THE ROLE OF STUDENTS' PERCEPTIONS OF CLASSROOM CLIMATE IN PREDICTING ACADEMIC MOTIVATION AND ASSIGNED GRADES IN MIDDLE SCHOOL MATHEMATICS

By

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To my husband, Jack.

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The purpose of this study was to determine if middle school math students' perceptions of classroom climate could predict their end of year academic grade point averages and reported levels of end of year motivation. Students were asked to rate their mathematics class on perception of order and organization as well as perception of rule clarity and fairness of enforcement . Students also rated how much they valued learning math and how well they expected to perform in the class. Results of this study indicated students reported a significant decline in motivation in mathematics at the end of the year. Students who rated classrooms as more orderly and organized tended to achieve higher grades and report higher levels of end of year motivation. Students who perceived rule policies as clear and fair reported higher levels of end of year motivation. There were no effects for rule clarity on grade achievement.

CHAPTER 1
INTRODUCTION

As a first year graduate student, I had the opportunity to work with Dr. Heather Davis as a research assistant. Dr. Davis had been examining the role of student-teacher relationships among middle school students. As part of this extensive study, Dr. Davis collected a wide range of information concerning middle school students, in a comprehensive effort to understand the many impacting variables on academic success. Among the variables, were students self-report of values and expectations of academic success, their perceptions of school climate, classroom climate, and parent and peer relationships, as well as their perceptions of their relationships with their teachers. By exploring the values and expectations of the teachers, their perceptions of students' success, their perception of school climate, and their perceptions of their relationships with students, this larger study focused on constructing relationship models to explain the variables impacting student-teacher relationships in middle schools in relation to student success.

While working with these data sets, Dr, Davis would discuss the data with me and answer questions I had regarding the implications each of the measures. During these discussions, I became interested in how these variables impact student performance in schools. Of greatest interest to me, was the construct of classroom climate. In the past, I have had teachers and classrooms that remain prominent in my memory of school. Those teachers made a difference to me, motivating me to out-perform my previous performances. Along with this unexpected excellence, came the realization that learning

was worthwhile and satisfying, intrinsically. Because of the memories of those most prominent experiences, I was driven to wonder what specific qualities figure most prominently in positive academic experiences. The data collected in this larger study gave me an opportunity to explore these qualities.

Of the many questions I had, I wanted to understand how classroom variables affected student outcomes and if these outcomes were measurable in actual grade achievement. Classrooms that are orderly and organized, in which rules and expectations are fair and consistent, closely resemble my thoughts on classroom factors that would facilitate personal growth and academic success. Therefore, I decided to pursue these constructs of classroom climate. When discussing possibilities with Dr. Davis, she urged me to consider other factors involved, such as students' expectations for success and the value they place on learning and achievement. In order to understand the effects of classroom climate on achievement, I realized that I would have to factor in and control for individual levels of motivation. It was then that I wondered if classroom climate would also affect motivation levels. By using existing data from Dr. Davis' larger study, I decided to pursue this topic as well. In researching academic domains correlated with classroom climate scales, I selected math classes, since traditionally methods of instruction appeared to rank highest in correlation to the constructs of Order/Organization and Rule Clarity (Moos & Trickett, 1974). Finally Dr. Davis and I arrived at this study, which examines the predictive role of classroom climate on achievement and motivation.

CHAPTER 2
REVIEW OF THE LITERATURE

Focus on educational outcomes has increased in the past decade with statewide high stakes testing and nationwide school accountability programs. In an effort to improve the academic success of students, it has become necessary to examine all components of the educational process in order to maximize the effectiveness of instruction within the classroom. Demonstrated to enhance the learning process and affect academic outcomes (Kunc, 1992; Osterman, 2000) classroom climate has been emerging as an important component of education (Haertel, Walberg, & Haertel, 1981). The purpose of this study is to examine the effects of classroom climate on motivation and achievement. In order to understand and measure its effects, this study will examine the roles of the school, the teacher, and the individual student as they contribute to classroom climate in relation to student motivation and achievement. In examining role of classroom climate and motivation on academic achievement, this study seeks to answer two questions. First, if individual levels of motivation are controlled for, will students who perceive a more positive classroom climate score higher grades than those with less positive views? Second, if controlling for initial levels of motivation, will students with more positive perceptions of classroom climate report feeling more motivated at the end of the year?

In the following sections, this study will define classroom climate and describe the contributory components comprising classroom climate in relation to motivation and learning. The contribution of school climate to classroom climate will then be considered

as it relates to student motivation and achievement. This study will examine how teachers contribute to classroom climate through their own qualities and experiences (Crohn, 1983) and how students contribute to classroom climate with personal characteristics affecting how they interpret classroom climate (Chapin & Eastman, 1996). Contributions of student motivation to perceptions of classroom climate in relation to achievement (Alspaugh, 1998) will also be examined. Because individual motivation has been found to impact achievement, it will be necessary to understand its effects in order to clarify the roles of motivation and classroom climate on achievement.

Because this study is interested in students' perceptions of classroom climate on achievement and motivation for mathematics, possible differences will be considered for gender, developmental age, and preferences for math. Finally, the impact of perceptions of classroom climate on achievement and motivation will be examined. In order to understand the impact of classroom climate, it must be first understood.

Classroom Climate

Wang, Haertel, and Walberg (1993) described classroom climate as encompassing all the socio-psychological dimensions of classroom life. This included common interest and the pursuit of common goal achieved through focused, organized and well planned lessons. The physical arrangement of the classroom furniture, the availability of resource materials, length of the class period (Chapin & Eastman, 1996), and type and pace of instruction (Wang et al., 1993) were also considered to influence the climate of the classroom. In sum, all events and influences within the classroom, including classroom management, comprised the construct of classroom climate (Gottfredson & Gottfredson, 1989).

Classroom climate encompassed the level of task difficulty (Wang et al., 1993), individual values, and interpersonal relationships (Gottfredson & Gottfredson, 1989). Review of the literature suggested that individual values and level of task difficulty were important determinants of student motivation to achieve (Wigfield, 1994). Therefore, in order to understand the role of classroom climate on student achievement it was necessary to understand the role of motivation in classroom climate as well as on academic outcomes.

The next section will review how fundamental needs to belong to a community, school, and classroom affect perceptions of classroom climate as well as motivation and achievement.

Role of Belongingness in Classroom Climate, Motivation, and Achievement

Baumeister and Leary (1995) posited that the need to belong is a fundamental human motivation. Belongingness, or the feeling of relatedness to others, has been suggested as an influential factor in academic outcomes owing to its importance in behavioral and socio-emotional development (Deci, Vallerand, Pelletier, & Ryan, 1991). Belongingness has been correlated with lower rates of emotional distress, drug abuse, violent behavior, criminal behavior, suicide, and school dropout rates (Battistich & Horn, 1997; Resnick et al., 1997). Deci and colleagues (1991) suggested the need for a sense of belonging, was so important that not meeting these needs could adversely affect development, motivation, and performance.

Beyond the community of family and peers, belongingness has been directly linked to student motivation and engagement within the school (Kunc, 1992; Osterman, 2000). In a study by Goodenow (1993a) belonging and support was demonstrated as having significant effects on motivation and achievement in individual subjects. Levels of

classroom belonging were significantly associated with motivation-related measures indicating values for academic classwork and expectancies for success (Goodenow, 1995). Children who reported feeling involved within the school community were more likely to report a stronger sense of identity, a greater sense of autonomy, a better ability to self-regulate their behavior, a greater tendency to respect authority, with a lesser propensity for engaging in deviant or negative behavior (Johnson, Lutzow, Strothoff, & Zannis, 1995; Kunc, 1992; Osterman, 2000).

While the importance of belongingness has been suggested by many to be critical to the development of cognitive and emotional process of students, research also showed that needs for belongingness were largely disregarded by schools (Kunc, 1992; Osterman, 2000). According to Kunc, schools were more likely to believe that the meeting of emotional needs should or did occur within the home community of family and peers. Students with unmet or greater needs, therefore, might be less likely to experience belongingness within the school community.

Because the fundamental need to belong, and how it is promoted in the schools, effects the climate of the school and the individual students level of motivation for achievement, the next section will review the effects of school climate as it contributes to classroom climate, motivation and achievement.

Contribution of School Climate to Classroom Climate, Achievement, and Motivation

The extent to which a school community promotes belongingness has been demonstrated to affect outcomes in student development, motivation, and achievement (Kunc, 1992; Osterman, 2000). Studies found that schools rated high in the encouragement of student interrelationships, providing for feelings of safety and security,

attention paid to morale, parent and community involvement, and in structure and organization reported less drop out rates, higher attendance records, greater levels of student engagement and motivation, and improved student educational outcomes (Alspaugh, 1998). Alspaugh suggested the significance of school climate was the degree to which policies and practices support or endorse these qualities. The relationship between school climate and student performance and student motivation was strong but indirect, retaining its influence across grades (Fyans & Maehr, 1987).

