Grade      0.04027  0.01573   2.56  0.012*


S = 1.35040   R-Sq = 11.7%   R-Sq(adj) = 9.5%

Analysis of Variance

Source          DF       SS     MS     F      P
Regression       2   19.414  9.707  5.32  0.007**
Residual Error  80  145.886  1.824
Total           82  165.300
```

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