The Impact of School Climate on Student Achievement in the Middle Schools of the Commonwealth of Virginia: A Quantitative Analysis of Existing Data

By David Alexander Bergren

B.A. in English Literature, May 1992, Virginia Tech
M.A. in English Literature, January 1995, Saint Louis University
Ed.S. in Educational Leadership, December 2004, The George Washington University

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Linda K. Lemasters
Associate Professor of Education Administration

The Graduate School of Education and Human Development of The George Washington University certifies that David Alexander Bergren has passed the Final Examination for the degree of Doctor of Education as of February 21, 2014. This is the final and approved form of the dissertation.

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David Alexander Bergren

Dissertation Research Committee

Linda K. Lemasters, Associate Professor of Education Administration, Dissertation Director

Sharon A. Dannels, Associate Professor of Educational Leadership, Committee Member

Eugene F. Soltner, Principal, Great Neck Middle School, Committee Member

Dedication

For Claire, Charlotte, and Caroline, my amazing daughters. I can only hope to inspire you as much as you inspire me.

Acknowledgments

First, thank you to my chairperson, Dr. Linda Lemasters. I have no doubt I have been a difficult student, but you took me on and stuck with me anyway. You were the first person I met at George Washington, and I am thankful you are with me at the end of my twelve year journey there. Thank you also to Dr. Sharon Dannels, who similarly agreed to work with me despite a tremendous workload. Your incisive feedback enriched my thinking and my document immeasurably.

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Abstract of the Dissertation

The Impact of School Climate on Student Achievement in the Middle Schools of the Commonwealth of Virginia: A Quantitative Analysis of Existing Data

This quantitative study was designed to be an analysis of the relationship between school climate and student achievement through the creation of an index of climate-factors (SES, discipline, attendance, and school size) for which publicly available data existed. The index that was formed served as a proxy measure of climate; it was analyzed through both a hierarchical clustering method and a multiple regression.

The data used for the study was drawn from a sample of 335 middle schools in the Commonwealth of Virginia, and student achievement was measured using pass percentage rates for each school on the Virginia SOL tests in each of the four tested content areas. Through analysis of the data generated through both the cluster analysis and the multiple regression process, a clearer picture of the relationship between school climate and student achievement was revealed. Five clusters of schools emerged from the cluster analysis, ranging from highly negative to highly positive in terms of climate. Findings indicated that for each of the four core content areas, there was a significant difference in the mean achievement of each cluster; these findings supported the general hypothesis of the study that as climate becomes more positive student achievement rises. Further, the multiple regression analysis supported the findings of the cluster analysis. With regard to the variables used as climate factors, both the cluster analysis and the multiple regression analysis showed that school size had the least impact on achievement whereas SES had the greatest impact. In both analyses, the climate factors reflected a more significant relationship to student achievement when examined collectively.

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Chapter 1

Introduction

Overview

In his book *The Global Achievement Gap*, Wagner (2008) both noted an impending shift in the priorities of American education and issued a call to action for administrators and teachers to change the focus of their work to prepare students for success in a rapidly changing 21st-century world. He lamented the current culture of the education profession, stating,

> We have no clear standards for what is good practice in our work—no standards for what is effective teaching or leadership…as educators we work alone, all day, every day. Lacking both standards of practice and colleagues from whom we can learn, we must try to figure out how to be competent teachers or leaders all by ourselves. (Wagner, 2008, p. 154)

Despite the efforts of the American accountability movement to ensure that all students are better prepared for success in the global marketplace, Wagner noted that little had changed in the skills with which students are actually equipped by the time they leave American schools.

Despite the best intentions of an accountability movement, which gained initial momentum in 1983 with the publication of *A Nation at Risk* (National Commission on Excellence in Education) and which over the last decade has become the primary touchstone of education following the passage of the No Child Left Behind Act (NCLB), American students have continued to lose ground with their international counterparts just as the American business community has increased its pressure on American schools to better prepare students for the workplace (Friedman, 2005; Wagner, 2008). Wagner stated, "Authority and accountability in education—from state, to district, to school, to

individual classroom—are very much top-down and one-way and, as such, create a culture of compliance. But it is a culture that, surprisingly, doesn't penetrate very deeply" (Wagner, 2008, p. 155).

Although schools across the nation have both struggled with and made significant progress toward meeting the demands of Adequate Yearly Progress (AYP) as outlined in NCLB, Wagner noted that the accountability systems developed to meet those demands "are primitive and do not yet measure the skills that matter" (Wagner, 2008, pp. 156-157). Many states across the nation, including Virginia, have received waivers from the requirements of NCLB but have done so only on the condition that each state's accountability system meet federally approved guidelines, thereby ensuring that high stakes remain in place. The Commonwealth of Virginia uses federally approved Annual Measurable Objectives (AMO) to accredit schools (VDOE, 2012). Wagner did note, however, that those same accountability systems were "beginning to have a disruptive influence on old established patterns" (Wagner, 2008, p. 157). One positive outcome of the accountability movement is that it has begun to break down longstanding attitudes and practices that have been the hallmark of American education, thereby forcing administrators and teachers to rethink their practice:

> Teachers cannot figure out all by themselves how to get *all* students to be proficient, and administrators, working alone, do not know how to create a system where *all* their teachers improve continuously. Indeed, no one could solve these problems working alone. The challenges are too complex. (Wagner, 2008, p. 157)

The complexity of the challenges facing educational leaders today is directly related to the heart of school culture and climate. Wagner (2008) has identified the crossroads at which American education stands; it is imperative that schools transform

their conceptions of how and what teachers must teach, as well as how and what students must learn. The issue of transforming education is beyond the scope of a single study, but without consciously and carefully working to transform the cultures and climates of their schools, educational leaders will not be successful (Smith, 2005). Culture and climate form the framework through which all educational reform will either succeed or fail.

In this regard, the researcher of this quantitative study examined the relationship between climate and student achievement in Virginia middle schools by replicating a study conducted by Smith (2005), who examined the relationship between climate and student achievement in Virginia at the division level. Using Hoy and Hannum's (1997) theory of organizational health as a framework, the researcher identified factors for which data had been collected related to the health, also described as climate, of a school, and used those factors to evaluate the climates of individual schools on a climate index (CI). Based on the CI, a hierarchical cluster analysis was completed using achievement data drawn from School Report Cards. Additionally, the researcher conducted a multiple regression analysis to compare the results with those of the hierarchical cluster analysis. An examination of the results determined the extent to which there was a relationship between climate and achievement in each school.

Statement of the Problem

Student performance on the Virginia Standards of Learning (SOL) tests was used to measure student achievement; achievement scores served as the basis for school accreditation. At the middle school level, students in grades six, seven, and eight are expected to pass with a proficient score in English–reading, mathematics, history–social

science, and science. Accreditation status for the 2011-2012 school year was based on the test results from the 2010-2011 school year. For a school to be accredited, the pass-percentage rate in each of the four core content areas must meet or exceed 70%.

Similarly, student performance on Virginia SOL tests serves as the basis for federal accreditation. Prior to 2012-2013, schools were measured by the federal standards of Adequate Yearly Progress (AYP). AYP status for 2011-2012 was based on 2010-2011 results. For a school to meet AYP, students in each of seven subgroups—all, Caucasian, African American, Hispanic, economically disadvantaged, limited English proficient (LEP), and special education—must pass at a rate of 86% for reading and 85% for mathematics. Schools must also meet measures for student participation. Schools in which specific subgroups do not meet the benchmarks can meet AYP by showing improvement over the previous year.

In the Commonwealth of Virginia, the VDOE has emphasized standardized testing, developing the Virginia SOL tests, which are used to test students in Grades 3 through 12. The performance of students on the SOL tests currently serves as the primary vehicle through which schools may document student achievement and demonstrate their effectiveness. It is on the basis of student performance on the SOL tests, established in 1995, that schools are evaluated for both state accreditation and federal accreditation under NCLB (Smith, 2005).

For the school year 2011-2012, VDOE rated each school's accreditation status according to one of four designations: fully accredited, provisionally accredited, accredited with warning, or accreditation denied. Table 1 illustrates the four categories of accreditation status, the number of schools for each accreditation category, and the

percentage of schools for each accreditation category. Only those schools that participated in the Virginia SOL tests have been included.

Table 1. *Virginia School Accreditation Ratings for School Year 2011-2012*

Category	Number of schools	Percent of schools
Fully accredited	1,768	96%
Accredited with warning	30	2%
Accreditation denied	2	<1%
Provisionally accredited	30	2%

Students in Grades three, five, six, seven, and eight take grade-level SOL tests in reading, writing, mathematics, social studies, and science. High school students take several of 12 end-of-course (EOC) SOL tests; they must demonstrate proficiency on a certain number of the tests to earn the requisite number of verified credits required for graduation. The number of required verified credits varies based on the type of diploma a student is seeking, with an advanced diploma requiring the highest number of verified credits (VDOE, 2009b). VDOE tracks the individual accreditation status of each school within the commonwealth. The number of fully accredited schools during the 2010-2011 school year was 1,768, which represented 96% of schools in the commonwealth, a vast majority (VDOE, 2011a).

The accreditation ratings of Virginia schools demonstrate significant improvement from year to year, and with 96% of schools achieving accreditation for 2010-2011, the ratings seem impressive. The accreditation benchmark for achieving accreditation, however, was only 70% for each content area for 2010-2011, and accreditation was based on the achievement of students as a whole (VDOE, 2009b). As

such, accreditation is an easier designation for schools to achieve than AYP, which for 2010-2011 required schools to meet a benchmark of 85% in mathematics and 86% in reading for each subgroup of students identified by AYP, including overall students, Caucasian students, African American students, Hispanic students, disabled students, economically disadvantaged students, and limited English students. Table 2 illustrates the two levels of AYP status and provides a summary of how Virginia schools fared for 2011-2012 (the rating is based on achievement data from 2010-2011) (VDOE, 2011b). Table 3 illustrates the two levels of AYP status for Virginia school divisions.

Table 2. *Virginia Statewide AYP for School Year 2011-2012 (Schools)*

Status	Number of schools	Percent of schools
Made AYP	701	38%
Did not make AYP	1,124	61%

Table 3. *Virginia Statewide AYP for School Year 2011-2012 (Divisions)*

Category	Number of divisions	Percent of divisions
Made AYP	4	4%
Did not make AYP	128	97%

According to the data presented in Tables 2 and 3, schools and divisions in Virginia have a more difficult time making AYP than state accreditation, and as the benchmarks rise each year (e.g., the benchmarks for 2012-2013 based on 2011-2012 achievement data were 85% for mathematics and 86% for reading), it is increasingly likely the number of schools and divisions not meeting federal accreditation will increase. The difficulty for

schools can be accounted for by the focus on subgroups of students and the higher benchmarks. Even as the Virginia has been allowed by the federal government to replace AYP with state developed Annual Measurable Objectives (AMO), a school that misses even one benchmark will not meet the AMOs (e.g., a school that demonstrates success for all students but falls short for economically disadvantaged students in mathematics will not make federal accreditation). Though this study does not use accreditation, AYP, or AMOs as variables—as dichotomous variables, they were not appropriate for use in a cluster analysis—it is important to recognize the high stakes student achievement on the Virginia SOL tests have for schools throughout the Commonwealth of Virginia, and to understand the impact of school climate on that achievement.

The body of research on school climate is substantial, and for good reason; there can be little question that the presence of a strong and positive climate is essential for the successful function of a school (Deal & Peterson, 1999; Freiberg & Stein, 1999). Yet, as other researchers have pointed out, "there is a glaring gap between school climate research findings on the one hand and policy, school improvement practice, and teacher educator efforts on the other. This gap undermines K-12 students' ability to learn and develop in healthy ways" (Cohen, McCabe, Michelli, & Pickeral, 2009, p. 181). In other words, what we know about climate has had little impact on what the education establishment has done about it. It may be that what the research shows does not translate into a plan for what can be done with it. In the interim, too many American students are not achieving.

As the review of the literature shows, the climate of a school is simultaneously created by the stakeholders within the school (students, teachers, administrators,

community members) and reflective of the school. As Roney, Coleman, and Schlichting stated, "healthy middle schools have higher levels of student achievement in reading, mathematics, and writing" (Roney, Coleman, & Schlichting, 2007, p. 290). The same can be said of any school. The research makes a convincing case. Cohen et al. wrote, "A review of the literature reveals that a growing body of empirical research indicates that positive school climate is associated with and/or predictive of academic achievement, school success, effective violence prevention, students' healthy development, and teacher retention" (Cohen et al., 2009, p. 181). Doubtless, these goals are all worthy in ensuring successful schools. School leaders and teachers are under intense pressure to demonstrate the effectiveness of their schools through student achievement (Smith, 2005).