Directed by policy and practices, the school community, consisting of teachers, students, and administrators, along with individual values and expectations, comprise the school climate. Rather than for their unique style of teaching which may contradict with the traditions within the school, prospective teachers tended to be hired for their congruity with school administrators' expectations (Hamilton, 1983). Therefore, school climate indirectly affects classroom climate through the adopted policies and practices of the teachers. Ellis (1996) proposed that these practices were brought into the classroom and became components of the students' immediate community, the classroom environment.

Along with the promotion of school climate, teachers contribute their own personal characteristics to classroom climate, which impacts student motivation and achievement. To gain a better understanding of the role of the teacher in relation to motivation and achievement, the contributions of teacher characteristics will be examined.

Teacher Contribution to Classroom Climate, Achievement, and Motivation

Classroom climate variables involving teacher characteristics have been described by Chapin and Eastman (1996) as teaching methods, clear goals, and standards, vocational relevance, and appropriate workload. According to Haertel, Walberg, and

Haertel (1981), positive classroom climates enhanced deeper rather than surface learning approaches. A surface approach to learning or reproductive learning has been described as reliance on the routine, memorization of materials. These more traditional approaches to learning allowed the student to recite facts and figures, with little interpretation. Deeper approaches to learning were those in which the teacher prompts the student to make connections of the new material with previous knowledge or with different aspects of that knowledge (Dart, Burnett, & Purdie, 2000). Dart (1998) suggested teachers could promote deep approaches to learning by creating classroom climates that were safe and supportive, with ample opportunities for exploration and experimentation. Clear and structured rules (Keyser & Barling, 1981), predictability and clarity (Anderson, Stevens, Prawat, & Nickerson, 1987), and teacher support (Osterman, 2000) were also found to promote deeper, rather than surface, approaches to learning. Additionally, explicit learning objectives, guided student practice, appropriate instructional pace, frequent assessment and positive feedback (Wang et al., 1993) with frequent opportunities for active engagement and participation (Keyser & Barling, 1981) promoted deeper approaches to learning. These positive classroom climates not only enhanced learning approaches, they were consistently correlated with higher achievement in a variety of educational outcomes (Haertel et al., 1981).

Other characteristics found to impact student success were expectations and behaviors of the teacher (Crohn, 1983) and teacher creativity (Denny & Turner, 1967). Direct influences, such as the frequency and quality of student-teacher interactions, were also found to impact student success (Juarez, 2000;Wang et. al., 1993). Jacobson (2000) suggested that teacher student relationships could promote student motivation and

increase students' values for success through positive rapport and establishing supportive learning environments. In a study by Goodenow (1993a), teacher support was strongly correlated with expectancy and values for student success.

While many studies have examined the role of relationships, other studies have concluded that elements of the instructional style, assignments, and degree of competitiveness promoted within the classroom were key determinants of educational outcomes. In a study involving 3rd and 4th grade students, Anderson and colleagues (1987) demonstrated the importance of the predictability of the task environment. Among his conclusions, he found learning was enhanced when teachers structured the classroom environment in a predictable and comprehensible manner. Specifically, teachers should provide explicit structures of information regarding the predictability, the consistency and relevance of tasks as well as providing students with a sense of control over their outcomes (Anderson et. al., 1987). Orderly and organized classrooms allowed for more emphasis on instruction and less in control, thereby increasing the amount of time spent on the lessons (Proctor, 1984). Other factors affecting teaching and learning included appropriate workload, clear goals, and consistent standards (Townsend & Hicks, 1995).

In addition to these elements of classroom environment, the role of interclass competition was suggested to have an impact on academic success. While in most studies, a cooperative environment has been shown to enhance educational outcomes (Fraser, 1986) and attitudes (Zahn, Kagan, & Widaman, 1986), other studies have suggested that competition, in certain academic areas may, in fact, increase student productivity and learning ability (Dunn & Harris, 2002).

Not only have teacher characteristics been found to contribute to classroom climate, motivation, and achievement, individual student characteristics have been found to mediate the effects of classroom climate on achievement and motivation as well. The next section will be review how the students contribute to classroom climate.

Student Contribution to Classroom Climate in Relation to Motivation and Achievement

Review of the literature suggested each individual brings into the classroom his or her own personal characteristics as well as previous educational history and experiences. Some of these characteristics included their sense of well-being, self-efficacy beliefs (House, 2002; Jackson, 2002), self-concept (Crohn, 1983), sense of belongingness (Goodenow, 1995; Osterman, 2000), as well as their satisfaction within social activities (Townsend & Hicks, 1997) and interpersonal relationships (Osterman, 2000).

Just as students may differ in their personal characteristics, such as interest and knowledge, self-ability, and locus of control, so may their interpretation of the learning environment, which shapes their approach learning (Chapin & Eastman, 1996). For example, in a study of classroom motivation, Greene (1983) found classes containing more motivated students were perceived to have greater involvement, order and organization, and task orientation. Deci, and collleagues (1991) suggested teachers who supported active student engagement with mathematical concepts and who promote personal construction of math ideas may encourage more autonomy and independence in students, thereby increasing intrinsic interest in math.

Students' evaluation of their learning environment was found to be guided by their individual values and expectations for success (Eccles, 1983). Wigfield, and colleagues (1992) found that as early as the second grade, children have developed values for school

activities as well as beliefs about their performance abilities. Although younger children tended to overestimate their abilities (Winfield, 1994) and engaged in tasks based upon personal interest, motivation for engagement was recognized early (Wigfield, Eccles, & Rodriguez, 1994).

Eccles' (1983) model of expectancy-value system assumed that an individual's belief in, and interpretation of, an event were more influential on his behavior than the event itself. According to Eccles and colleagues (1983), the value an individual placed on task engagement related to level of interest, or intrinsic value, how important it was perceived to be, attainment value, and how useful it was perceived to be, utility value. They further suggested that the cost of engaging in a task, which excluded engagement in other, more desirable activities, affected the level of motivation to engage. Additionally, competency beliefs, or how well one predicts performance level, mediated the motivation to engage. From this perspective, students with high expectations and values for success might be more likely to engage in academic tasks with higher motivation to achieve while students with lower expectations and values for success might be more likely to avoid academic tasks, which would result in lower achievement.

Likewise, Townsend and Hicks (1997) found students who reported more social satisfaction reported higher value and lower task cost associated with mathematic and language curricula. Classroom climates that promoted individual goal setting and provided choices for students were judged to be more encouraging by middle school students (Pintrich et al., 1994). Classrooms reporting variations in the use of learning strategies, valued effort, and fostered positive feelings toward learning were found to be more successful in promoting mastery of subject material (Ames & Archer, 1987).

Perceptions of teacher support were positively associated with instructional techniques that featured mastery and learning goals (Wentzel, 1995). Other studies found that the degree to which students' feel they are cared about mediate academic performance (Goodenow 1993b; Haertel 1996; Wentzel 1995).

Although individual values and expectations for success were found to impact students' motivation and achievement, elements in classroom climate were different for boys and girls. Goodenow (1993a) found that teacher support was found to have a stronger association with expectancy and value for girls while boys were more likely to be influenced by peer support. Because of gender differences in motivation, the next section will examine the potential gender differences in perceptions of classroom climate.

Gender Differences in Classroom Climate

Gender differences have been found in classroom climate ratings (Townsend & Hicks, 1995) with girls viewing classroom climate more favorably than boys (Goh & Fraser, 1995). Girls were more likely to favor a cooperative learning atmosphere (Owens & Barnes, 1982) in which positive social interactions provided a means of student support rather than individual competitiveness (Slavin, 1991). Because girls may be more likely to engage in behavior that is consistent with cooperative learning styles (Charlesworth & Dzur, 1987), Gardner, Mason, and Matyas (1989) found they were more likely to benefit from this type of classroom structure than boys. Specifically, in areas of mathematics and language activities, girls' outcomes were more affected by climate factors than boys', with girls having more success in cooperative goal structured environments such as language curriculum (Townsend & Hicks, 1997). Because the domain in which the climate is perceived may mediate successful outcomes in relation to climate classroom, the effects of domains will be considered in the next section.

Domain Differences in Classroom Climate

Fraser (1993) found that classroom environment variables might actually differentiate among different curricula. Different components of classroom climate were found to correlate with success in different academic areas (Moos & Trickett, 1994). Deci, Spiegel, Ryan, Koestner, and Kauffman (1982) suggested teachers who support active student engagement with mathematical concepts and promote personal construction of math ideas may encourage more autonomy and independence in students, thereby increasing intrinsic interest in math. Conversely, a study on the effects of competition upon mathematical achievement determined that competition actually enhances learning in areas of math computation, concepts and applications (Dunn & Harris, 2002). While Dunn and Harris (1998) found no evidence that climate influences mathematical achievement in 4th grade students, Goh and Fraser (1995) not only found consistent associations between climate and outcome, but also found that in areas of mathematics, while boys performed better, girls rated classroom environment more favorably than boys.

The perception of the learning environment may also affect the quality of educational outcomes (Dart, 1998; Fraser, 1986). Providing a caring and supportive environment was determined to be a necessary component in academic success (Juarez, 2000). Positive classroom climates have been associated with higher achievement outcomes for students in schools rated as having more positive climates than those with less positive outcomes (Alspaugh, 1998). For high school chemistry students, classroom climate variables have been accountable for a substantial variance in cognitive and affective outcomes beyond the characteristics of the student (McRobbie &Fraser, 1993). Specific variables in classroom climate, such as class activities, instructor skill, and the

extent of critical demands were found to mediate academic outcomes for students (Hoffman, 1979). In studying the effects of domain differences, however, Wigfield and Eccles, (1992) found these differences change as children grow older. The next section will examine the possible effects of students' development in perceptions of classroom climate.

Developmental Differences in Classroom Climate

While belongingness, family, teacher, and peer support play an important role in an individual's values and expectancies, the impact of these supports diminish with age. Goodenow (1993) discovered a decline in the impact of these factors from 6th grade to 8th grade and concluded that previous external influences on concepts of these constructs may begin to be replaced the more internalized concepts and self-efficacy beliefs. Fyans and Maehr (1987) also reported a shift in influence from family, to school to peer as children aged from 4th to 10th grade. With older students, academic experiences, such as prior knowledge, successes, and failures were found to play an important role in their current perceptions of values for learning as well as how successful they expect to be (Jacobson, 2000). Jacobson, suggested students with previous success in a subject may feel more confident and have a higher sense of self-esteem and self-efficacy, which may support a better expectation of future achievement. Those with negative experiences may feel devalued, reluctant to participate, with less motivation than their counterparts. Therefore, while individual motivation plays an important role in achievement, it may be changeable across grades. These findings suggested the effects of students' perceptions of classroom climate might be susceptible to grade level differences. In order to determine the effects of classroom climate perceptions, however, it must be measurable. The next section reviews scales designed to measure perceptions of classroom climate.

Capturing Classroom Climate

Scales not only differ in terminology, but also on focus, according to the authors' definition of classroom climate (Fraser, 1979; Moos, 1974). According to Moos (1974), climate refers to a group phenomenon relating to the social and psychological atmosphere of any social setting. Within this social climate, there exist four dimensions: Relationships, Personal Development, System Maintenance, and System Change. Relationships refer to the type and intensity of relationships and include teacher-student, student-student, and staff-staff. It reflects the extent to which individuals within the environment are involved, helpful, and supportive as well as the quality of openness within the relationships. Personal Development includes competition with emphasis on academic achievement and describes the basic direction in which personal growth and self-enhancement tend to occur. System Maintenance includes organization and orderliness within the classroom. Rule clarity, teacher consistency, and clarity of expectations are among the factors encompassed in this dimension. System Change refers to the manner and facility of change within the classroom as well as advocated variety within activities and creativity in student thinking. From these basic dimensions, a variety of scales were developed to assess classroom climate. The Classroom Environment Scale (CES) is one assessment scale, developed by Moos, to assess the social climate of the classroom environment in grades 7-12 (Moos & Trickett, 1973). The CES is based upon the four dimensions of climate and focuses on student interest and participation, interclass room relationships, the measurement of support within the environment, emphasis on task completion, the degree of task difficulty, the factors of interclassroom competition, the clarity of rules and expectations, the enforcement of rules and expectations, as well as how the overall environment is organized and managed. In

addition, student contribution to creativity and planning, regarding class activities, is also considered.

Summary

School communities have been found to exert influence upon the classroom in addition to the influences of teachers and students. The policies and practices of the schools have been found to direct how the educational process is addressed within the classrooms. Within the classrooms, teachers have been found to bring unique perspective into the learning environment through teaching philosophy as well as student-teacher interaction. Additionally, each student has been found to enter the classroom with their own expectations and values, competency beliefs, and learning preferences developed as a result of their unique experiences. These perspectives may be different for girls versus boys and may be subject to change in response to academic domain and developmental age. These findings from the literature suggested in order to measure the effects of classroom climate on motivation and achievement, it will be necessary to include the influence of gender and grade differences for this study, as well as students' self-ratings of motivation at the beginning of the school year.

Purpose

The purpose of this study is to examine the relationships among classroom climate, motivation, and achievement. Classroom climate has been described as encompassing all the socio-psychological dimensions of classroom life (Wang et al., 1993). Students in this study were asked to rate their perceptions of mathematics classroom as to the degree of order and organization present in the class as well as how clear and consistent they perceived the rules to be. Motivation has been described as encompassing the expectancy of success and the value placed on that attainment (Wigfield & Eccles, 1992). Students

were asked to rate their levels of motivation in math class at the beginning and end of the year. Achievement was measured in end of year in numerical points, ranging from 0 to 100. Because the literature regarding motivation, achievement, and classroom climate ratings suggested students may vary by gender, age (Fyans & Maehr, 1987; Goodenow, 1993a), and the individual characteristics they bring to the classroom (Biggs, 1993; Chapin & Eastman, 1996), this study attempted to control for these variables.

In past studies, classroom climate ratings were compared to mean grade achievement. To date, little or no research has centered on class grades, in relation to classroom climate ratings. This study will examine the relationship between students' perception of classroom climate with academic outcomes and end of year motivation in mathematics. Specifically, this study proposes:

- Students' higher or more positive ratings of the Order/Organization and Rule Clarity scales of CES (Moos & Trickett, 1973) will predict higher academic outcomes
- Students' higher or more positive ratings Order/Organization and Rule Clarity scales of CES (Moos & Trickett, 1974) will predict end of year motivation

CHAPTER 3
METHODOLOGY

Participants

Data for this study were collected as part of a larger, school-wide case study in a rural middle school (Davis, 2001). The middle school was situated in a predominately agricultural county. Participants included 860 of the 1,100 students in the 6th, 7th, and 8th grades. Of the 860 students, 425 were boys and 435 were girls. Additionally, 45 teachers, including 28 homeroom teachers, also participated. At each grade level, students are divided into two teams of five teachers for their core classes of English, reading, mathematics, social studies and science. Within the larger study, multi-method data were collected simultaneously throughout the year. Survey data were collected at four time points from the students and three time points for the teachers over the 1999-2000 school year.

The purpose of this study is to examine the students' perception of classroom climate as it predicts academic outcome in mathematics in 6th, 7th and 8th grade at time point four, at the end of the school year. Additionally, this study examines the effect of classroom climate perception as it predicts motivation levels at the end of the academic year. For this study, 342 students (N= 169 boys, N=173 girls, N= 81 6th grade, N= 135 7th grade, and N=125 8th grade) were selected on the basis of participation across all time samples.

Measures

Classroom Climate

The Classroom Environment Scale (CES) was developed by Moos and Trickett (1973) to assess students' perceptions of the learning environment in junior and senior high school classrooms, grades 7-12. The development of the CES was based on the theory that there are four basic dimensions of social climate: relationships, personal development, and system maintenance and the physical environment. Each of these dimensions exerts a directional influence on behavior, for example learning and achievement in the classroom. *System Maintenance* measures the extent to which the environment is organized, orderly and clear in expectations. The S*ystem Maintenance* dimension includes the subscales of *Rule Clarity* and *Order and Organization*. *Rule clarity* measures the degree to which the teacher presents clearly defined classroom rules, ensures the students' understanding of these rules, and the consistency with which the teacher enforces these rules. *Order and organization* measures the emphasis on students behaving in and orderly, quiet and polite manner and the overall organization of classroom activities and assignments.

Data for this study were originally collected as part of a larger study encompassing the role of social context on students' motivation, learning, and achievement. *Rule Clarity* and *Order/Organization* were two measures that helped define the properties involved in student-teacher interactions and relationships (Davis & Davis, under review). The standard methods of mathematical instruction are generally organized into presentation then practice of new mathematical concepts in primary and secondary schools. Because of this widely accepted instructional style, mathematical curriculum is found to be most highly correlated with these subscales. Therefore, these two dimensions

were the focus in the assessment of classroom climate. Classrooms rated high on organization and clarity has been found to correlate with better educational outcomes. Therefore, by focusing on these, it may be possible to determine if students' perceptions of classroom climate can predict their level of mathematical achievement.

A shortened form of the CES was administered encompassing these two dimensions, with 10 items measuring the qualities of *Order/Organization* and 10 measuring the qualities of *Rule Clarity*. The 20 item survey included questions such as "*The Math teacher is consistent in dealing with students who break the rules"* and *"Math is well organized"* and was completed across the domain of math as well as the domains of English, social studies, science, and reading. This study focuses on the classroom climate assessment of mathematics.

The test-retest reliability of the CES was determined using 52 students within a 6-week interval. Reliability was reported as .85 for *Order and Organization*, and .72 for *Rule Clarity* (Moos & Trickett, 1994). An internal reliability analysis conducted for each scale in this study revealed an internal reliability of .80 for *System Maintenance*, .65 for *Order and Organization*, and .74 for *Rule Clarity*.