One route to improved achievement is consciously planning to affect school climate for the better, deliberately planning for the development of "a sustainable, positive school climate [that] fosters youth development and learning necessary for a productive, contributive, and satisfying life in a democratic society. This climate includes norms, values, and expectations that support people feeling socially, emotionally, and physically safe" (Cohen et al., 2009, p. 180). That support is intended not only for students but for teachers as well. It is essential if the nation is to achieve the vision of 21st-century education outlined by Wagner (2008).

School administrators need a tool they can easily use to determine the quality of the climate of their schools. The tool they use must identify and incorporate factors associated with either a good school climate or a poor school climate and be able to effectively identify relationships between those factors and student achievement (Smith,

2005). When leaders can measure the climate of their own school, they can more easily develop a plan for improvement.

Research Questions

The purpose of this study was to determine the relationship between the school climate of middle schools in the Commonwealth of Virginia as measured by a Climate Index (CI) and the achievement of students in those schools. Although many studies already had demonstrated that such a relationship exists, the overwhelming majority relied on point-in-time surveys to create a body of data. The data used in this study were summary data that reflected information collected over an extended period of time. The data for each of the independent variables used in the study represented a count or average of the data generated throughout a school year. Discipline data represented the number of discipline incidents per 100 students as of the end of the previous school year; attendance rate was the average of the daily attendance taken throughout a school year; school size, which fluctuates insignificantly throughout a school year, was based on a September 30 count reported yearly to the state; and SES was based on the number of students receiving free or reduced-price lunch per 100 students. As with school size, SES data fluctuate insignificantly throughout a school year. The goals of this study were to examine existing data collected by the Virginia Department of Education (VDOE), thereby potentially eliminating biases inherent in point-in-time survey data, and to apply a heretofore unused methodology, with the exception of its use in the study being replicated (Smith, 2005), in the analysis of those data. The following primary research question was studied through both hierarchical cluster and multiple regression analyses:

Is there a relationship between the climate of Virginia middle schools, as measured by the Climate Index (CI), and the achievement of students in those schools?

Although the broad purpose of cluster analysis is to sort data into classifications, cluster analysis may also be used to make specific-purpose classifications, in that "scientists often make classifications with the specific purpose in mind of investigating their relation to other variables. The variables may be (1) qualitative or (2) quantitative" (Romesburg, 2004, p. 59). In this study, the cluster analysis was used to determine the relationship between the clustered variables of the CI and student achievement as measured by state test data. Similarly, multiple regression analysis was used "to relate a set of regressor variables (independent or predictor) variables to a criterion (dependent or outcome) variable" (Kelley & Maxwell, 2010, p. 281). To answer the overarching question, the primary research question was divided into subquestions to be analyzed similarly as follows:

a. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in English–reading in those schools?
b. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in mathematics in those schools?
c. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in history–social science in those schools?

d. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in science in those schools?

The general hypothesis guiding this study was that all aspects of school health (i.e., those factors included in the CI), as framed by Hoy and Hannum (1997), are positively related to student achievement: the stronger the organizational health of a middle school in Virginia, the greater the achievement of students. Hoy et al., in refining the 1997 study, posed the question, "Does school climate improve student achievement or does high student achievement produce a better school climate?" (Hoy et al., 1998, p. 343). Their answer was as follows: "We posit an interdependent and reciprocal relationship. School climate affects student achievement, but the reverse is also true: student achievement affects school climate. The two are mutually dependent" (Hoy et al., 1998, p. 343). Similarly, this study did not attempt to determine a causal relationship.

Statement of Potential Significance

As noted in the following review of literature, only one study was found that used hierarchical cluster analysis to examine climate. That study, which used the hierarchical cluster analysis to develop five clusters of school divisions in the Commonwealth of Virginia to determine a relationship between climate and achievement (Smith, 2005), was replicated by this study. In this study, the researcher examined the same relationship using the same methodology; however, this research focused on middle schools in Virginia. The vast majority of climate studies have utilized surveys and questionnaires to gather data on various climate factors (Smith, 2005). This study is significant in that it utilized preexisting summaries of data occurring over an extended period of time, data

that were not influenced by the limitations of surveys and questionnaires, to examine the relationship between climate and achievement.

As pressure has increased for schools to document student achievement, contemporary trends in education—from the entrenched accountability movement to the burgeoning move toward preparing students for the 21st century—have impacted the climate of schools. Schools that have been successful in maintaining a climate conducive to teaching and learning have realized improved student achievement, whereas those that have not maintained a positive climate have not met with similar success (Deal & Peterson, 1999). It is important for school leaders, therefore, to be able to identify controllable factors that define climate and to develop plans for improving those factors to strengthen climate and improve student achievement (Marzano, Waters, & McNulty, 2005). These factors are developed in Chapter 2. The hierarchical cluster analysis provides leaders a methodology for examining existing data that define the climate of a school and for drawing meaningful conclusions about the relationship between climate and student achievement.

As evident in the already extensive and continuously growing body of research, school climate is an issue all school practitioners must actively address. As such, educational leaders from the school, division, and state levels may use the cluster analysis (CI) to draw conclusions about the relationship between their schools' climates and their students' achievement, to target specific behaviors or account for key factors that may influence climate, or to use resulting data as justification or rationale for making decisions about programs, practices, resources, and structures—for example, programs designed to reduce discipline problems, to increase attendance, or to recover low-income

students who are not achieving—that may be put in place to ensure the success of all students.

A second purpose of this study was to develop a new methodological model for examining climate. By using hierarchical cluster analysis and multiple regression analysis side by side, the researcher hoped to build a replicable predictive model to advance the existing methodology of climate studies as well as provide consistency of results. Additionally, the design of this study allowed the researcher to examine whether or not the two statistical procedures would result in different conclusions.

Figure 1 provides the conceptual framework through which factors related to school climate were analyzed.

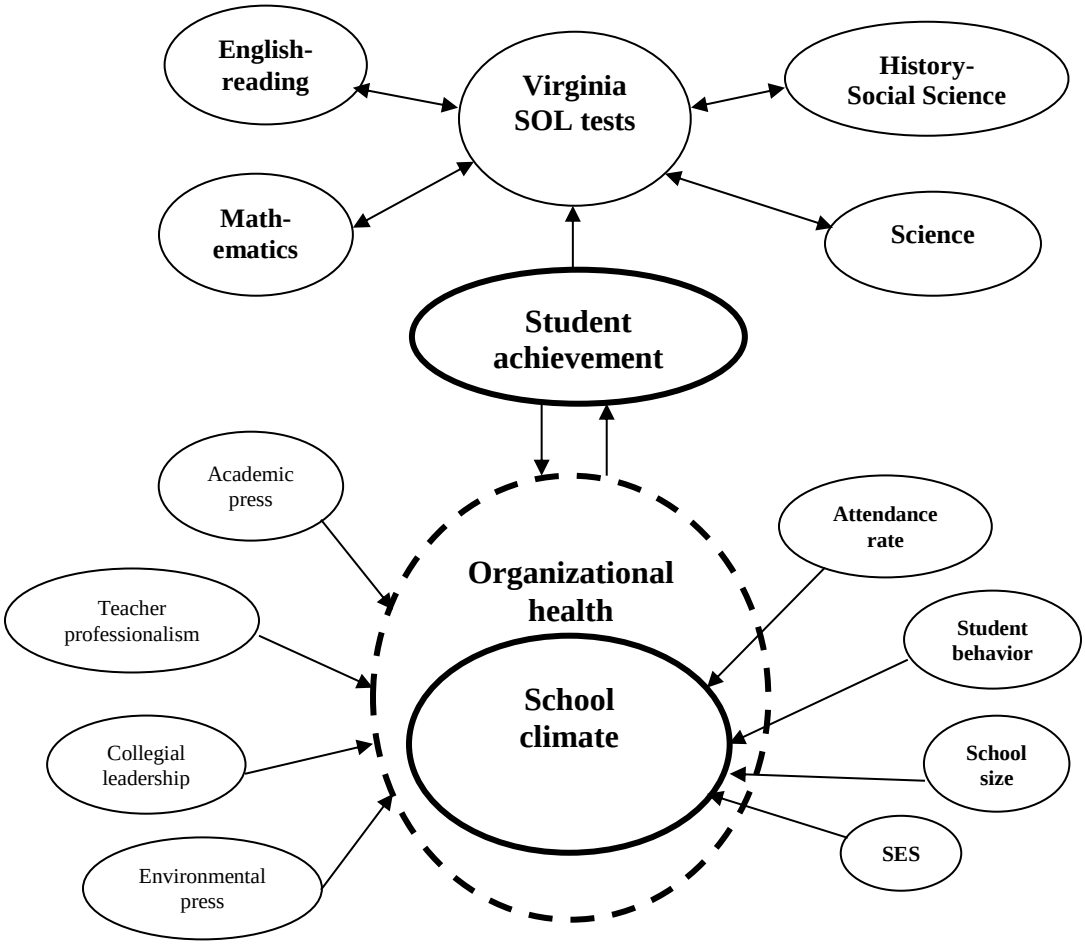

Figure 1. Climate factors (Hoy, Hannum, & Tschannen-Moran, 1998) related to student achievement.

Summary of Methodology

A CICI to measure school climate, which was viewed through the lens of organizational health, was formulated using data available from the VDOE. Factors used to formulate the CI included student discipline or behavior data, which consisted of counts of referrals resulting in suspensions in specific discipline categories; school SES data; attendance rates; and school size data. The factors were selected as proxy measures of school climate because of a demonstrated correlation with or relationship to climate shown in prior research studies. Using these factors, a CI score was calculated for each middle school in the state. Those scores then were clustered using a dendrogram. The number of clusters was determined with Ward's method using Euclidean distance (Aldenderfer & Blashfield, 1984). The clusters were then correlated with student achievement data, also available from the VDOE, averaged for each cluster. The achievement data consisted of student performance on Virginia SOL tests in each core content area. The achievement data was expressed as a pass rate, or the percentage of students who scored 400 or better on the respective SOL tests. A hierarchical cluster analysis was completed using SPSS, and an analysis of the clusters was conducted to determine whether there is a relationship between climate and achievement (Everitt, 1993). The means of each cluster were analyzed using ANOVAs and appropriate post hoc tests. Finally, effect sizes were calculated. A multiple regression analysis also was completed to determine which climate factors exhibited the strongest predictive

relationship with student achievement and to delineate which content areas of achievement were most closely related to climate (Kelley & Maxwell, 2010).

Limitations

Although previous climate studies, as demonstrated by the review of the literature, generally have involved the use of survey instruments to gather data on specific climate domains, this study did not. For this study, the researcher utilized existing data collected by the VDOE and, therefore, did not take into account certain climate domains for which data are typically collected through surveys (e.g., perceptions of principal support). Despite the absence of data typically collected through surveys, the review of the literature showed that the domains for which data were available nonetheless formed a strong basis for defining climate. This study involved the examination of specific results and required that assumptions be made about how those variables both reflected and impacted the climate of a school. As a result, the researcher needed to conduct careful analysis and be thoroughly knowledgeable in the field to ensure the highest degree of accuracy in determining findings and drawing conclusions.

Another limitation of this study is inherent in the potential limitations of the hierarchical cluster analysis itself: (a) Different clustering methods often yield varied results; (b) results can be affected by the way in which variables are ordered; (c) once the cluster analysis has been conducted, dropping a single case may significantly impact the course of the analysis; and (d) the nature of the cluster analysis makes it difficult for poor decisions early in the process to be rectified (Field, 2000). Given these limitations, it was incumbent upon the researcher to be precise and thorough in implementing the methodology.

Delimitations

A delimitation of this study is that the unit of analysis was confined to middle schools. In the Commonwealth of Virginia, there is variance in the grade levels of students included in middle schools. The majority of middle schools comprise sixth grade to eighth grade; however, some middle schools include fifth-grade students or ninth-grade students, and some have only two grade levels, typically seventh and eighth. All middle schools that included sixth, seventh, or eighth grade to the exclusion of all other grade levels were included in the study. Because the study was confined to middle schools, certain data points could not reasonably be included in the formulation of the climate indices for this study. Those data points included, but were not limited to, graduation and dropout rates and truancy data, all of which do not exist in significant numbers at the middle school level. This study did not account for data uniquely relevant to high schools or elementary schools.

Another delimitation of this study is that achievement data were confined to analysis of student performance on Virginia SOL tests relative to the federal mandate of AYP. Although the use of these data allowed the researcher to examine a variety of ways of determining achievement, this study did not include other measures of achievement, such as SAT and PSAT performance, AP test participation and performance, classroom achievement, portfolio assessments, industry certifications, and the like. In addition, data measuring student achievement in other areas often deemed more important to the function of school than success on standardized tests—data reflecting such skills as problem solving and critical thinking, collaboration, citizenship, and leadership—were not included because consistent quantitative measures of those skills do not exist. To

ensure continuity and consistency, all data used for this study were available for all middle schools directly from the School Report Cards produced by the VDOE.