Motivation

To measure domain-specific motivations, items were drawn from the self-efficacy and intrinsic scales of the Motivated Strategies for Learning Questionnaire (MSLQ: Pintrich & DeGroot, 1990). Items on these scales were developed to evaluate students' perceived confidence and ability to perform in middle school and junior high school. For this study, items were slightly altered in order to evaluate domain specific motivations. Questions such as "I *think what we are learning in class is interesting*" were changed to "*I think what we are learning in math class is interesting.*" In addition, three items were

eliminated due to similar wording. Internal consistency estimates for this subscale were reported at r = .89 (9 items) for the expectancy of success and r = .87 for the value of academic success (9 items) scales (Pintrich & DeGroot, 1990). Our findings revealed internal consistency estimates of r = .83 for expectations of success (8 items) and r = .82 for value of success (7 items).

Grades

Grades were measured by numerical points, scored 0 through 100, assigned to the students at the end of the year for mathematics. All grade data were collected at the completion of the study.

Procedures

Passive parental consent for survey participation was obtained for initial recruitment of each student. After notifying parents of the nature of the school-wide project, the purpose of the study, and the types of questions to be asked, parents were asked to respond only if they *did not* want their child to participate. Assent was also obtained from each student.

Students were asked to complete surveys in class at four time points throughout the school year (time 1 = beginning of year, time 2 = midpoint of year, time 3 = early spring, time 4 = end of year). All survey items were rated on a 5-point Likert scale ranging from 1-*Never true* to 5-*Always true.* Students were allowed to complete the surveys at their own pace, with make up sessions arranged for those students who were unable to complete the surveys during class or students who were not present during the original administration times. For this study, time point 1, beginning of the year, and time point 2, end of the year, were considered.

The CES (Moos& Trickett, 1973) abridged form measuring students' perception of classroom climate on the *System Maintenance and Change* dimensions was administered during class at time 3, in the early spring. Data for motivation were collected at time 1, for the dependent variable *motivation 1*, at the beginning of the school year. Data for end of year motivation were collected at time 4, for the dependent variable *motivation 3*. Data on the students' grades were collected at the end of the year.

Analysis

Data from Classroom Climate (Moos & Trickett, 1973) scales were entered into a text file and imported to SPSS (10.0 for Windows). An integrity check was performed to ensure the accuracy of the data. In order to address unavailable data, a correlational relationship was established among each item with all other items within the same grade level and domain. Each item was then examined to compare the strongest correlation of inner-item ratings. For example, ratings for item 1 might be strongest for items 5, 9, 15, and 17 within the 6^{th} grade math surveys. These four strongest correlations were summed and averaged to produce a predicted value for the missing response. Owing to the strength of the correlation selected, these values were considered the best estimate with greater predictability for individual item response. Because unavailable responses were rare, these imputed values were not anticipated to affect the overall outcome of the items rated.

Data files were sorted by descending order using the student identification number with the order of variables listed in the same sort sequence. Initially, data for climate, motivation, and grades were entered into imputed files. Data were merged by identification number per each domain, matching cases listwise. In rare instances, cases with duplicate numbers were identified and cross referenced with their original hard

copy, corrected, and re-entered. Cases that did not have matching cases in the other files were excluded from analysis (e.g. listwise deletion). Once the files were merged, data for math domain were selected for the purpose of this analysis.

Creating Composites

In order to maintain consistent direction of response analysis, items whose wording reflected an opposite direction of strength in perception of quality rating were reverse coded. For example, item 8 on the classroom climate scale asks *Math hardly ever starts on time.* Students responding with a 1 indicate that they always disagree; therefore, the response reflects that math always starts on time. Items such as these were recoded to represent "one" to reflect a strong absence of the quality being perceived and "five" to indicate a strong presence of the quality being perceived. Data for motivation were entered using the same procedure. The actual grade point averages, collected at the end of the year, were entered into an SPSS file for each participant.

Observations with multiple omissions across all three measures were excluded. Coefficient alpha was used as an estimate of reliability. For the System Maintenance scale, the value equaled .80, and for Order/Organization, the value equaled .74.

Using frequency and descriptive statistics, composite data were screened for missing values, normality, and outliers. A composite score was computed for each subscale to create variables for *Order/Organization* and *Rule Clarity* by averaging scores across items.

Statistical Analysis

The independent variable, classroom climate, was examined in relation to the dependent variable of achievement and motivation. A univariate analysis of variance between subjects was run on the classroom climate subscales to evaluate homogeneity of

student ratings of classroom climate across teachers. Results indicated the *Rule Clarity* and *Order/Organization* subscales exhibited differences in teacher ratings. Because this study was interested in patterns of students' perceptions, scores were standardized to control for the influence of actual teacher differences.

For each analysis, two multiple-regression models were examined, one for classroom climate with achievement and one with classroom climate and motivation. The first model included the interactions of gender and grade on *Order/Organization*, *Rule Clarity*, and *motivation 1*. Non-significant interactions were dropped, one at a time, from the regression equation. Analyses were then conducted to examine the linear relationship between the five predictive variables of *Order/Organization*, *Rule Clarity*, beginning of the year *motivation 1*, *gende*r, and *grade level* with end of year *motivation 3* and end of year *achievement* (see appendix A).

For each analysis, an omnibus test of the proportion of explained variation in each response variable by the predictive variable in combination was calculated. Using semi-partial correlations, the unique contribution of each variable was considered.

CHAPTER 4
RESULTS

Descriptive Data

The purpose of this study was to examine the relationships between students' perceptions of classroom climate with end of year motivation in mathematics and students' perceptions of classroom climate with academic outcomes in mathematics. By controlling for student ratings of motivation at the beginning of the year, as well as gender and grade differences, this study proposed:

- Higher ratings of *Order/Organization* and *Rule Clarity* scales of the CES (Moos & Trickett, 1973) will correlate positively with higher academic outcomes.
- Higher ratings of *Order/Organization* and *Rule Clarity* scales of the CES (Moos & Trickett, 1973) will correlate positively with higher ratings for end of year motivation.

Table 1. Means and Standard Deviations

	6th grade		7th grade		8th grade		Total
	Boys	Girls	Boys	Girls	Boys	Girls	
End of Year Motivation	3.94 (.70)	4.01 (.61)	3.76 (.73)	3.65 (.83)	3.46 (.75)	3.58 (.68) (.75)	3.70
End of Year Achievement	85.07 (7.28)	87.08 (7.26)	85.16 (9.77)	86.41 (8.41)	75.89 (13.74)	84.30 (13.16) (11.16)	83.78
Perception of Classroom Order/Organization	2.93 (.45)	3.00 (.49)	3.09 (.51)	2.97 (.56)	2.82 (.67)	3.03 (.54) (.57)	2.97
Perception of Classroom Rule Clarity	3.27 (.57)	3.45 (.58)	1.56 (1.88)	1.46 (1.74)	3.12 (.71)	3.28 (.69) (1.51)	2.57
Baseline Motivation	4.05 (.49)	4.09 (.68)	3.96 (.74)	3.82 (.77)	3.54 (.84)	3.82 (.64)	3.85 (.73)
	N=45	N=36	N=61	N=74	N=62	N=63 N=341	

Motivation

Regarding motivation, this study proposed students' higher ratings of *Order/Organization* and *Rule Clarity* scales of the CES (Moos & Trickett, 1973) would positively correlate with higher self- reported ratings of end of year motivation for mathematics. Data analysis began by testing a full model in Time 1 (baseline) by gender and grade level.

Table 2 displays findings based on the initial model run. This model accounted for 35.8 % of the variance ($F_{(342.9)} = 16.75$, $p<.000$). Table 2 demonstrates interaction of rule clarity by grade to be significant. To teat for interaction effects, post hoc analysis using multiple regression, revealed the effects to be non-significant. Interactions were dropped, yielding a revised model for predicting end of year motivation.

Table 2. Motivation Full Model.

Model	B	*t* value	*p* value	*r*	*R*	*F*	*p*
End of Year Motivation				.599	.358	16.75	.000
Perception of Classroom Order/Organization	0.236	3.474	0.001*				
Perception of Classroom Rule Clarity	0.104	2.238	0.026*				
Gender	-0.112	-0.343	0.732				
Grade	0.241	0.649	0.517				
Baseline Motivation	0.360	5.135	0.000*				
Gender/Order Interaction	-0.415	-1.355	0.176				
Gender/Rule Interaction	-0.046	-0.190	0.849				
Gender/Motivation Interaction	-0.157	-0.483	0.629				
Grade/Order Interaction	-0.294	-0.930	0.353				
Grade/Rule Interaction	0.573	2.135	0.034*				
Grade/Motivation Interaction	0.069	0.238	0.812				

Note. * Denotes significant difference at $p < .05$

The final model for end of year motivation in table 3 explained 35 % of the variance in end of year motivation ($F_{(342,5)} = 30.10$, $p<.000$) .

Table 3 Regression for End of Year Motivation : Final Model

Model	B	*t* value	*p* value	*r*	*R*	*F*	*p*
End of Year Motivation				.592	.350	30.102	.000
Perception of Classroom Order/Organization	0.153	3.278	0.001*				
Perception of Classroom Rule Clarity	0.095	2.116	0.035*				
Gender	-0.450	-1.889	0.060				
Grade	-0.136	-3.009	0.003*				
Baseline Motivation	0.376	5.865	0.000*				
Gender/Baseline Motivation Interaction	0.459	1.886	0.060				

Note. * denotes significance at $p < .05$ *Note*. Gender differences approach significance

As anticipated, a significant positive relationship was also found between end of year motivation and students' ratings of perceptions of classroom *Rule Clarity*, perceptions of classroom *Order/Organization*. These findings suggested students who perceived their classroom as more orderly and organized with fair and explicit rules tended to report higher levels of motivation at the end of the year.

Differences by gender and baseline motivation approached significance ($p = .06$) When comparing gender, these findings suggested boys may have somewhat lower competency beliefs and/or value math less at the beginning of the school year than girls. Differences by gender and end of year motivation approached significance ($p=.06$) with girls reporting higher levels of motivation at the end of the year when comparing across grades. However, when comparing all the boys' and girls' ratings of motivation in middle school mathematics, overall, there were no significant differences (Figure 1).

Lastly, findings revealed significant differences in end of year motivation based on grade level suggesting students report different levels of motivation across the 6th, 7th, and 8th grades. Students in 6th grade reported the highest levels for motivation in mathematics while the 8th grade students reported the lowest level of end of year motivation towards math. This finding supports earlier research that, although values and expectations for math remain constant in relative to rankings of other domain in terms of importance and usefulness, such as reading and English, motivation towards mathematics decline as children grows older (Wigfield et al., 1994).

Achievement

Regarding achievement, this study proposed students' higher or more positive ratings of the *Order/Organization* and *Rule Clarity* subscales of the CES (Moos & Trickett, 1973) would predict higher academic achievement in mathematics at the end of the school year. Data analysis began by testing a full model in Time 1 (baseline) by gender and grade level. Table 4 displays findings based on the initial model run.

Table 4 Regression for Achievement : Initial Model

Model	B	*t* value	*p* value	*r*	*R*	*F*	*p*
End of Year Achievement				0.442	0.196	8.866	0.000
Perception of Classroom Order/Organization	0.172	2.608	0.009*				
Perception of Classroom Rule Clarity	0.089	1.885	0.060				
Gender	0.338	1.032	0.303				
Grade	-0.685	-1.877	0.061				
Baseline Motivation	0.202	2.912	0.004*				
Gender/Order Interaction	-0.149	-0.495	0.621				
Gender/Rule Interaction	-0.036	-0.148	0.882				
Gender/Motivation Interaction	0.002	0.007	0.995				
Grade/Order Interaction	0.291	0.936	0.350				
Grade/Rule Interaction	-0.082	-0.263	0.792				
Grade/Motivation Interaction	0.328	1.142	0.254				

Note. * denotes significance at p < .05 *Note*. Grade differences approach significance

This model accounted for 19.6% of the variance ($F_{(342,10)} = .8.9$, p<.000). Post hoc analysis tests for interaction using multiple regression, dropping each interaction, one at a

time, revealed the effects to be non-significant. Interactions were dropped, yielding a revised model for predicting end of year motivation. The final model predicting end of year motivation, gender, math grades, and baseline motivation with perceptions of *Order/Organization*, *Rule Clarity* is presented in Table 5.

Table 5 Regression for Achievement : Revised Model

Model	B	*t* value	*p* value	*r*	*R*	*F*	*p*
End of Year Achievement				.433	.188	18.836	.000
Perception of Order/Organization	0.168	3.533	0.000*				
Perception of Rule Clarity	0.079	1.756	0.080				
Gender	0.221	4.548	0.000*				
Grade	0.168	3.754	0.000*				
Baseline Motivation	0.151	3.312	0.001*				

Note. * denotes significance at $p < .05$

This model explained 16.8 % of the variance ($F_{(342,4)} = 18.8$, $p<.000$). Findings indicate a significant positive relationship between achievement and students' ratings of *Order/Organization.* Students who perceived the classroom as more structured and organized tended to earn higher grades than students who did not.

A significant negative relationship was found between baseline motivation and achievement. These findings suggested the students who reported lower levels of motivation for math at the beginning of the school year achieved higher grades than those who did not. However, student levels of motivation decline when comparing across grades while achievement improves. When comparing 6th grade students to 8th grade students, motivation levels tend to decline and achievement in mathematics increases. Therefore, when combining grade levels, these findings may suggest the overall rate of decline in motivation is greater than the overall rate of increase in achievement. . However, this study did not address the level of achievement and motivation across grades. The negative relationship is not expected for within grade comparisons

Gender differences were found to be significant for achievement. Girls tended to earn higher grades at the end of the year than boys (Table 1). These findings do not support earlier studies that suggest boys tend to have higher achievement in math for middle school students (Goh & Fraser, 1995).

Lastly, there were significant differences in achievement by grade level. Achievement in 8th grade was significantly lower for boys and significantly higher for girls (Table 1). Because this study did not address the level of math difficulty across grades, future studies are needed to examine the role of grade and math performance in middle school.

CHAPTER 5
DISCUSSION

The purpose of this study was to examine the relationships among classroom climate, motivation, and achievement. Classroom climate has been described as encompassing all the socio-psychological dimensions of classroom life (Wang et.al. 1993). Students in this study were asked to rate their perceptions of mathematics classroom as to the degree of order and organization present in the class as well as how clear and consistent they perceived the rules to be. Motivation is described as encompassing the expectancy of success and the value placed on that attainment (Wigfield & Eccles, 1992). Students were asked to rate their levels of motivation in math class at the beginning and end of the year. Achievement was measured at end of year in numerical points, ranging from 0 to 100. Because the literature regarding motivation, achievement, and classroom climate ratings suggest students may vary by gender, age (Fyans & Maehr, 1987; Goodenow, 1993a), and the individual characteristics they bring to the classroom (Biggs, 1993; Chapin & Eastman, 1996;), this study attempted to control for these variables.

This chapter presents a discussion and interpretation of the results of the study as they relate to previous findings in the area of classroom climate and motivation, as well as the research questions and hypotheses. It also addresses the implications of the findings. The chapter concludes with a discussion of future directions for research and limitations of the current study.

Perceptions of Classroom Climate and Motivation

The first goal of this study was to determine if students who rated perceptions of classroom climate higher on would report higher levels of motivation at the end of the year than students with lower ratings. For end of year motivation levels, results of this study indicated that students who rated classroom climate as higher in *rule clarity* and *order/organization* also tended to report higher levels of motivation at the end of the year. These findings supported the literature, which suggested positive classroom climate promotes students' expectations and values for success.

In this analysis, there were no statistically significant differences between males' and females' ratings of motivation in middle school mathematics. However, while boys reported higher levels of motivation for math at the beginning of the year, girls tended to report higher levels of motivation towards math at the end of the year. Because the literature suggested boys have higher competency beliefs, with higher task values, and greater expectations for success for math (Wigfield & Eccles, 1992), it was expected ratings of motivation for math, boys would report higher ratings at both time points. However, literature also suggested that values and expectations associated with math decline for both boys and girls (Wigfield et. al., 1998). These findings bring interesting questions about gender differences in motivation. While motivation declines for math for girls and boys, these findings suggested the decline might be somewhat more pronounced in males during middle school. Another possibility may be recent trends in math competency suggesting the gender gap in math is narrowing (Townsend & Hicks, 1997). A third possibility may be girls were reported to be more sensitive to classroom climate (Goh & Fraser, 1995). Therefore, girls' declines in competency beliefs, values, and expectations for math may be more responsive to positive classroom climate. Future

studies may wish to address the differential role of gender and motivation as it pertains to middle school mathematics.

Early motivation, as anticipated, was a significant factor in end of year motivation levels for girls and boys across grades. Findings revealed students who entered the classroom with higher expectations and values for success in math reported higher expectations and values for success in math at the end of the year than those who did not.

There were also grade differences in ratings of motivation. In all grades, students who perceived their mathematics class as more orderly and organized tended to achieve higher than those who did not. However, while 6th grade students' perception of rule clarity and fairness did not affect their self-ratings of motivation at the end of the year, students in the higher-grade levels, who rated higher levels of both the *Rule Clarity* and *Order/Organization* factors of classroom climate, expressed higher levels of motivation at the end of the year.