Definition of Terms

Climate has been defined as "a relatively enduring quality of the entire school that is experienced by members, describes their collective perceptions of routine behavior, and affects their attitudes and behavior in the school" (Hoy & Miskel, 1996, p. 1). By extension, Hoy and Hannum defined climate as "the collective perceptions of teachers about the relations in schools between teachers and students, teachers and administrators, teachers with each other, and the school with the community" (Hoy & Hannum, 1997, p. 293). Hoy and Hannum, whose work formed the theoretical framework for this study, defined climate in terms of organizational health, stating, "Health is … metaphor for examining school climate" (Hoy & Hannum, 1997, p. 292). They further stated, "Healthy organizations manage successfully with disruptive outside forces while effectively directing their energies toward the mission and objectives of the organization" (Hoy & Hannum, 1997, p. 292). In describing climate, the researchers selected the health framework for describing climate "as earlier research had demonstrated its superiority in predicting student achievement" (Hoy & Hannum, 1997, p. 292). For the purposes of this study, based on the review of the literature and utilizing Hoy and Hannum's theoretical framework describing climate in terms of organizational health, the operational definition of climate is as follows: The climate of a school as described by factors including student discipline, student attendance, school SES, and school size is a function of organizational health, which is formed by the quality of relationships (student discipline and attendance), the level of emphasis on academic excellence (student achievement), the

quality of leadership (student discipline and attendance), and the influence of external factors (SES, school size).

The Climate Index (CI) is an index created specifically for this study to measure the organizational health, or climate, of middle schools in the Commonwealth of Virginia. Data used to formulate the CI were derived from information compiled by the VDOE on School Report Cards, as well as the National School Lunch Program (NSLP) Free and Reduced-Price Eligibility Report.

Socioeconomic status (SES) is "a person's overall social position to which attainment in both the social and economic domains contribute" (Ainley, Graetz, Long, & Batten, 1995, p. ix). For the purpose of this study, SES was determined by the percentage of students receiving free or reduced-price lunch as reported by VDOE.

State accreditation in the Commonwealth of Virginia is determined by the pass percentage rates of students on the Virginia Standards of Learning (SOL) tests in the areas of English–reading, mathematics, history–social science, and science. To be accredited, a school must achieve a 70% pass rate in each of the content areas.

Adequate Yearly Progress (AYP) is a measure of student achievement in reading and mathematics defined by NCLB. In Virginia, AYP measures progress on the Virginia SOL tests for each of seven subgroups of students: overall, Caucasian, African American, Hispanic, economically disadvantaged, disabled, and limited English proficient. For 2010-2011, the benchmarks required for each subgroup were 86% in reading and 85% in mathematics. Beginning in 2012-2013, Virginia revised its accreditation process to set Annual Measurable Objectives (AMOs) for schools to meet in various subgroups to be accredited both federally and by the state. The data for this study were drawn from 2010-

2011 when schools in Virginia were under the auspices of AYP. In any case, this study used raw data to measure achievement and did not use AYP as a dichotomous variable. The AMOs, which would also be dichotomous variables as schools either meet or fail to meet them based on the SOL achievement in reading and mathematics of various subgroups of students, did not impact the decision to measure achievement using raw SOL data.

Organization of the Study

This chapter has provided an overview of the issue of the relationship between school climate and student achievement, as well as the purpose and research questions for this study of the relationship between school climate and student achievement in the middle schools of the Commonwealth of Virginia. The chapter has addressed the potential significance of the study with regard to educational leadership and presented both limitations and delimitations of the study. The chapter also presented a conceptual framework, grounding the study in a theoretical foundation, and defined key terms relevant to the study. Chapter 2 presents a review of literature related to school climate and achievement in general and to those factors in middle schools specifically, including a historical overview, an exploration of the theoretical framework, and discussion of the key climate factors, specifically student discipline or behavior, student attendance, SES, and school size. Following the literature review, Chapter 3 details the methodology used in this quantitative study, specifically detailing the reasons for replication, the research procedures, the method of analysis, and the process for interpreting resulting data. Chapter 4 presents the results and findings of the hierarchical cluster and multiple

regression analyses, and Chapter 5 includes discussion of the findings along with recommendations for further study.

Chapter 2

Review of the Literature

Introduction

The review of literature cites key studies relevant to this examination of the relationship between school climate and student achievement. In the process, the review is used to formulate a theoretical and conceptual framework for studying climate and achievement, identify the connection between school culture and school climate, examine the relationship between climate and achievement, provide a historical overview of the study of school climate, explore the key terms utilized in this study, and describe other relevant studies, including an in-depth description of the study being replicated.

Restatement and Summary of the Problem

As discussed in Chapter 1, the existence of a strong and positive school climate is essential for the successful function of a school (Hoy & Hannum, 1998). Cohen et al. pointed out, "There is a glaring gap between school climate research findings on the one hand and policy, school improvement practice, and teacher educator efforts on the other. This gap undermines K-12 students' ability to learn and develop in healthy ways" (Cohen et al., 2009, p. 181). In light of the fact that many American students are not achieving as expected, particularly with the growing expectations for 21st-century education (Wagner, 2008), it becomes more important that the role of climate in the success of schools not be overlooked. School leaders must plan for the development of a school climate conducive to growth and improvement. To plan for that climate, they must understand how to describe the climate of their schools.

Historical Background and Overview

Although Halpin and Croft (1962) may not have been the first to focus on the relationship between climate and achievement, they effectively initiated the growth in the body of research on climate through their own work on the subject. They essentially established the foundation for the study of the organizational climate of schools. Halpin asserted,

> Anyone who visits more than a few schools notes quickly how schools differ from each other in their *"feel."* In one school the teachers and the principal are zestful and exude confidence in what they are doing. They find pleasure in working with each other; this pleasure is transmitted to the students, who thus are given at least a fighting chance to discover that school can be a happy experience. In a second school the brooding discontent of the teachers is palpable; the principal tries to hide his incompetence and his lack of a sense of the direction behind a cloak of authority, and yet he wears his cloak poorly because the attitude he displays to others vacillates randomly between the obsequious and the officious. A third school is marked by neither joy nor despair, but by hollow ritual. Here one gets the feeling of watching an elaborate charade in which teachers, principal, and students alike are acting out parts. The acting is smooth, even glib, but it appears the show just does not seem to be "for real." And so, as one moves to other schools, one finds that each appears to have a "personality" of its own. It is this personality that we describe here as the "organisational [*sic*] climate" of the school. (Halpin, 1966, p. 131)

In identifying the concept that "each school has a personality of its own," and by suggesting there is a connection between that personality and the wellbeing, and by extension the achievement, of students, Halpin (1966) ushered in a concept that was highly interesting to researchers. Consequently, countless researchers over the next few decades have investigated what determines the personality of a school (Hannum, 1994; Hoy et al., 1991), why school climates differ (Deal & Peterson, 1999; Hoy & Hannum, 1998), how climate is determined (Creemers & Reezigt, 1999; DiPaola & Tschannen-Moran, 2001; Freiberg & Stein, 1999), how climate is affected (Davidson, 2000; Lee et al., 1999) , how it impacts student achievement (Bedford, 1987; Benson, 2003;

Brookover et al., 1978; Bulach, Malone, & Castleman, 1995; Callison, 2002; Olive, 2005), and what, if anything, the various stakeholders in schools can do about it (Bulach, 1995; Cohen et al., 2009; Edmonds, 1979; Sackney, 1988).

In *The Management of a City School*, Perry (1908) was likely the first to identify the importance of the relationship between a positive school climate and student success. It was not until the late 1950s, however, that researchers began to develop studies of organizational climate, in particular in education (National School Climate Center [NSCC], 2007). The earliest body of work in climate research focused primarily on climate in the work environment in business and universities (Anderson, 1982). Most climate studies during this time period were conducted by social scientists, who examined aspects of the work environment, including individual and group attitudes, individual and group perceptions of their organization, and ways to measure these attitudes and perceptions. Among the first research instruments developed to measure climate was the College Characteristic Index (Pace & Stern, 1958), which was developed specifically to capture college students' attitudes and perceptions of their university.

In the 1960s, interest in the climate of schools and classrooms grew, and researchers began to focus more of their energy on developing studies to examine climate in the public school classroom (Anderson, 1982). A variety of research instruments was developed including the Classroom Environment Scale (CES), the Learning Environment Inventory (LEI), and My Class Inventory (Walberg, 1969), which were designed to measure classroom climate. Although the LEI was used to measure the climate of a classroom, it also has been used to draw conclusions on school-wide climate (Anderson, 1982). Other instruments such as the Pupil Control Ideology (PCI), the Organizational

Climate Index (OCI), the Organizational Health Inventory-Elementary Schools (OHI-E), and the Charles F. Kettering Foundation, Ltd. School Climate Profile (CFK School Climate Profile) also have been developed to measure various aspects of positive and negative school climates, factors associated with both kinds of climate, and the impact of leadership styles on school climate and academic achievement (Smith, 2005).

One of the most notable of the early climate instruments is the Organizational Climate Descriptive Questionnaire (OCDQ) developed by Halpin and Croft (1962) at Ohio State University (Smith, 2005). The OCDQ was used to measure school climate based on staff perceptions; it focused on six types of organizational climate: open, autonomous, controlled, familiar, paternal, and closed. It also measured three profile-factors including authenticity, satisfaction, and leadership initiation. Additionally, the OCDQ measured eight subtest descriptors, which included group characteristics such as disengagement, hindrance, and esprit, as well as leadership behaviors such as aloofness, production emphasis, and consideration (Smith, 2005). The preponderance of instruments designed to measure climate is evidence of the breadth of school climate studies and the importance placed on the relationship between school climate and school success.

Some researchers (Brown & House, 1967; Thomas, 1976) argued that the OCDQ lacked consistency in showing the existence of a relationship between school climate and student achievement; others (Andrews, 1965; Smith, 2005) determined that a relationship between school climate and student achievement could be identified using the OCDQ. One of the most significant outcomes that emerged through the development and use of the OCDQ was that a need existed for further studies and analysis in the area of school

climate and its effect on student achievement. Halpin and Croft (1962) effectively opened the door for the development of a wide variety of research studies and instruments focusing on measuring climate and determining its impact on productivity and achievement (Smith, 2005).

The vast majority of climate surveys and questionnaires have relied heavily on perception-based responses and the opinions of a school's climate gleaned from its staff members and administrators (Anderson, 1982; Cushing, Horner, & Barrier, 2003). As such, most climate studies rely upon data collected at a specific point in time, and because they are based on perception and opinion, there are many factors that must be controlled to develop a true sense of the comprehensive climate of a school rather than a snapshot of a moment in time.

Although many of the studies focused on staff perceptions, through a review of research included in a classroom environment study conducted by International Studies in Educational Achievement (IEA), Anderson (1989) concluded that student assessment of classroom climate is more realistic than a teacher's assessment of classroom climate. His findings support the idea that utilizing a climate instrument with instructional staff will capture their perceptions of school climate at a given time only rather than provide a comprehensive measure of school climate (Anderson, 1989; Smith, 2005). Sackney (1988) noted that the climate of a school most often reflects the current thinking and practices in the school. Hoy and Miskel (1996) indicated that school climate describes routine behaviors and attitudes experienced by members of the organization. Based on these findings, the reality of the current educational climate presents an obstacle to the successful implementation of surveys. In an era of both high-stakes accountability and a

call for moving the focus of education to preparing students for life after school by developing 21st-century skills—a movement that is precipitating significant changes to the business of education—administrators often must make difficult decisions to answer the twin callings of standardized achievement scores and 21st-century skills. These decisions affect the attitudes and perceptions of those impacted by them, complicating the timing of survey implementation. Relying on perceptions and opinions may not yield the best results for measuring a school's climate (Smith, 2005). Although stakeholders' perceptions of school climate are important, the data collection process, if conducted at varying points during a school year, may yield varied results. Because the climate of a school is dynamic, this phenomenon may not be surprising, but it presents a challenge in making broad conclusion about the impact of climate as measured at a specific time. The purpose of this study was to use existing data to develop a broad index of the impact of climate over the course of an entire school year, an opportunity that does not exist when survey data are central to defining climate. Additionally, the data used to build the CI were passively collected, publicly available, easily accessible, and noninvasive. As proxy measures of climate, the data used for this study were as valuable as predictors of climate as data collected through surveys and interviews.

Theoretical Framework

Theory of organizational health. In their seminal climate study, "Middle School Climate: An Empirical Assessment of Organizational Health and Student Achievement," researchers Hoy and Hannum (1997) developed a theoretical framework based on the 1953 work of Parsons, Bales, and Shils as well as prior studies conducted by Hoy and other colleagues. Hoy and Hannum examined two metaphors of school climate:

personality and health. The conception of climate as personality was founded in the 1963 work of Halpin and Croft, in which "climate was viewed as the 'personality' of the school and seen along a continuum from open to closed" (as cited in Hoy & Hannum, 1997, p. 292). The health metaphor described by Hoy and Hannum is one in which "healthy organizations manage successfully with disruptive outside forces while effectively directing their energies toward the mission and objectives of the organization" (Hoy & Hannum, 1997, p. 292).