Classroom Climate and Achievement

This second goal of this study was to determine whether students who rated perceptions of classroom climate higher on subscales of *Order/Organization* and *Rule Clarity* would achieve higher grades than students with lower ratings. Results of this study indicated in middle school mathematics, students who perceived the classroom, as being more orderly and organized tended to earn higher grades than students who did not. These findings support earlier findings by Williams and Somers (2001), in which the orderliness of the classroom contributed significantly to test scores in mathematics and language. Overall, students' perceptions of *Rule Clarity*, in which the rules are clearly defined and fairly executed, were not a significant factor in terms of predicting math achievement. These findings suggest that students' perform better in math with a

classroom that is structured with organized lessons. However, students' perceptions of the fairness of rules, how clearly and defined they are, do not predict higher achievement. Middle school students' experiences are reported to become less intimate and more anonymous than elementary school. Eccles, Midgely, and Adler (1984) suggested middle schools to be larger and more impersonal. Therefore, these results suggested students in middle school may be unaware of teacher bias in the enforcement of rules or did not perceive them to be an important component of their individual success.

Findings revealed a negative relationship of students' early ratings of motivation for math achievement. These findings indicated students entering the classroom with higher expectations and values for success for math earned lower grades at the end of the year.

Gender was a factor in achievement, with girls earning higher grades in math than boys. Literature has suggested girls are more sensitive to classroom climate scales and tend to yield higher ratings while males perform better in climates that are more orderly and organized (Goh & Fraser, 1995). Results from this indicated no significant gender differences for ratings of classroom climate but did indicate higher achievement for females over males in end of year math achievement. These results do not support earlier findings which indicated boys have higher achievement in math (Townsend & Hicks, 1997). Reasons for these differences were considered to be a result of declines in motivation for math (Wigfield, & Eccles, 1992), social attitudes reflecting math as a nontraditional female domain, or classroom bias in the promotion of math achievement for girls. One reason for higher achievement for girls in middle school may be a reflection of the change in social values for math. Recent trends in research suggested

the gap in gender differences for math achievement might be narrowing. Another possibility for gender differences in math achievement may be due to girls' sensitivity to classroom climate, which was observed in this study with the increase in girls' motivation for math at the end of the year. Therefore, while in this study, girls and boys were analogous in their perceptions of rule clarity and order/organization, achievement for girls may be more positively effected by positive classroom climates.

Findings did show a difference in middle school students' achievement as they progress to grade levels. These results suggested that students tended to achieve higher grades as they achieved higher-grade levels. One possibility may be students entering middle school tended to have lower performances across domains. Students in the sixth grade were prone to declines in school engagement in a study by Simons-Morton and Crump, (2003). While declines may be influenced by the transition to middle school (Eccles et al., 1993), academic performances were demonstrated to rebound, improving as students' adjusted to their new environment and rose to higher grade levels (Wigfield, Eccles, &Rodriguez, 1998). Because this study did not address differences in math curriculum, reasons for improvement in achievement by grade level might be addressed in future studies.

Implications

In past decades, classroom climate has been established as a salient aspect of student learning and well- being. The construct of classroom climate has been considered a critical factor in students' emotional and intellectual development. Gottfredson and Gottfredson (1989) explored the positive influential role of safety, morale, personal security, and classroom orderliness on academic performance, attendance, and dropout rates among elementary, middle, and high schools. Studies indicated that establishing a

positive classroom climate increased attendance and student involvement (Mayer & Mitchell, 1993; DeYoung, 1977). Creation of classrooms with a positive climate has been indicated as a buffer to many current problems in the academic arena. Mayer and Mitchell (1993) suggested that creating positive classroom climates in which positive feedback, structured tutoring programs, with clearly defined rules resulted in reducing dropout rates, increasing attendance and increasing on task behavior. Other variables in the learning environment impacting academic success included feelings of support within the classroom, teacher availability, and feelings of belonging, safety and caring (Hayes, Ryan, & Zeller, 1994) which affected the students' perception of the quality of life within the classroom (Dunn & Harris, 1998).

Biggs (1993) suggested while students may bring a preferred approach into the classroom, but that the classroom climate can hinder or promote their preferences. These approaches have been found to determine whether the student learns on a superficial level or achieves mastery. Findings of this study indicated students with higher ratings of classroom climate performed better and were more motivated than those who did not. Interesting questions are: are better students more sensitive to classroom climate or do students do students perform better because they are better able to identify elements of the classroom that assist with learning?

Because perceptions of classroom climate have been significantly associated with higher achievement and motivation in this study, implications for School Psychology are many. First, classroom climate scales may be used to understand the experience of the individual within the classroom. In assessing the individual, it will be helpful to gain an understanding of the student within his classroom. Using classroom climate scales as an

assessment tool provides an opportunity to assess students' perception these experiences. Using these results may help design better interventions within the classroom to improve students' achievement outcomes. Additionally, just as children may be explicitly trained in social skills to recognize social cues, students at risk for academic failure may benefit with explicit training in recognizing classroom supports that may be obscure to students with low ratings of classroom climate. Students' with lower ratings may then be able to benefit from positive classroom climates.

Second, because the positive effects of classroom climate have been demonstrated in this study to be related to students' achievement and motivation, teachers may find having structured and organized lesson plans, with fair and consistent enforcement of rules may improve student learning. With current emphasis on accountability for teachers regarding students' educational success, teachers may find that promoting a positive classroom climate will increase productivity through high student motivation and improve academic grades through enhanced student learning. Additionally, teachers who implement classroom practices designed to promote a positive classroom climate may use the climate assessment as a means of assessing the success of the programs or as a means of facilitating changes within the classroom.

Finally, the assessment of perceptions in classroom climate may help understand the changes in students' perceptions of their educational experiences. For example, in this study, students' perceptions of *Order/Organization* were associated with higher motivation and higher achievement. *Rule clarity*, however, was associated with higher motivation but did not effect achievement. Closer examination of the data revealed differences in effects of rule clarity on achievement for different grade levels. These

results indicated developmental differences in the effects of classroom climate. By assessing classroom climate as a means of understanding developmental change, a greater understanding of students' needs within the classroom may be achieved in order to improve academic outcomes.

Limitations and Future Studies

Findings of this study revealed perceptions of classroom climate to be significantly associated with higher achievement and higher motivation levels in middle school mathematics students. Because this study involved a large sample of middle school students, findings may generalize to other middle school students. Additionally, because this study controlled for gender, grade level and initial levels of motivation, the impact of classroom climate on achievement and end of year motivation may be more clearly indicated. Therefore, although students' enter the classroom with values and expectations for success in mathematics, the classroom experience relating to positive classroom climates may be important for student success.

Although the sample for this study was large, a limitation of this study might be the sample was taken from a predominantly white, rural middle school. Research has demonstrated the effects of positive classroom climates in rural middle schools were analogous to racially mixed urban middle schools. However, future studies may wish to replicate these findings to determine if actual grade achievement and motivation levels can be predicted by classroom climate in urban schools.

Another limitation was the focus of this research, which did not include perceptions and ratings from other academic domains. Findings in this study may not generalize to domains where subscales of classroom climate of *Rule Clarity* and *Order/Organization* are not highly correlated. Research has indicated positive effects for

classroom climates rated high on scales of *Order/Organization* and rule clarity in all domains (Juarez, 2000). However, future studies may wish to replicate the predictive role of classroom climate on achievement and motivation in other domains.

A final limitation in the focus of this study was it sought to examine the predictive quality of positive classroom climate for middle school students. Because findings indicated different effects of ratings of *Rule Clarity* for 6th grade, future studies may wish to examine classroom climate for each grade, separately, to determine if the effects of classroom climate are stable across grade level.

Future studies are needed to determine the predictive effects of positive classroom climate as it pertains to individual student achievement and self-ratings of motivation in elementary schools. Because initial levels of motivation are found to be associated with previous classroom experiences, promoting positive classroom climates early may help students develop higher motivation for academic engagement. Additionally, understanding the role of classroom climate may facilitate changes within the classroom that promote learning mastery. With the current emphasis on educational accountability, higher achievement outcomes associated with positive classroom climates are promising.

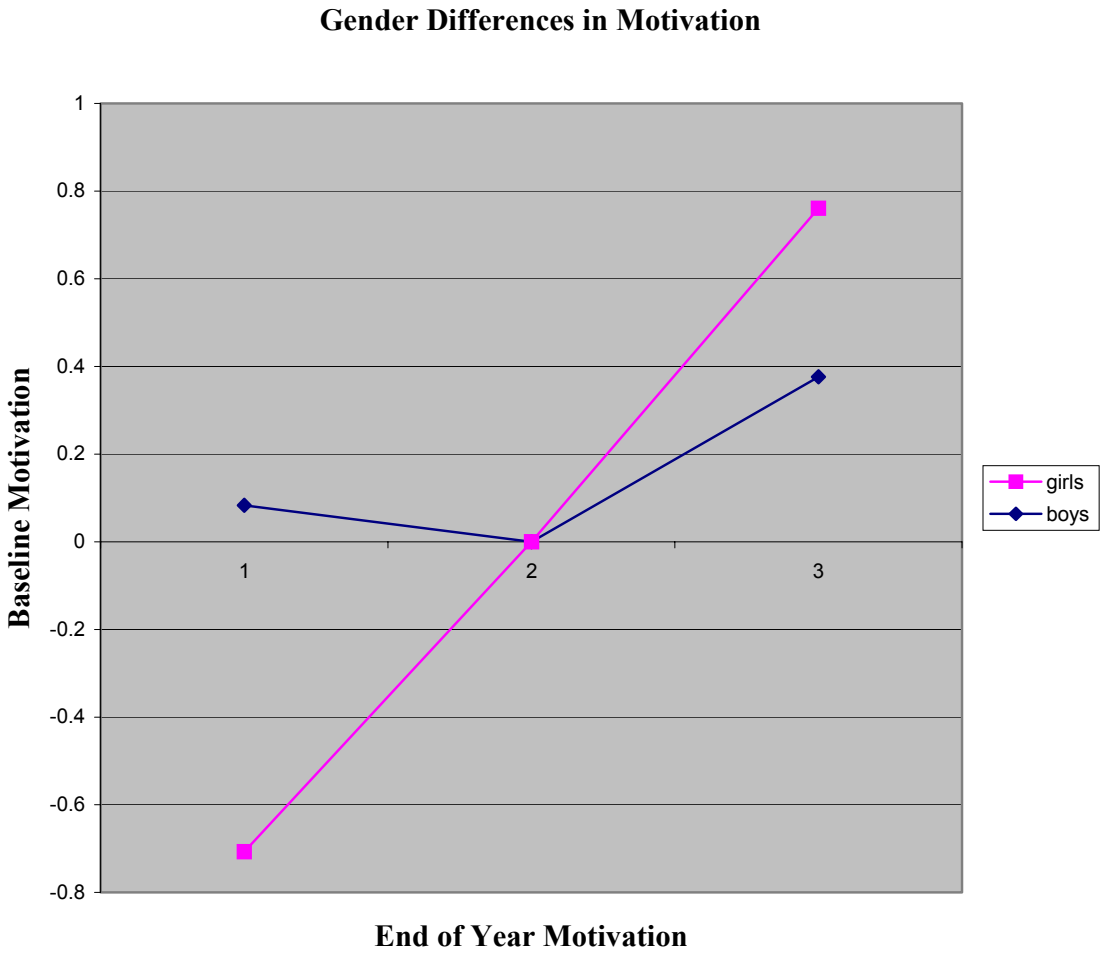

Figure 1. Baseline Motivation

APPENDIX
REGRESSION EQUATIONS

Multiple Regression Equations

How much is motivation predicted by classroom climate, controlling for gender, grade, and initial motivation ?

Y_M = Motivation

$$Y_M = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6(X_3X_1) + b_7X_7(X_3*X_2) + b_8X_8(X_3*X_5) + b_9X_9(X_4*X_1) + b_{10}X_{10}(X_4X_2) + b_{11}X_{11}(X_4X_5)$$

X_1 = Classroom climate : order/ organization
X_2 = Classroom climate: rule clarity
X_3 = gender
X_4 = grade
X_5 = motivation time 1
X_6 = gender * order/organization
X_7 = gender * rule clarity
X_8 = gender * motivation
X_9 = grade* order
X_{10} = grade*rules
X_{11}= grade*motivation

Omnibus Test of Predictive Variables for Motivation Full Model

(k = 11)
Sample Size:

H_0 : $\mathbf{R^2}\ (Y_M/X_1X_2X_3X_4\ X_5X_6\ X_7X_8\ X_9X_{10}\ X_{11}) = 0$

$$F_{M\,7} = \frac{\mathbf{R^2}\ (Y_A/X_1X_2X_3X_4\ X_5X_6\ X_7X_8\ X_9X_{10}\ X_{11})}{(1-\mathbf{R^2}\ (Y_M/X_1X_2X_3X_4X_5X_6\ X_7X_8\ X_9X_{10}\ X_{11})\ /\ (N - k\text{-}1))}$$

Tests of Interaction

$H_0 : \mathbf{R^2} (Y_M/X_1X_2X_3X_4\ X_5X_6\ X_7X_8\ X_9X_{10}\ X_{11}) = 0$

$$F_M = \frac{\mathbf{R^2}\ (Y_m/X_1X_2X_3X_4\ X_5X_6\ X_7X_8\ X_9X_{10}\ X_{11})}{(1- \mathbf{R^2}\ (\ Y_M/X_1X_2X_3X_4X_5X_6\ X_7X_8\ X_9X_{10}\ X_{11}) / (\ N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_M/X_1X_2X_3X_4\ X_5X_6\ X_7X_8\ X_9X_{10}) = 0$

$$F_M = \frac{\mathbf{R^2}\ (Y_m/X_1X_2X_3X_4\ X_5X_6\ X_7X_8\ X_9X_{10})}{(2- \mathbf{R^2}\ (\ Y_M/X_1X_2X_3X_4X_5X_6\ X_7X_8\ X_9X_{10}\ ) / (\ N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_M/X_1X_2X_3X_4\ X_5X_6\ X_7X_8\ X_9\ X_{11}) = 0$

$$F_M = \frac{\mathbf{R^2}\ (Y_A/X_1X_2X_3X_4\ X_5X_6\ X_7X_8\ X_9\ X_{11})}{(1- \mathbf{R^2}\ (\ Y_M/X_1X_2X_3X_4X_5X_6\_X_7X_8\ X_9\ X_{11}) / (\ N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_M/X_1X_2X_3X_4\ X_5X_6\ X_7X_8\ X_{10}\ X_{11}) = 0$

$$F_M = \frac{\mathbf{R^2}\ (Y_m/X_1X_2X_3X_4\ X_5X_6\ X_7X_8\ X_{10}\ X_{11})}{(3- \mathbf{R^2}\ (\ Y_M/X_1X_2X_3X_4X_5X_6\ X_7X_8\ X_{10}\ X_{11}) / (\ N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_M/X_1X_2X_3X_4\ X_5X_6\ X_7\ X_9X_{10}\ X_{11}) = 0$

$$F_M = \frac{\mathbf{R^2}\ (Y_m/X_1X_2X_3X_4\ X_5X_6\ X_7\ X_9X_{10}\ X_{11})}{(4- \mathbf{R^2}\ (\ Y_M/X_1X_2X_3X_4X_5X_6\ X_7X_8\ X_9X_{10}\ X_{11}) / (\ N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_M/X_1X_2X_3X_4\ X_5X_6\ X_8\ X_9X_{10}\ X_{11}) = 0$

$$F_M = \frac{\mathbf{R^2}\ (Y_m/X_1X_2X_3X_4\ X_5X_6\ X_8\ X_9X_{10}\ X_{11})}{(5- \mathbf{R^2}\ (\ Y_M/X_1X_2X_3X_4X_5X_6\ X_8\ X_9X_{10}\ X_{11}) / (\ N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_M/X_1X_2X_3X_4\ X_5\ X_7X_8\ X_9X_{10}\ X_{11}) = 0$

$$F_M = \frac{\mathbf{R^2}\ (Y_m/X_1X_2X_3X_4\ X_5\ X_7X_8\ X_9X_{10}\ X_{11})}{(6- \mathbf{R^2}\ (\ Y_M/X_1X_2X_3X_4X_5\ X_7X_8\ X_9X_{10}\ X_{11}) / (\ N - k\text{-}1))}$$

Omnibus Test of Predictive Variables for Motivation Revised Model

($k = 6$)

H_0 : $\mathbf{R^2}\ (Y_M/X_1X_2X_3X_4\ X_5X_8) = 0$

$$F_M = \frac{\mathbf{R^2}\ (Y_A/X_1X_2X_3X_4\ X_5X_8)}{(1-\mathbf{R^2}\ (\ Y_M/X_1X_2X_3X_4X_5X_8\ )\ /\ (\ N - k\text{-}1))}$$

Tests of Individual Coefficients:

$H_0 : B_i = 0$, if í=1

$$T_{Xi} = \frac{\mathbf{R^2}\ (Y_M/X_1X_2X_3X_4\ X_5) - \mathbf{R^2}\ (Y_M/X_2X_3X_4\ X_5)}{(1-\mathbf{R^2}\ (Y_M/X_1X_2X_3X_4\ X_5\ )\ /\ (\ N - k\text{-}1))}$$

Calculate Semi-Partial R^2

H_0: (Y_M (X_1/ $X_2X_3X_4X_5\ X_8$)) = 0

$$F_A = \frac{\mathbf{R^2}\ (Y_M/\ X_1X_2X_3X_4\ X_5\ X_8) - \mathbf{R}\ (X_1/\ X_2X_3X_4\ X_5\ X_8\ )}{(1-\mathbf{R^2}\ (\ Y_M/\ X_1X_2X_3X_4\ X_5\ X_8\ )\ /\ (\ N - k\text{-}1))}$$

H_0: (Y_M (X_2/ $X_1X_3X_4\ X_5\ X_8$)) = 0

$$F_M = \frac{\mathbf{R^2}\ (Y_M/\ X_1X_2X_3X_4\ X_5\ X_8\ ) - \mathbf{R^2}\ (X_2/\ X_1X_3X_4\ X_5\ X_8\ )}{(1-\mathbf{R^2}\ (\ Y_M/\ X_1X_2X_3X_4\ X_5\ X_8)\ /\ (\ N - k\text{-}1))}$$