Of the two metaphors, the health metaphor of climate was used by Hoy and Hannum to develop their study, forming a framework based on organizational health because "it had demonstrated its superiority in predicting student achievement" (Hoy & Hannum, 1997, p. 292). In particular, the researchers developed their framework based on Parson's theory of organizational health, which stated,

> All social systems, including schools, must solve four basic problems if they are to survive, to grow, and to prosper. Each must accommodate to its environment, set and implement its goals, maintain a cohesive system, and create and preserve a distinctive culture. (Hoy & Hannum, 1997, p. 293)

Hoy and Hannum posited that a healthy school climate is essential for the development of a sustainable and enriching school culture. In this regard, Hoy and Hannum identified three types of control schools have over their activities: technical, managerial, and institutional. Specifically, technical control refers to the primary mission of schools: teaching and learning. Managerial control refers to coordinating the internal workings of a school; in this case, institutional refers to the connection between school and community (Hoy & Hannum, 1997). Based on their application of Parsons's theory, Hoy and Hannum developed their own theoretical framework, in which "a healthy middle school is one in which the technical, managerial, and institutional levels are in harmony

and the school is meeting its basic needs as it successfully copes with disruptive external forces and directs its energy toward its mission" (Hoy & Hannum, 1997, p. 293).

Hoy and Hannum (1997) subdivided the three levels of school control into six dimensions of climate that describe the health and general wellbeing of a school. Two of the dimensions fall under technical control: academic emphasis and teacher affiliation; three fall under managerial control: collegial leadership, resource support, and principal influence; and one falls under institutional control: institutional influence. These dimensions "map important aspects of teacher and student behavior at the technical level…tap important administrative functions at the managerial level" (Hoy & Hannum, 1997, p. 293) and describe the ways in which a school "maintains the educational integrity of its programs" (Hoy & Hannum, 1997, p. 294) at the institutional level.

Hoy, Hannum, and Tschannen-Moran (1998) refined the work of Hoy and Hannum (1997) even further. Working from the same definition of climate, the researchers stated, "Implicit in this definition is the idea that healthy organizations successfully manage disruptive outside forces while effectively directing their energies toward the mission and objectives of the organization" (Hoy et al., 1998, p. 339). They then identified the key problems a school or any organization must solve to preserve an effective climate. Those include "the problem of acquiring sufficient resources and accommodating to the environment, the problem of setting and attaining goals, the problem of maintaining solidarity within the system, and the problem of creating and preserving the values of the system" (Hoy et al., 1998, p. 339).

Building on the Parsonian framework of organizational health, the researchers identified how the three areas of responsibility—the technical, the managerial, and the

institutional—apply in schools (Hoy et al., 1998). The following information is based upon the theorists' descriptions of those organizational functions:

- The technical function refers to the teaching and learning process, which places responsibility on the classroom teachers. Because the product of an effective school is an educated child, the problems associated with effective teaching and learning lie at the heart of the technical level of responsibility.
- The managerial function typically places responsibility on principals, who are responsible for controlling the internal activities of the school. In doing so, they must motivate staff members, garner commitment, and organize how work is done. They function as mediators between teachers and students or parents, and procure resources to ensure that teachers can be effective.
- The institutional function places responsibility on both teachers and administrators to effectively manage the connections between the school and its environment (e.g., parents and community members, among others). The challenge in this regard is to manage that connection in such a way as to prevent those outside forces from becoming an undue influence or interfering with the function of the school (Hoy et al., 1998).

In the context of their seminal study of middle schools, Hoy et al. (1998) refined the dimensions of climate identified by Hoy and Hannum (1997) from six to four dimensions, including environmental press, collegial leadership, teacher professionalism, and academic press. The basis of their refinement process was a definition of healthy climate, which

> is characterized by positive student, teacher, and administrator interrelationships. Teachers like their colleagues, their school, their job, and their students and are

> driven by a quest for academic excellence. They believe in themselves and their students, and set high, but achievable goals. The learning environment is serious and orderly. Students work hard and respect others who do well academically. Principal behavior is also positive; that is, it is friendly, open, and supportive. Principals have high expectations for teachers and go out of their way to insure that teachers have the resources they need to do a good job. Healthy schools have principals who have influence with their superiors and can "go to bat" for their teachers. Finally, healthy schools have institutional integrity; that is, teachers are protected from unreasonable and hostile outside forces. (Hoy et al., 1998, p. 340)

After determining that all significant factors that could be used to define climate essentially fall into those four areas, the researchers inserted those factors into the Parsonian framework for viewing school health as follows: "the institutional (environmental press), the managerial (collegial leadership), and the technical (teacher professionalism and academic press)" (Hoy et al., 1998, p. 342). Additionally, they connected their factors to what they viewed as four important relationships that exist in schools: "community-school (environmental press), principal-teacher (collegial leadership), teacher-teacher (teacher professionalism), and teacher-student (academic press)" (Hoy et al., 1998, p. 342).

Hoy et al. (1998) hypothesized that each of the four climate factors they identified—collegial leadership, teacher professionalism, academic press, and environmental press—would be positively related to student achievement in the areas of reading, writing, and mathematics. Moreover, the researchers drew from their own research that "climate is a general concept that captures an enduring quality of organizational life" and hence "hypothesize[d] that the consequences of organizational climate on achievement would persist over several years" (Hoy et al., 1998, p. 345).

The researchers used two survey instruments, the OCDQ-RM and the Organizational Health Inventory (OHI), to gather data on the openness and health of

middle schools throughout New Jersey. The collected data included responses from 2,741 teachers in 86 middle schools. The researchers also gathered achievement data from New Jersey's standardized tests given to eighth graders. They also included data on SES to account for the influence of SES on student achievement. Using these data, they conducted multiple regression analyses. In analyzing the results, they determined that SES did indeed have a significant effect on achievement but so did the four climate variables they had identified; they concluded, "Although socioeconomic status is the single best predictor of achievement, Environmental Press and Academic Press are not far behind. Collegial Leadership and Teacher Professionalism work together to contribute to achievement" (Hoy et al., 1998, p. 352). The researchers collected the data twice, 2 years apart, and drew the same conclusions, thereby supporting their hypothesis that "the impact of a school's climate is relatively enduring" (Hoy et al., 1998, p. 353).

Within the framework developed by Hoy and Hannum (1997) and refined by Hoy et al. (1998), the researcher for this study attempted to quantitatively examine the relationship of climate factors to those identified by Hoy and Hannum (1997). Just as the "six dimensions of teacher-student, teacher-teacher, and teacher-administrator relations can be combined into an overall index of general school health or well-being" (Hoy & Hannum, 1997, p. 294), so too can the climate factors identified for the purposes of this study be combined to form an index of healthy school climate. For the purposes of this study, the identified variables were all described by existing and publicly available data. Although these variables did not focus on every aspect of Hoy and Hannum's framework, they provided data related to key aspects of it, most significantly the dimensions of teacher-student relations, community-school relations, and teacher-administrator

relations. The following sections further explore both the distinction and the connection between school culture and school climate as well as the variables that emerged from the literature to form the CI developed for the cluster analysis.

Connection between culture and climate. Culture and climate are invariably connected when researchers undertake studies that deal with the issue of climate in schools. Deal and Peterson offered a straightforward definition of school culture: "Culture consists of the stable, underlying social meanings that shape beliefs and behavior over time" (Deal & Peterson, 1999, p. 3). A school's culture develops over time and is formed by both the short-term and long-term activities of the stakeholders in the school. It is a "complex web of traditions and rituals that have been built up over time as teachers, students, parents, and administrators work together and deal with crises and accomplishments" (Deal & Peterson, 1999, p. 4). Inevitably, those traditions and rituals impact the personality of a school, more generally referred to as climate.

Climate becomes the face of a school's culture, and although Deal and Peterson (1999) focused on culture, they did not ignore the significance of climate. They cited research on effective schools from the late 1970s and early 1980s, stating that the "effective schools consistently showed that these schools had a climate conducive to learning" and concluding that "these were places where a clear mission focused on student learning was embedded in a culture that supported high expectations for all students" (Levine & Lezotte, as cited in Deal & Peterson, 1999, p. 5). Climate is, therefore, an essential function of culture, as well as a means by which an observer can make judgments about how a school's culture is defined.

Defining and describing a school's culture and climate is a school improvement process whereby leaders can determine how to undertake the task of changing climate and culture such that it leads to increased student achievement. In the report of the studies they summarized, Deal and Peterson stated,

> Teachers…were more satisfied with their work, seen by students as enjoying teaching, and less likely to be absent. Students … were less likely to misbehave (e.g., by cutting class, being absent, or disrupting class), were less likely to drop out, and showed higher gains in mathematics achievement. (Deal & Peterson, 1999, p. 6)

The factors cited (e.g., student behavior and attendance, effective instruction, dropout rates, etc.) all play a role in how a school's climate can be measured. Climate, as a function of a school's culture, and its impact on student achievement was the primary focus of this study.

What is climate? How, specifically, is climate defined? A white paper published by the National School Climate Center (NSCC) stated, "School climate refers to the quality and character of school life. It is based on patterns of school life experiences and reflects norms, goals, values, interpersonal relationships, teaching, learning and leadership practices, and organizational structures" (NSCC , 2007, p. 5). The definition provided by the NSCC shares much of the same language used in the definition of school culture espoused by Deal and Peterson (1999), further enhancing the connection between climate and culture. Another researcher stated that school climate "reflects the physical and psychological aspects of the school that are more susceptible to change and that provide the preconditions necessary for teaching and learning to take place" (Tableman, 2004, p. 2). She pointed out that "culture is reflected in an

organization's atmosphere" (Tableman, 2004, p. 1) and emphasized that that ability to impact and shape climate ultimately will lead to change in culture.

Many other theorists and scholars have taken on the task of defining climate in the context of an educational environment, but a common thread throughout the research is that climate refers to the environment or personality of a school and that it is connected to the manner in which students, teachers, community members, and other stakeholders identify with an educational institution. Freiberg and Stein wrote,

> School climate is about that quality of a school that helps each individual feel personal worth, dignity and importance, while simultaneously helping create a sense of belonging to something beyond ourselves. The climate of a school can foster resilience or become a risk factor in the lives of people who work and learn in a place called school. (Freiberg & Stein, 1999, p. 11)

Their claim was that the climate of a school can be a predictor of its success or failure, which is demonstrated through the achievement of its students. Similarly, Bower described climate as "the way we do things around here" (Bower, 1966, p. 3). Deal and Kennedy defined it as "the shared beliefs and values that closely knit a community together" (Deal & Kennedy, 1982, p. 2). Throughout the definitions, the commonality of climate as an environment and a codification of intangibles was pervasive. Within the description of an institution's climate can be found a picture of the success of an organization and its constituents, which in the case of schools, most importantly includes students.

Hoy, Tarter, and Kottkamp (1991) and Shore (1995) asserted that there are many definitions of climate and that there is often disagreement about how to define climate. Other researchers have argued there is no single definition of school climate (Smith, 2005). In fact, some have pointed out that most definitions are descriptive in nature and

are not based on empirical evidence (Cushing et al., 2003). For example, in an early definition, Halpin and Croft described school climate as "the organizational personality of a school; figuratively, personality is to the individual what climate is to the organization" (Halpin & Croft, 1962, p. 1); more than three decades later Hoy et al. described organizational climate as a "set of internal characteristics that distinguishes one organization from another and influences the behavior of organizational members" (Hoy et al., 1998, p. 337). Although the definitions cited to this point have demonstrated significant variety, certain commonalities emerged: one being that climate is often described in human terms, that is, the behaviors of various stakeholders in an organization share the organization's climate.

What makes students care? What causes them to feel like citizens? What characteristics are endemic to a school's having a positive school climate? According to Creemers and Reezigt, "Stringfield defines the school climate very broadly as the total environment of the school" (Creemers & Reezigt, 1999), pp. 30-31). What constitutes that environment? Creemers's model of climate factors in educational effectiveness emphasizes orderly environment, expectations for student outcomes, and teacher behavior. These factors, which are explored in greater depth throughout this chapter, are just a few of the many that researchers have used to try to define climate and to understand what it is about the climate of an organization that can serve as a predictor of success. Over time, the research has been varied; Freiberg and Stein viewed this variety positively: "Just as viewing a painting or sculpture from various perspectives adds to a richer appreciation of the artistic quality of a piece, so does viewing schooling from each

of these varying traditions add to a richer understanding and appreciation of the essence of a healthy school" (Freiberg & Stein, 1999, p. 17).

Regardless of the viewpoint, research has supported the claim that school climate is an important aspect of effective schools (Hoy & Hannum, 1997). Just as the development of an individual relies on addressing a hierarchy of needs, to develop a positive school climate, school leaders and practitioners must address basic human needs, from physiological needs and safety needs to acceptance and friendship needs, and from achievement and recognition needs to the need to maximize both individual and institutional potential (Howard, Howell, & Brainard, 1987).

The definitions of climate previously cited are not exhaustive. Tagiuri and Litwin defined organizational climate as

> a relatively enduring quality of the internal environment of an organization that (a) is experienced by its members, (b) influences their behavior, and (c) can be described in terms of the values of a particular set of characteristics (or attributes) of the organization. (Tagiuri & Litwin, 1968, p. 27)

Hoy and Miskel offered another definition of climate when they averred that school climate is "a relatively enduring quality of the entire school that is experienced by members, describes their collective perceptions of routine behavior, and affects their attitudes and behavior in the school" (Hoy & Miskel, 1996) , p. 1). Yet another definition was offered by Litwin and Stringer, who defined organizational climate as "a set of measurable properties of the work environment, perceived directly or indirectly by the people who live and work in this environment and assumed to influence their motivation and behavior" (Litwin & Stringer, 1968, p. 1).

Common themes emerged from the various definitions of school climate cited previously. In each case, the researchers made the case that climate is a tangible and

influential presence regardless of the quality of the climate. They agreed that climate is both symptomatic of and influential upon culture. The researchers also agreed that climate is a function of the internal workings of an organization and that it is formed by the behaviors of the constituents of each organization. They determined that the climate of an organization influences the effectiveness of the organization. Additionally, the researchers noted that organizational climate, including school climate, evolves from the perceptions, behaviors, and attitudes of the organization's members. Anderson (1982) echoed these themes in her study, which had as its primary purpose the identification of common themes that emerged from her exhaustive review of research-related articles on school climate. The four themes she identified included the following: (a) each school has a climate unique to the organization; (b) the characteristics of a school and its climate are diverse and complex; (c) climate affects the academics, behavior, values, and satisfaction of students; and (d) to improve student behavior, school climate must be further researched. As the broader movement for educational reform impacts the climate of schools throughout the nation, the final theme is of particular importance to this study, which has continued in the tradition of school climate studies.

The research on climate has been so compelling, in fact, that Cohen et al. (2009) undertook a study to determine the actual impact of climate research upon policy, practice, and professional development. They began with the following assumption: "A sustainable, positive school climate fosters youth development and learning necessary for a productive, contributive, and satisfying life in a democratic society. This climate includes norms, values, and expectations that support people feeling socially, emotionally, and physically safe" (Cohen et al., 2009, p. 180). They determined through

their own review of the literature that "a growing body of empirical research indicates that positive school climate is associated with and/or predictive of academic achievement, school success, effective violence prevention, students' healthy development, and teacher retention" (Cohen et al., 2009, p. 181). The researchers' work was grounded in the theoretical framework developed by Hoy et al. (1998) as they focused on their own climate dimensions, including safety (teacher professionalism), relationships (collegial leadership), teaching and learning (academic press), and the external environment (environmental press) (Cohen et al., 2009).

Through their review of the literature, Cohen et al. elicited several themes: (a) "Positive school climate is associated with significantly lower levels of absenteeism…and is predictive of rate of student suspension" (Cohen et al., 2009, p. 185); (b) "School climate also promotes—or complicates—meaningful student learning. School climate powerfully affects student motivation to learn" (p. 185); and (c) "School climate promotes or complicates students' ability to achieve academically" (p. 186). Although the study did not reach the level of a meta-analysis, the researchers conducted an exhaustive review and examination of the research; they reported,

> There is a compelling, and growing, body of research that underscores the importance of school climate. Positive school climate promotes student learning, academic achievement, school success, and healthy development, as well as effective risk prevention, positive youth development efforts, and increased teacher retention. (Cohen et al., 2009, p. 187)

Additionally, they determined that the principal is potentially the single most important influence on the quality and character of a school, and found, quite simply, that "what is clear is that school climate matters" (Cohen et al., 2009, p. 187), concluding climate must be a primary focus for a principal. Disappointingly, though, "these research findings are

not reflected in current educational policy, practice, or teacher education efforts" (Cohen et al., 2009, p. 187).

Cohen et al. (2009) employed a variety of research methods to investigate the relationship between what research says about the importance of climate and the responsiveness of policy, practice, and teacher development to that research including a historical analysis, an extensive review of the literature, "a national State Department of Education policy scan, and a national survey of building, district, and state educational leaders about school climate measurement and improvement practices" (Cohen et al., 2009, p. 180). Two of the key conclusions they drew included that many state accountability systems do not factor in school climate and that "states focus all or most improvement efforts on curricular reforms through additional testing, teacher professional development in math and literacy, and academic resources, ignoring the role of climate" (Cohen et al., 2009, p. 191). The lack of responsiveness to what climate research has indicated emphasized the importance of continued work in the field of school climate, not only to identify what the factors are that impact climate, but also to develop tools and assessments schools can use to measure their own climate and to develop strategies for responding to the results.

Climate and achievement. Student achievement is significantly connected to how students relate to the school they attend. Freiberg and Stein stated, "When students become citizens of the school, they take responsibility for their actions and those of others" (Freiberg & Stein, 1999, p. 12). In taking responsibility, students are more likely to excel. In becoming citizens of the school, they feel a part of the school, they take

ownership for it and develop pride in it, and they are therefore more likely to care about what they are doing. As Freiberg and Stein concluded, when students care, they achieve.

According to Chrispeels (1990), effective schools are those in which students from all socioeconomic backgrounds, regardless of the school's size, score at comparable levels on standardized achievement tests. Chrispeels also determined that an effective school provides students an environment grounded in high expectations for all and that it has a positive school climate and culture. Although many researchers have linked school climate to improved student achievement (Anderson, 1982; Brookover et al. 1978), others have contended that there is not enough empirical evidence to determine a connection (Purkey & Smith, 1982; Smith, 2005). In the 27 years since Purkey and Smith's study, though, a preponderance of research has demonstrated otherwise. Many of those studies are reviewed further in this chapter.

Deal and Peterson (1999) cited a case study comparison of two schools in which one school displayed characteristics of a negative culture and climate. The school with the more negative culture also had lower achievement: "[School B] was a place of cohesion, passion, commitment, and extensive interactions among teachers. The higher performing school had a positive, focused culture" (Deal & Peterson, 1999, p. 6). That focused culture was evident in the climate of the school, where "also present was an ethos of caring, sharing, and mutual help among staff and students, based on respect, trust, and shared power relations among staff" (Deal & Peterson, 1999, p. 7). The positive connections between staff and students invariably led the students to achieve at a higher level, the teachers to find greater satisfaction in their job, and both groups to be more highly motivated to perform at a high level.

The power of a negative climate to overwhelm positive individuals also cannot be underestimated. Improving climate is not simply a process of bringing happy, positive people into an organization. Deal and Peterson stated, "Some school cultures are 'toxic.' The social milieu is so negative that even the positive individual can become discouraged or disheartened" (Deal & Peterson, 1999, p. 8). Climate cannot necessarily be improved from the bottom up, that is, by changing the people who are part of the organization. Improving climate begins with leadership's making careful decisions about and developing strategies for the improvement of climate. It is a process that is prolonged, continuous, and intentional, in which leaders focus on "strong and meaningful values" and "daily work is focused on the important issues of quality instruction, continuous refinement of teaching, and the accelerated learning of all students" (Deal & Peterson, 1999, p. 9) and in which teachers and students develop important connections with organizational priorities, form meaningful relationships with stakeholders throughout the school, and ultimately achieve more.

Deal and Peterson's (1999) findings are supported throughout the research, even to the point that many researchers have determined one key role of leaders in modern schools to be focusing on climate. For instance, Hoy et al. noted, "Positive school climate has become part of the effective school rhetoric and is advocated by educational practitioners and reformers as a specific means for improving student achievement" (Hoy et al., 1991, p. 1). Throughout the research, study after study established a relationship between school climate and student achievement (Anderson, 1982; Brookover et al., 1978; Bulach, Lunenburg, & McCallon, 1995; Gayton, 1999) and found that the broad nature of a school's climate necessitates taking into account a wide variety of school

factors (Anderson, 1982; Moos & Insel, 1974; Sackney, 1988; Tagiuri & Litwin, 1968), from SES to school size (enrollment), from the behaviors of school administrators to legislative mandates and fiscal practices, and from truancy to student discipline (Bulach, Malone, & Castleman, 1995; Gayton, 1999; Smith, 2005).

Roney et al. (2007) used the theoretical framework of Parsons et al. (1953) as applied to schools through Hoy and Feldman's (1987) concept of organizational health (refined by Hoy and Hannum in 1997 and by Hoy, Hannum, and Tschannen-Moran in 1998) to examine a connection to student achievement in middle schools. Roney et al. wrote, "The purpose of this study was to examine the relationship between student achievement in reading and the organizational health of five middle grades schools in North Carolina" (Roney et al. 2007, p. 290). Development of a body of work continued in which

> a number of studies by other researchers and reformers…also successfully linked healthy school climates to improved learning environments and thus increased student achievement (Bossert, 1998; Comer, 1980; Grosin, 1991; Hoy, Hannum, & Tschannen-Moran, 1998; McPartland, Balfanze, Jordan, & Legters, 1998; Purkey & Smith, 1983; Stedman, 1987). (Roney et al., 2007, p. 291)

Roney et al. (2007), as did many other climate researchers, conducted a mixed-methods study, which included surveys of teachers and school leaders as well as semistructured interviews. In all, 169 teachers in five schools responded to a sequence of surveys, the OHI-M, administered over a 2-year period. The researchers also gathered qualitative data from interviews with 35 educators. The researchers analyzed the survey responses and resulting indices using the Pearson's *r* correlation coefficient, triangulated interviews from teachers, and principals, and used verbatim statements and low-inference descriptors. As in many other studies, the researchers found a relationship between

climate and achievement, recommending "that principals, along with their middle grades school teams, may want to make academic emphasis their central theme" and "that school administrators can and should reflect on the influence of their practices on student achievement" (Roney et al., 2007, p. 314). In particular, the researchers found the climate dimension of academic emphasis to be influential, concluding that

> emphasis on academics is the key to increasing student achievement in high-poverty, high-minority schools. This emphasis must occur in the classrooms, in administration, and in the community. It must occur in safe, supportive, and positive environments, and it must be communicated as the priority in the school. (Roney et al., 2007, pp. 314-315)

The study by Roney et al. (2007) collected data twice in 2 consecutive years, each time drawing upon a single point in time during a school year, first administering the survey at the end of the 2005 school year and again at the end of the 2006 school year. As with other studies, however, this research also demonstrated the problem with point-in-time surveys: the problem of controlling a myriad of factors that might influence a respondent's viewpoint, from the mood a person is in on a given day to the large changes (e.g., teaching assignment) that might influence a teacher's overall job satisfaction from one year to the next.

Without deliberate attention being turned to the essential elements of culture and climate that allow goals and objectives to be achieved and that bring people together to collaboratively determine how to achieve them and to support each other in the process, the goals and objectives of school leaders are perfunctory. Deal and Peterson cited several studies in their analysis of school culture and climate: "Like other studies of successful schools, [Rutter and his colleagues (1979)] discovered that the underlying norms, values, and traditions of a school contributed to achievement gains" (Deal &

Peterson, 1999, p. 5). Rutter's study showed that achievement does not simply arise from setting goals, but from taking care of the cultural elements that give people striving to meet those goals the best chance of success. Deal and Peterson found the same theme throughout their analysis: "In study after study, where culture did not support and encourage reform, that improvement did not occur "(Deal & Peterson, 1999, p. 5). In this age of school reform, if leaders do not concern themselves with culture and climate, their students will be left behind.

Climate and leadership. One thing about which climate research was clear is that culture and climate are vitally connected to the success of an organization or school; this conclusion lends weight to the leadership priority of understanding climate and undertaking the process of consciously working to improve climate. Deal and Peterson stated, "The culture of an enterprise plays the dominant role in exemplary performance" (Deal & Peterson, 1999, p. 1). Especially in an educational era with a two-pronged mission—the simultaneous but often contradictory pressures of high-stakes accountability for student achievement and of preparing students for the 21st-century global community and workplace—understanding climate and how to impact it are essential for school leaders.

The dynamic aspect of climate means leaders cannot leave the improvement of climate to chance, especially as climate has been shown to be indelibly connected with student achievement. As an essential function of leadership, consciously addressing school climate is an ongoing and continuous process. There is no point at which the job of deliberately planning for the improvement of climate is completed. Climate will not improve without deliberate effort on the part of a leader. As Freiberg and Stein pointed

out, "one would expect that school climate under normal conditions would improve each year, but with the entry of new groups of students and, at times, new teachers, the need to both sustain and improve school climate is a continuous process that requires a continuous effort" (Freiberg & Stein, 1999, p. 26). Just as a school is dynamic in light of the yearly turnover of students and staff, so is the climate of a school.