H_0: (Y_M (X_3/ $X_1X_2X_4\ X_5\ X_8$)) = 0

$$F_M = \frac{\mathbf{R^2}\ (Y_M/\ X_1X_2X_3X_4\ X_5\ X_8) - \mathbf{R^2}\ (X_3/\ X_1X_2X_4\ X_5\ X_8\ )}{(1-\mathbf{R^2}\ (\ Y_A/\ X_1X_2X_3X_4\ X_5\ X_8)\ /\ (\ N - k\text{-}1))}$$

H_0: (Y_M (X_4/ $X_1X_2X_3$ X_5 X_8) = 0

$$F_M = \frac{\mathbf{R^2}\ (Y_M/\ X_1X_2X_3X_4\ X_5\ X_8\ ) - \mathbf{R^2}\ (X_4/\ X_1X_2X_3\ X_5\ X_8\ )}{(1 - \mathbf{R^2}\ (\ Y_M/\ X_1X_2X_3X_4\ X_5) / (\ N - k\text{-}1))}$$

H_0: (Y_M (X_5/ $X_1X_2X_3$ X_4 X_8) = 0

$$F_M = \frac{\mathbf{R^2}\ (Y_M/\ X_1X_2X_3X_4\ X_5\ X_8) - \mathbf{R^2}\ (X_5/\ X_1X_2X_3\ X_4\ X_8\ )}{(1 - \mathbf{R^2}\ (\ Y_M/\ X_1X_2X_3X_4\ X_5\ X_8) / (\ N - k\text{-}1))}$$

H_0: (Y_M (X_8/ $X_1X_2X_3$ X_4 X_5) = 0

$$F_M = \frac{\mathbf{R^2}\ (Y_M/\ X_1X_2X_3X_4\ X_5\ X_8) - \mathbf{R^2}\ (X_8/\ X_1X_2X_3\ X_4\ X_5\ )}{(1 - \mathbf{R^2}\ (\ Y_M/\ X_1X_2X_3X_4\ X_5\ X_8) / (\ N - k\text{-}1))}$$

Multiple Regression Equations

How much is achievement predicted by classroom climate given gender, grade, and motivation ?

Y_A = Classroom Achievement

$$Y_A = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6\ (X_4{*}X_1) + b_7X_7(X_4{*}X_2) + b_8X_8(X_4X_3) + b_9X_9\ (X_5X_1) + b_{10}X_{10}(X_5X_2) + b_{11}X_{11}(X_5X_3)$$

X_1 = Classroom climate : order/ organization (smorder)
X_2 = Classroom climate: rule clarity (smrules)
X_3 = motivation time 1 (mot1)
X_4 = gender
X_5 = grade
X_6 = gender * order/organization
X_7 = gender * rule clarity
X_8 = gender * motivation
X_9 = grade* order
X_{10} = grade* rules
X_{11} = grade* motivation

Omnibus Test of Predictive Variables for Achievement Revised Model

($k = 11$)

$H_0 : \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{10}X_{11}) = 0$

$$F_A = \frac{\mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{10}X_{11})}{(1- \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{10}X_{11}) / (N - k\text{-}1))}$$

Tests of Interaction

$H_0 : \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{10}X_{11}) = 0$

$$F_A = \frac{\mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{10}X_{11})}{(1- \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{10}X_{11}) / (N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{10}) = 0$

$$F_A = \frac{\mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{10})}{(1- \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{10}) / (N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{11}) = 0$

$$F_A = \frac{\mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{11})}{(1- \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_9X_{11}) / (N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_{10}X_{11}) = 0$

$$F_A = \frac{\mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_{10}X_{11})}{(1- \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_8X_{10}X_{11}) / (N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_9X_{10}X_{11}) = 0$

$$F_A = \frac{\mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_9X_{10}X_{11})}{(1- \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6X_7\ X_9X_{10}X_{11}) / (N - k\text{-}1))}$$

$H_0 : \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6\ X_8X_9X_{10}X_{11}) = 0$

$$F_A = \frac{\mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6\ X_8X_9X_{10}X_{11})}{(1- \mathbf{R^2} (Y_A/X_1X_2X_3X_4\ X_5X_6\ X_8X_9X_{10}X_{11}) / (N - k\text{-}1))}$$

H_0 : $\mathbf{R^2}\ (Y_A/X_1X_2X_3X_4\ X_5X_7\ X_8X_9X_{10}X_{11}) = 0$

$$F_A = \frac{\mathbf{R^2}\ (Y_A/X_1X_2X_3X_4\ X_5X_7\ X_8X_9X_{10}X_{11})}{(1-\ \mathbf{R^2}\ (Y_A/X_1X_2X_3X_4\ X_5X_7\ X_8X_9X_{10}X_{11}) / (N - k\text{-}1))}$$

Omnibus Test of Predictive Variables for Achievement Revised Model

($k = 5$)

H_0 : $\mathbf{R^2}\ (Y_A/X_1X_2X_3X_4\ X_5) = 0$

$$F_A = \frac{\mathbf{R^2}\ (Y_A/X_1X_2X_3X_4\ X_5)}{(1-\ \mathbf{R^2}\ (Y_A/X_1X_2X_3X_4\ X_5) / (N - k\text{-}1))}$$

Test of Individual Coefficients:

$H_0 : B_i = 0$, if í=1

$$T_{Xi} = \frac{\mathbf{R^2}\ (Y_A/\ X_1X_2X_3X_4\ X_5) - \mathbf{R^2}\ (Y_A/\ X_2X_3X_4\ X_5)}{(1-\ \mathbf{R^2}\ (Y_A/\ X_1X_2X_3X_4\ X_5) / (N - k\text{-}1))}$$

$H_0 : B_2 = 0$

$$F_A = \frac{\mathbf{R^2}\ (Y_A/\ X_1X_2X_3X_4\ X_5) - \mathbf{R^2}\ (Y_A/\ X_1X_3X_4\ X_5)}{(1-\ \mathbf{R}\ (Y_A/\ X_1X_2X_3X_4\ X_5) / (N - k\text{-}1))}$$

$H_0 : B_3 = 0$

$$F_A = \frac{\mathbf{R^2}\ (Y_A/\ X_1X_2X_3X_4\ X_5) - \mathbf{R^2}\ (Y_A/\ X_1X_2X_4\ X_5)}{(1-\ \mathbf{R}\ (Y_A/\ X_1X_2X_3X_4\ X_5) / (N - k\text{-}1))}$$

Calculate Semi-Partial R

H_0: (Y_A (X_1/ $X_2X_3X_4\ X_5$)) = 0

$$F_A = \frac{\mathbf{R^2}\ (Y_A/\ X_1X_2X_3X_4\ X_5) - \mathbf{R^2}\ (X_1/\ X_2X_3X_4\ X_5)}{(2-\ \mathbf{R}\ (\ Y_A/\ X_1X_2X_3X_4\ X_5) / (N - k\text{-}1))}$$

H_0: (Y_A (X_2/ $X_1X_3X_4\ X_5$)) = 0

$$F_A = \frac{\mathbf{R^2}\ (Y_A/\ X_1X_2X_3X_4\ X_5) - \mathbf{R^2}\ (X_2/\ X_1X_3X_4\ X_5)}{(2 - \mathbf{R^2}\ (\ Y_A/\ X_1X_2X_3X_4\ X_5X_6X_7) / (\ N - k\text{-}1))}$$

H_0: (Y_A (X_3/ $X_1X_2X_4\ X_5$)) = 0

$$F_A = \frac{\mathbf{R^2}\ (Y_A/\ X_1X_2X_3X_4\ X_5) - \mathbf{R^2}\ (X_3/\ X_1X_2X_4\ X_5)}{(2 - \mathbf{R^2}\ (\ Y_A/\ X_1X_2X_3X_4\ X_5) / (\ N - k\text{-}1))}$$

H_0: (Y_A (X_4/ $X_1X_2X_3\ X_5$)) = 0

$$F_A = \frac{\mathbf{R^2}\ (Y_A/\ X_1X_2X_3X_4\ X_5) - \mathbf{R^2}\ (X_4/\ X_1X_2X_3\ X_5)}{(1 - \mathbf{R^2}\ (\ Y_A/\ X_1X_2X_3X_4\ X_5) / (\ N - k\text{-}1))}$$

H_0: (Y_A (X_5/ $X_1X_2X_3\ X_4$)) = 0

$$F_A = \frac{\mathbf{R^2}\ (Y_A/\ X_1X_2X_3X_4\ X_5) - \mathbf{R^2}\ (X_5/\ X_1X_2X_3\ X_4)}{(1 - \mathbf{R^2}\ (\ Y_A/\ X_1X_2X_3X_4\ X_5) / (\ N - k\text{-}1))}$$

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BIOGRAPHICAL SKETCH

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