Four decades after the work of Halpin and Croft (1962), Marzano and his research teams addressed climate issues in the work resulting from their comprehensive research, including *School Leadership That Works* (Marzano et al., 2005). Of the 21 responsibilities of the school leader identified by Marzano et al., four are related to the purpose of this study: discipline, order, focus, and culture. Their meta-analysis correlated each of the 21 leadership responsibilities with student achievement. A .25 correlation indicates that principals who increase their effectiveness in a particular responsibility by one standard deviation from the mean will realize an increase in student achievement. For example, when both the principal and student achievement are average (i.e., at the 50^{th} percentile), a correlation of .25 between a specific responsibility and increased achievement translates as follows: If the principal improves one standard deviation (i.e., from the 50^{th} to the 84^{th} percentile), student achievement also will rise one standard deviation (i.e., from the 50^{th} to the 60^{th} percentile). Each of the four responsibilities relevant to this study demonstrates a strong correlation with student achievement as follows: focus, $r = .24$; culture, $r = .25$; order, $r = .25$; and discipline, $r = .27$ (Marzano et al., 2005, p. 63).

Of the four leadership responsibilities relevant to the study by Marzano et al. (2005), two are discussed in this section: culture and focus. Culture and focus, as defined

by Marzano et al., align closely with the definitions of culture and climate developed by Deal and Peterson (1999), Freiberg (1999), and Hoy and Hannum (1997). The results of the meta-analysis conducted by Marzano et al. also provided support for the findings of other researchers discussed throughout the chapter. For example, with regard to the relationship between leadership behavior, school culture, and student achievement, the researchers wrote, "An effective leader builds a culture that positively influences teachers, who, in turn, positively influence students" (Marzano et al., 2005, p. 47). In analyzing how a leader builds a culture conducive to student achievement, the researchers stated that the

> behaviors associated with this responsibility … [are] 1. Promoting cohesion among staff, 2. Promoting a sense of well being among staff, 3. Developing an understanding of purpose among staff, and 4. Developing a shared vision of what the school could be like. (Marzano et al., 2005, p. 48)

These behaviors outline where a leader should place his or her attention to improve the culture of a school, and all of the behaviors are connected as functions of relationship building to foster a common purpose.

Another leadership behavior related to the idea of culture as developing shared vision is closely linked to school climate; Marzano et al. identified this behavior as *focus*: "The responsibility of Focus refers to the extent to which the leader establishes clear goals and keeps those goals in the forefront of the school's attention" (Marzano et al., 2005, p. 50). The behaviors the researchers identified as closely associated with the responsibility of focus included

> 1. Establishing concrete goals for curriculum, instruction, and assessment practices within the school, 2. Establishing concrete goals for the general functioning of the school, 3. Establishing high, concrete goals, and expectations that all students will meet them, and 4. Continually keeping attention on established goals. (Marzano et al., 2005, p. 50)

Within this context, a leader must bring focus to the practice of teaching, to the overall function of a school, and to the expectations that are communicated to all stakeholders in a school. The researchers found that a leader who is successfully able to demonstrate success with the responsibilities they identified as culture and focus also will have success in building a positive school climate to foster student achievement.

The study by Marzano et al. (2005) is in many ways a description of researchers' knowledge about what works in school leadership in the present day. Of course, at this point in the evolution of education, their meta-analysis is widely considered seminal to what educators know about how students learn, how teachers should teach, and how leaders should lead.

Theory and Research Specific to the Topic

The study being replicated (Smith, 2005). The primary source for this research was a study conducted by Smith in 2005 entitled *The Relationship Between School Division Climate and Student Achievement of School Divisions in the Commonwealth of Virginia*. This study replicated Smith's study, using the same methodology for determining the connection between climate and achievement. In this study, the focus was on all middle schools in the Commonwealth of Virginia.

Smith's study addressed the problem of rising demand on schools to quantitatively demonstrate "the effectiveness of their schools through student achievement" (Smith, 2005, p. 11). As was Smith's study, this study was primarily interested in how the accountability movement—which "shift[ed] … measuring educational progress from qualitative to quantitative measures" (Smith, 2005, p. 11)—had changed the climate and priorities of schools and how those changes had impacted

student achievement; this study also had its genesis in the researcher's concern for how a high-stakes educational environment is impacting schools and students. As Smith stated, "accountability measures" such as the Virginia SOLs and the rising benchmarks of AYP outlined in NCLB "may affect how educators and students feel about their schools" (Smith, 2005, p. 11). At the time of this study, the added pressure of preparing students for success in the 21st-century global marketplace, which requires a different set of skills generally unaddressed by the accountability movement, also has significant potential to further impact the climate of schools and the achievement of students. School leaders and teachers are now balancing the dual responsibilities of being accountable for meeting state and federal accreditation standards and for preparing students to enter the "after school world" equipped with 21st-century skills (Friedman, 2005; Pink, 2005; Wagner, 2008), skills which are not measured by the standardized assessments currently used to judge the effectiveness of schools.

In light of these dual pressures, climate remains a significant concern. Smith stated,

> Theoretically, if educators are happy and feel a sense of importance to the school and their work, they will be productive teachers. Likewise, if students are happy and feel a sense of importance to their work and the school, they will achieve academically. If both are true, in theory, the climate of the school should be conducive to both teaching and learning. If both are not true, theoretically, the climate of the school will be poor and counterproductive to both teaching and learning. Therefore, it is important to identify factors associated with both a good school climate and a poor school climate. It is equally important to identify relationships between these factors and student achievement. (Smith, 2005, pp. 11-12)

In identifying both the factors of climate and the significance of the relationship between those factors and achievement, leaders and other school stakeholders can initiate the work

of deliberately and consciously growing and nurturing a school climate that will be maximally conducive to student success.

To guide his study, Smith focused on five research questions, the broadest and most important of which was, "Is there a relationship between school division climate, as measured by the Climate Index (CI), and student achievement in school divisions in the Commonwealth of Virginia?" (Smith, 2005, p. 12). After completing and reviewing the hierarchical cluster analysis that formed the methodology of his study, Smith noted,

> In the content area of English–reading, mathematics, history/social science and science lower achievement scores were related to higher incidents of disorderly conduct, fights, truancy and students who receive free or reduced-price lunch. Higher achievement scores in the content area of English–reading were related to lower incidents of disorderly conduct, fights, truancy, and students who receive free or reduced-price lunch. Based on these findings, school divisions that experience higher incidents of disorderly conduct, fights, truancy, and students who receive free or reduced-price lunch can expect the school division to have lower student achievement scores, whereas, school divisions that experience lower incidents of disorderly conduct, fights, truancy, and number of students who receive free or reduced-price lunch can expect the school division to have higher student achievement scores. (Smith, 2005, p. 95)

Smith's findings were supported by many studies he had cited in his review of the literature relevant to the study.

Although Smith's (2005) findings were significant, he also noted several limitations to the work, including his focus on school divisions, which did not account for individual variations in schools within a division. Other limitations he cited included potential discrepancies in data-reporting patterns from division to division; possible omissions from reported data; variations in how incidents were interpreted, and differences in what the state and a division reported, particularly with regard to truancy; limited sample size in certain cases, particularly with regard to vandalism; and changes in reporting requirements and policies at the local level (Smith, 2005).

One suggestion Smith made for further research was the following: "Based on the findings of this study, [one] recommendation for future study in the area of school climate and student achievement [is] … that this study be replicated using middle schools in the Commonwealth of Virginia" (Smith, 2005, p. 97). This recommendation, coupled with the clear limitation that Smith's study focused on school divisions rather than individual schools, which made it virtually impractical to generalize the findings to the school level, formed the foundation for this study. The primary intent of this study, therefore, was to replicate the process to determine whether the findings would be repeated at the school level, in this case in middle schools in the Commonwealth of Virginia.

Other relevant studies. In his review of the literature, Smith (2005) discussed several recent studies relevant to the study of the relationship between climate and achievement. In particular, he identified Gayton's (1999) study of the relationship between teachers' perceptions of climate and the accreditation status of West Virginia elementary schools and Davidson's (2000) study of the relationship between teachers' perceptions of climate and certain state identified characteristics of effective schools in Oklahoma high schools. Smith also described Callison's (2000) study of the relationship between teachers' perceptions of climate and student achievement in Sioux Falls, South Dakota and Fisher's (2003) study of the relationship between student achievement, school climate, and the leadership styles of principals in Idaho elementary schools. Each of the four studies warrants further scrutiny.

Gayton (1999) conducted a descriptive study of 100 elementary schools in the State of West Virginia to determine whether a significant relationship existed between

teachers' perceptions of school climate and the accreditation status of subject schools. As part of her study, Gayton used both the SES of the schools, determined by the percentage of students receiving free or reduced-price lunch, and school size as descriptive factors. She used the CFK Ltd. School Climate Profile to measure teachers' perceptions of their respective schools' climates. For achievement data, Gayton focused on results gleaned from the 1998 Stanford Achievement Test–9th Edition (SAT–9). Of the schools participating in the study, 53 had earned full accreditation and 47 were not fully accredited. Schools were categorized as small or large based on enrollment below or above 290 (the researcher used the mean student enrollment of all schools in the study to differentiate between small and large schools). Based on her results, Gayton made the following conclusions:

1. High morale is related to student achievement, and therefore high morale is related to state accreditation status of elementary schools in West Virginia.
2. In this study, however, cohesiveness was found to be lower in small respondent schools which lacked full accreditation status.
3. SES is related to student achievement and therefore to state accreditation status of elementary schools in West Virginia. Based on findings from this study … it is likely that low SES schools will be the schools with the highest number of students scoring below the 50th percentile and will therefore lack full accreditation status.
4. In higher SES schools students may be members of families in which parents have better paying jobs and therefore perhaps more education. Parents with greater education may understand the educational process better and may place more emphasis upon the process of education. Also, students from higher SES backgrounds may have broader life experiences and may be better able to relate to items on sometimes culturally biased achievement tests. (Gayton, 1999, pp. 80-81)

Although Gayton (1999) drew conclusions that seemed to go beyond the data (see Item 4 above), the researcher, using stepwise multiple regression, found that high morale and cohesiveness are climate factors and that they are related to student achievement. In her study, schools with lower climate scores were found to be more likely schools that

lacked full accreditation status. It was also true, however, that SES correlated strongly with accreditation status. More meaningfully, Gayton found that among schools with low SES (n = 36), schools with higher morale were more likely to be accredited. Her findings support the idea that SES is, in fact, related to climate; therefore, this study used SES as one proxy measure of climate. One problematic issue with Gayton's study was the use of norm-referenced test data as achievement data, although at the time West Virginia used the SAT-9 as a basis for state accreditation.

Davidson (2000) conducted a survey-based study examining the relationship between high school teachers' perceptions of climate and a range of specific characteristics determined by the State of Oklahoma to be indicative of effective schools. He administered the Organizational Climate Description Questionnaire for Secondary Schools (OCDQ-RS) to teachers from 30 randomly selected high schools—3 each from 10 localities—to assess their perceptions of their respective schools' climates. He chose schools of similar size and SES. He used the Oklahoma Educational Indicators Program (OEIP), which utilized three criteria—(a) student performance on the standardized Oklahoma Core Curriculum Tests, (b) graduation rate, and (c) dropout rate—as the measure of student achievement. Davidson reported,

1. There was no relationship between teacher perceptions of school climate and standardized test scores in 30 selected high schools in the state of Oklahoma.
2. There was no relationship between teacher perceptions of school climate and graduation rates in 30 selected high schools in the State of Oklahoma.
3. There was no relationship between teacher perceptions of school climate and dropout rates in 30 selected high schools in the State of Oklahoma. (Davidson, 2000, p. 102)

In fact, of the 54 possible relationships measured in the study, only 3, including Oklahoma history and writing, were found to be significant. Davidson's findings were a

clear contrast to those of Gayton (1999), although his smaller sample size could account for that difference, and in fact calls the veracity of the study into question.

Callison (2002) conducted a study that drew conclusions similar to those of Davidson (2000). She sought to determine whether a relationship existed between teachers' assessment of school climate and student achievement at all levels in Sioux Falls, South Dakota. Callison also researched whether there were differences in the perceptions of climate and student achievement at the elementary and secondary levels. She administered the Organizational Climate Index (OCI) to measure teacher perceptions of school climate; 250 surveys from 31 schools were returned. She used the results of the 2002 Stanford Achievement Test-9th Edition (SAT-9), which had been administered to fifth-, eighth- and eleventh-grade students. Her study incorporated the entire Sioux Falls school district, which included 22 elementary schools, 5 middle schools, 3 high schools, and an alternative school. Callison concluded,

1. Teacher assessments of school climate are not closely related to student achievement. This trend seems evident at both the secondary and the elementary level.
2. Elementary and secondary teachers share similar perceptions of school climate.
3. Elementary and secondary students share similar levels of academic achievement. (Callison, 2002, p. 70)

Although her conclusions were drawn from nonsignificant findings and her results were similar to Davidson's (2000), Callison's findings may be explained by the achievement data she used for her study. The SAT-9 is a norm-referenced, rather than criterion-referenced, test, and therefore results for South Dakota students are reported in the context of the achievement of students across the nation (i.e., as percentiles). In utilizing those results, any generalization of results will tend toward the mean, so variance from

school to school will be minor; hence the achievement data may not be useful in a comparative study. In fact, the designs of both Davidson's and Callison's studies are fundamentally flawed, thereby making both studies far less credible.

In contrast to the previous three studies, which focused only on teacher perceptions of climate, Fisher (2003) added the variable of principal leadership style to her study. She examined the relationship between principal leadership style, school climate, and student achievement in Idaho elementary schools. She administered the Multifactor Leadership Questionnaire (MLQ) to 640 teachers across 36 elementary schools to determine whether a principal's leadership style fell into one of three categories: transformational, transactional, or laissez-faire. She also administered the Organizational Climate Description Questionnaire – Revised for Elementary Schools (OCDQ-RE) to measure teachers' perception of school climate. Fisher included SES data in her study, basing it on the percentage of students receiving free or reduced-price lunch. For student achievement data, she used results of the Idaho Reading Indicator and the Direct Mathematics and Writing Assessments. Her analysis attempted to determine whether relationships existed between leadership and climate, between leadership and student achievement, between climate and student achievement, and between student SES and student achievement. Fisher's findings are summarized as follows:

1. The vast majority of schools (85%) identified the principal's leadership style as transformational. The remaining schools did not identify a dominant leadership style in the principals.
2. Of the schools identifying the principal as transformational, the vast majority (92%) also perceived the climate of their school as open or positive.

3. Although the results revealed no significant relationship between student SES and student achievement in reading, they did show a significant negative relationship between student SES and student achievement in math ($R^2 = .256$, $p < .05$) and writing ($R^2 = .184$, $p < .05$).
4. The only climate factor shown to have a relationship with student achievement was teacher openness ($R^2 = .325$, $p<.05$), which the OCDQ-RE identifies as including collegiality among teachers, professional intimacy among teachers and the principal, and teachers' connectedness with schoolwide focus and goals.

Fisher's study was broader than the previous three, examining multiple factors and their impact on student achievement. Nevertheless, as was the case with the other studies, her data were primarily drawn from surveys.

Although each of the four studies drew different conclusions, they had several commonalities, the foremost of which was to examine a relationship between student achievement and school climate as perceived by teachers. Two of the four studies, however, contained research design flaws that severely limited them in terms of offering meaningful conclusions. Each study utilized climate surveys with Likert scales to measure teacher perceptions. The climate surveys had some variance in terms of focus areas used to describe climate, from leadership styles and teacher affiliation to institutional integrity and resource influence. All, however, included as a climate domain academic press, defined by Lee, Smith, Perry, and Smylie as an approach that "emphasizes rigor and accountability. Its logic holds that students will achieve more when what they are supposed to learn is made clear, when expectations for academic

learning are high, and when they are held accountable for their performance" (Lee, Smith, Perry, & Smylie, 1999, p. 5). Achievement data varied from study to study; some used norm-referenced data from assessments like the SAT-9, whereas others used criterion-referenced data from state assessments. Each researcher also evaluated or accounted for the influence of student SES in his or her analysis (Smith, 2005).

More recently, in their study of elementary teachers' perceptions of climate, Johnson and Stevens defined school climate as "the psycho-social environment in which teachers work with other teachers, students, and administrators" (Johnson & Stevens, 2006, p. 113). The researchers developed two structural equation models to analyze data gathered from a survey, the School-Level Environment Questionnaire (SLEQ), "to investigate the relationship between teachers' perceptions of school climate and student achievement and whether that relationship is mediated by community and school context" (Johnson & Stevens, 2006, p. 113). The researchers relied on point-in-time data (i.e., survey) to test their question. As have others, these researchers acknowledged several factors that also could have been influential on their results; they attempted to include some of those factors by adding community and school context variables into the second research model. Ultimately, they found that "there was a positive and statistically significant relationship between teachers' perceptions of school climate and student achievement" (Johnson & Stevens, 2006, p. 118).

In their discussion of findings, though, the researchers urged caution, primarily because the model

> was missing other factors that might influence both school climate and student achievement. One of those factors is the community in which a school is situated. Schools don't operate in vacuums. They are reflections of and contributors to the communities in which they are based. (Johnson & Stevens, 2006, p. 118)

Hence, they added the school context factors into the second version of their research model.

Johnson and Stevens (2006) found that the school context factors mediated the effect of school climate. They stated, "In high SES schools, school climate was positively related to student achievement. But, in lower SES schools, there was a smaller relationship between school climate and achievement" (Johnson & Stevens, 2006, p. 119). Although the researchers did not treat SES as a climate factor, they suggested further research be conducted in the area of SES and climate. Taken a step further, their conclusion that SES mitigates the impact of school climate supports the notion that SES can be used as a proxy measure of climate.

In another mixed-methods study, Ross, McDonald, Alberg, and McSparrin-Gallagher (2007) focused their research on evaluation of the Knowledge is Power Program (KIPP) in schools in Tennessee. As with many other climate studies, the mixed-methods study utilized a variety of data gathered through surveys, interviews, and observations and compared it with data from norm-referenced achievement tests. According to the researchers, KIPP schools are "grounded on five foundational pillars: (a) high expectations, (b) choice and commitment by families, (c) more time to learn, (d) power to lead, and (e) focus on results" (Ross et al., 2007, p. 138).

Although the primary research question in the study by Ross et al. (2007) was "whether KIPP:DA [Diamond Academy] students would achieve at higher levels than would matched control students in literacy and mathematics on the state-mandated standardized assessment," the researchers also included other factors they deemed salient to the study, including "positive school climate, improved pedagogy, and teacher

support…as potential modulators and products of the KIPP:DA implementation" (Ross et al., 2007, p. 140). Research challenges included the identification of a viable control group as well as a reliance on point-in-time data gathered through surveys and observations.

With regard to the survey, key findings included the following observation: "All respondents agreed or strongly agreed with SCI Item 46: 'Student behavior is generally positive in this school'" (Ross et al., 2007, p. 146). The researcher noted that interview responses such as the following lent support to the notion that climate has a powerful impact on students:

> I think there has been a paradigm shift from feeling that 'I am a failure' to 'I celebrate me, I am unique in this world, no one can take my place.' Many of the children really do believe that they are college-bound. We talk about it daily. (Ross et al., 2007, p. 149)

The achievement gains over the course of one school year were notable as well: "Although the two groups scored very similarly on the pretests, KIPP:DA students performed directionally higher than control students on all CRT and NRT posttests" (Ross et al., 2007, p. 157).

The researchers of the study generally concluded that the KIPP school was successful in improving student achievement through a variety of means even as they acknowledged the problems inherent in a study of this nature:

> The simultaneous occurrence and interaction of multiple social, academic, administrative, and cultural events significantly complicates research efforts to isolate the effects of specific program components (Berliner, 2002; Ross, 2003). Accordingly, it is possible only to speculate from our data as to which elements of KIPP:DA had substantive impacts. (Ross et al., 2007, p. 159)

Nonetheless, the researchers asserted that their research was compelling evidence of a number of key ideas, including the notion that "positive climate facilitates program

implementation, which, in turn, can improve teaching effectiveness and curricula, and ultimately, student achievement" (Ross et al., 2007, p. 160).

Whereas each of the six studies previously described relied on point-in-time data, this study attempted to control for the variance inherent in survey data by utilizing existing data describing both climate and student achievement. These six studies, as well as many others subsequently reviewed in this chapter, utilized both SES and school size as variables. This study did so as well, using both variables as proxy measures of school climate.

Focus on middle school achievement. Hoy and Hannum identified the importance of focusing research on middle schools, stating, "Middle schools have been neglected as a domain of study even though they are an important part of contemporary American education" and "although middle schools are organized for the expressive development of students, academic achievement remains an important objective for all public schools including middle schools" (Hoy & Hannum, 1997, p. 291). In their middle school study, the researchers found that "most of the dimensions of school health were positively associated with student achievement" (Hoy & Hannum, 1997, p. 304).

Several other researchers have focused their climate studies more recently on the middle school level. Olive (2005) studied the relationship between school climate and student achievement at three Mississippi middle schools, one urban and two rural. Hannum (1994) focused on determining middle school characteristics most closely aligned with student achievement. Parish (2002) studied the relationship between middle school climate and student achievement in the Commonwealth of Virginia. DeLisi (2008) studied the climate of middle schools in the era of accountability and attempted to

determine how that accountability had impacted climate. Pierre-Pipkin (2001) examined the impact of climate, ethnicity, and SES on achievement at six middle schools in Texas. Finally, Sumner (2006) conducted a quantitative study designed to extend previous research by determining the extent to which value-added gains made by middle schools in Tennessee could be attributed to changes in climate.

Olive (2005) administered the National Association of Secondary School Principals (NASSP) School Climate Survey to the faculty of three Mississippi middle schools, including teachers and administrators. The survey provided information about the climate of the school based on level of agreement among responders with regard to the 10 subscales of the climate survey. Olive compared the survey information with achievement data drawn from the Mississippi Curriculum Test (MCT). Based on her analysis, schools with higher levels of agreement on the climate indicators also demonstrated higher levels of achievement in the areas of language, reading, and mathematics, thereby suggesting a relationship between positive school climate and high achievement; her sample was drawn from three schools, and included 73 teachers and 7 administrators.

Hannum (1994) developed his study with two purposes: (a) to determine the middle school characteristics that would lead to high student achievement, and (b) to examine the extent to which middle schools actually embraced and implemented the middle school philosophy, a philosophy primarily designed to address climate issues at the middle level. Hannum collected data on 86 schools from a variety of sources available in the State of New Jersey, including achievement data on state tests. He used a multiple regression analysis to determine whether climate, health, and both teacher and

personal efficacy data could predict achievement on state tests. Hannum found evidence that, in fact, there was a connection between climate and achievement in math, writing, and reading, regardless of the SES of the students. He also determined a connection between climate and the personal efficacy of teachers, which his regression analysis showed was also predictive of increased achievement.

Parish (2002) studied the relationship between organizational school climate and middle school student achievement on the eighth-grade SOL tests in the Commonwealth of Virginia. The School Climate Index (SCI) was used to study four factors of school climate (collegial leadership, teacher professionalism, academic press, and community engagement). Student achievement was measured by results obtained from two parts of the 2001 Virginia SOL tests: (a) English–reading, and (b) mathematics. The number of students receiving free or reduced-price lunch indicated the SES of each school. Representing a 33% response rate, 696 teachers from 49 middle schools in the Commonwealth of Virginia completed the SCI. From her study, Parish determined the following:

1. A relationship existed between school climate and student achievement in the areas of English–reading and mathematics.
2. Community engagement and academic press were correlated with higher student achievement in the area of English–reading.
3. A relationship existed between the SES of students and student achievement as measured by both the English–reading and mathematics.

With regard to the third finding, the multiple regression analysis conducted by Parish indicated that SES was a more significant variable in the index than the SCI, although both were significant at the .05 level for both English-reading and mathematics.

As did Parish (2002), DeLisi (2008) found a connection between academic press and the use of data-driven decision making and improved achievement. DeLisi was primarily concerned with how the accountability movement had impacted the behaviors of schools attempting to improve their accountability status. DeLisi compared two middle schools, one that had improved its accountability status and one that had not. Students (*n = 156*) and teachers (*n = 38*) at both schools were surveyed regarding their perceptions of climate, leadership, and educational practices. The results of the surveys from the two schools were compared. DeLisi determined that the improving school had done so through focused decision making and implementation of best practices in the context of a culture of caring, whereas the nonimproving school had compromised a culture of caring.

Pierre-Pipkin (2001) used a block research design, although the researcher called it a factorial design, to determine the impact of three variables on the achievement of middle school students in Texas, as determined by results on the Texas Assessment of Academic Skills (TAAS): (a) climate (divided into four levels: open, engaged, disengaged, closed); (b) principal's ethnicity (two levels: Black, White); and (c) the SES of the school's community (three levels: lower, middle, upper). His research design involved administering the OCDQ-RM to groups of faculty members at each of six middle schools (*n = 120*) and randomly sampling eighth-grade students who had taken the TAAS at each of the schools (*n = 288*). Pierre-Pipkin used three-way ANOVA to

examine the independent and interaction effects of the independent variables on student achievement. He also ensured there were equal *N*s for each level of each of the independent variables so that the assumption of equality of variance was met. When a difference was found in the sample means, the researcher used the Scheffe Method as a post hoc test to determine whether the difference was significant or simply a result of fluctuations due to random sampling. He concluded that school climate had the most significant effect on the achievement of students on the TAAS for both mathematics ($F = 3.683, p < .05$) and reading ($F = 4.422, p < .05$).

Sumner (2006) investigated the relationship between school climate and student performance to confirm previous research by specifically examining value-added gains over time. Using the School Climate Inventory (SCI) and the 2005 State of Tennessee Report Card, Sumner used a correlation analysis to analyze data drawn from 40 middle schools in the State of Tennessee. He found a significant correlation between climate and achievement in language arts ($r = .44, p < .05$); he also found significance with regard to climate and social studies ($r = .37, p < .05$) and science ($r = .33, p < .05$) scores. In doing so, Sumner was able to confirm previous research that had identified a relationship between school climate and student achievement.

Each of the cited studies found a relationship between school climate and the achievement of students at the middle school level. For the purposes of this study, the research also focused on the middle school level, examining all eligible middle schools in the Commonwealth of Virginia.

Factors Related to School Climate

Discipline or student behavior. Hoy and Hannum described academic emphasis (in comparison to the additional dimensions of teacher affiliation, collegial leadership, resource support, principal influence, and institutional influence) as "the single best organizational health predictor of student achievement" (Hoy & Hannum, 1997, p. 297). They arrived at this conclusion after conducting a multiple regression analysis of each of the climate domains using achievement as the criterion variable. Using beta weights, academic emphasis had the greatest significance ($\beta = .22$, $p < .05$). Consequently, schools "with an orderly and serious learning environment, with teachers who set high but achievable goals, and with students who work hard and respect others who do well academically have higher levels of student achievement" (Hoy & Hannum, 1997, p. 297). According to the researchers, student behavior was both a reflection of and an obstacle to academic emphasis. Their assertion that student behavior is an integral and impactful part of a school's climate supports the notion that discipline rates can be used as a proxy measure for climate.

According to Marzano et al., as school leaders attend to climate issues, one significant area of focus is discipline, which the researchers summarized by stating, "One important task of the school principal is to protect teachers from undue distractions" (Marzano et al., 2005, p. 48). Undue distractions are any of various activities or behaviors by students or staff that prevent teachers from teaching. Marzano et al. cited other research in support of the notion that leaders must give deliberate energy to ensuring that teachers can effectively perform their job function: "The structure and procedures Elmore (2000) speaks of are those that protect instructional time" (Marzano et

al., 2005, p. 48). Based on their research, they defined the leadership responsibility of discipline as "protecting teachers from issues and influences that would detract from their instructional time or focus" (Marzano et al., 2005, p. 48).

Several issues and influences may come into play as teachers lose instructional time in a number of ways. The most profound distraction from instructional time may be direct disruption of the classroom environment, which most commonly occurs through student misbehavior. Marzano et al. associated the following leadership behaviors with the responsibility of discipline: "1. Protecting instructional time from disruptions, 2. Protecting teachers from external and internal distractions" (Marzano et al., 2005, p. 49). In the research, internal distractions refer most often to student behavior.

Marzano et al. also cited order, which "in any dynamic environment is created by structure" (Marzano et al., 2005, p. 57), as another of the leadership responsibilities associated with effective schools. They defined order as "the extent to which the leader establishes a set of operating principles and routines" (Marzano et al., 2005, p. 57). These operating principles and routines should be designed to set clear parameters for all stakeholders regarding what is acceptable behavior in a school. The researchers again cited other studies: "Nunnalley, Whaley, Mull, and Hott (2003) define order as clear boundaries and rules for both students and faculty" (Marzano et al., 2005, p. 57). Order was closely aligned with discipline in the meta-analysis by Marzano et al. Both order and discipline address the learning environment—order deals with governing human behavior whereas discipline deals with protecting instruction—and hence have a direct bearing on the climate of a school. Previous research based on perceptions of behavior in schools supports the idea that climate affects behavior (Hoy & Miskel, 1996). A leader who

recognizes the relationship between behavior and climate will have an easier time establishing a positive school climate. As does research by Hoy and Hannum (1997), Marzano's research supports the notion that student discipline can be used as a proxy measure of climate.

With regard to both order and discipline, the behavior of students lies at the heart of the matter. A leader is responsible for addressing correct behavior for both adults and children in the school context. Marzano et al. (2005) identified the leadership behaviors key to successfully implementing order as "1. Establishing routines for the smooth running of the school that staff understand and follow, 2. Providing and reinforcing clear structures, rules, and procedures for staff, 3. Providing and reinforcing clear structures, rules, and procedures for students" (Marzano et al., 2005, p. 57). The researchers identified structure, rules, and procedures as key to establishing a safe and orderly environment, a conclusion addressed in other studies, as discussed in this literature review.

Safety and order were cited in several studies as key factors in measuring the climate of a school. Howard et al. (1987) asserted that for a school to be successful, the school climate must address the "safety needs" of both teachers and students. In another study, Sackney (1988) subdivided climate into two areas—"academic climate" and "social climate"—and showed that each type has a set of norms, structures, and processes. Sackney described academic climate as the "quality of instruction and student performance" and social climate as activities and behaviors within the social interactions that "indirectly impact student learning" (Sackney, 1988, p. 9). Safety and order fall into the domain of social climate, including negative student behaviors. Berliner and Biddle

(1995) emphasized the importance of addressing social issues in schools to find solutions for pervasive problems in contemporary education. The social issues they addressed included income or wealth inequity, that is, SES, which is addressed in the next section; violence and drug use, which are behavioral issues that have a direct bearing on a safe and orderly environment; and school size, which is addressed in a later section. Brookover et al. also noted the distinct connection between climate and social environment, concluding that student achievement is clearly affected by a school's social environment and that "the differences in climate between schools are important aspects of the school's social environment" (Brookover et al., 1978, p. 303). Finally, Sugai and Horner, whose study is addressed more completely later in this chapter, focused directly on the environment of a school, reporting that "learning and teaching occur best in school climates that are positive, orderly, courteous, and safe" (Sugai & Horner, 2001, p. 2). Likewise, Smith (2005) used incidences of violence and student misbehavior as key climate factors in the design of his cluster analysis.

In *What Works in Schools: Translating Research to Action,* Marzano (2003) focused on a safe and orderly environment as one of the five school-level factors associated with improved achievement. The researcher stated, "If teachers and students do not feel safe, they will not have the necessary psychological energy for teaching and learning…without a minimum level of safety and order, a school has little chance of positively affecting student achievement" (Marzano, 2003, p. 53). As stated previously, the researchers also determined that a school without a minimum level of safety and order cannot have a climate conducive to learning. Hence, safety and order are key climate

factors. The extent to which student behavior is governed has a direct bearing on whether safety and order are established and maintained.

Marzano's (2003) recommendations for establishing a safe and orderly environment, in fact, directly addressed student behavior. He recommended the following action steps regarding a safe and orderly environment:

1. Establish rules and procedures for behavioral problems that might be caused by the school's physical characteristics or the school's routines,
2. Establish clear schoolwide rules and procedures for general behavior,
3. Establish and enforce appropriate consequences for violations of rules and procedures,
4. Establish a program that teaches self-discipline and responsibility to students. (Marzano, 2003, pp. 55-57)

Marzano extended the concept of safe and orderly environment to classroom management, which he maintained is one of three teacher-level factors affecting student achievement. In doing so, he defined the aspects of successful classroom management as follows:

> establishing and enforcing a comprehensive list of rules and procedures, using disciplinary interventions that strike a balance between positive reinforcement for appropriate behavior and negative consequences for inappropriate behavior, establishing relationships with students that involve appropriate levels of dominance and cooperation, and developing the mental dispositions of withitness and emotional objectivity toward students. (Marzano, 2003, p. 105)

Throughout this review of literature, climate has been defined in various ways, and Marzano echoed these definitions in defining teacher behavior. His focus on relationships, rules and procedures, emotional objectivity, and addressing behavior appropriately all extended themes and connections to climate found throughout the research.

Finally, Marzano (2003) extended his analysis one step further, from classroom management to student motivation, one of four student-level factors contributing to

increased student achievement. Hoy supported the notion of a relationship between motivation and climate, describing schools as social systems with "emphasis on motivation, school culture, organizational climate, shared decision making, and leadership" (Hoy, 2013, p. 1). In Hoy's view each of the listed domains was related to the others. Marzano recommended "altering the competitive nature of classroom success, engaging students in long-term projects that tap into their deeply held passions, and providing students with information about motivation and training in techniques to control their motivation" (Marzano, 2003, pp. 152-153). As did other previously discussed researchers, Marzano connected student behavior and motivation with improved student achievement as well as a positive and supportive school climate (Berliner & Biddle, 1995; Brookover et al., 1978; DiPaola & Tschannen-Moran, 2001; Howard et al., 1987; Hoy & Hannum, 1997; Sackney, 1998; Sugai & Horner, 2001).

Student behavior can be influenced by adult behavior. DiPaola and Tschannen-Moran (2001) conducted a study on organizational citizenship behaviors (OCBs), which they equated to the level at which individuals go above and beyond the described duties of their jobs to serve the greater good of the organization. Their study focused on the impact of those OCBs by employees on school climate, and they tested their hypothesis of "a positive relationship between OCB and school climate; that is, the more positive the school climate, the greater the incidents of organizational citizenship behaviors" (DiPaola & Tschannen-Moran, 2001, p. 434).

For the purposes of their study, the researchers developed and tested their own instrument, the Organizational Citizenship Behavior in Schools Scale (OCBSS), a survey instrument they used with two separate samples of teachers. The instrument generally

isolated two types of OCBs: those involving employees' going out of their way to help other individuals and those involving employees' going out of their way to help the organization. The researchers measured the climate of the school using the School Climate Index (SCI) developed by Hoy et al. (1998) and subsequently conducted both factor analyses and correlational analyses.

The researchers found that "organizational citizenship was related to the climate of the school in both…samples" (DiPaola & Tschannen-Moran, 2001, p. 438). The sample for the first study included 664 teachers in 42 public schools in Ohio and Virginia. The sample for the second study included 1,210 teachers in 97 public schools in Ohio. Their findings, however, showed that the influence of climate was stronger on behaviors involving teachers' going above and beyond to support organizational goals (i.e., OCBs). The work of DiPaola and Tschannen-Moran (2001) indicated that OCBs are more frequent in schools with a positive climate than in schools without a positive climate. As adults in a school building demonstrate higher instances of OCBs, they model behaviors for students that make them good citizens of not only the organization but also broader society.

Further research also demonstrated the connection between student behavior and school climate. Allodi (2002) conducted a two-level analysis of classroom climate to determine the relationship between climate and social context. She used structural equation modeling to analyze data collected from 679 students in 39 classrooms at 16 schools. Using an adapted version of the My Class Inventory (MCI) and the Individualized Classroom Environment Questionnaire (ICEQ), she collected data on students' perceptions of satisfaction, friction, competition, cohesiveness, and

personalization. Comparing the data of students of varying socioeconomic status, she concluded, "Learning environments vary from school to school, depending on the school's social context" (Allodi, 2002, p. 268). As a result of her study, she posited that learning environment and social context have a significant relationship and that the climate formed from that relationship is directly linked to student achievement. Goddard, Sweetland, and Hoy (2000) conducted a multilevel analysis of urban elementary schools and found that academic press not only improves school climate but also positively influences student behavior. Kuperminc, Leadbeater, and Blatt (2001) conducted a regression analysis of students' perceptions of their school's climate and its relation to behavioral, emotional, and academic problems. They examined students (*N = 560*) with both positive and negative perceptions of school climate. From their study, they concluded that the degree to which students displayed emotional and behavioral problems had a direct relationship with school climate: the higher the level of emotional problems, the lower the climate, and vice versa. They stated, "A positive social climate may have particularly strong constructive effects for students at greatest risk of academic, emotional, and behavioral difficulties" (Kuperminc et al., 2001, p. 144). Additionally, the National Center for Education Statistics (NCES, 2003) demonstrated that a school's climate is improved when a school reduces behavioral problems including tardiness, absenteeism, verbal and physical conflicts, vandalism, weapons, alcohol, and drug abuse; reduction in these behavioral problems in turn improves the academic environment and therefore leads students to greater academic success (Smith, 2005).

Sugai and Horner's (2001) seminal theoretical work in positive behavior management relied on a body of research that stressed the relationship between student

behavior and school climate. The researchers stated, "Defiant, disruptive and violent behaviors decrease the effectiveness, efficiency, and relevancy of teaching and learning for everyone" (Sugai & Horner, 2001, p. 2). They identified the following challenges facing educators and the broader school community:

1. general lack of discipline (e.g., disrespect, insubordination),
2. increasing school violence (e.g., assaults, fighting),
3. inefficient use or loss of instructional time (e.g., decreased achievement and teaching time),
4. over-reliance on punishment-based, exclusionary programming (e.g., office discipline referrals, detention, suspensions, expulsions),
5. failed attempts to provide individualized and appropriate educational opportunities for students with disabilities and students from diverse backgrounds,
6. lack of fluency with specialized behavior practices (e.g., functional behavioral assessment, behavior intervention planning, teaching pro-social skills),
7. disenfranchisement of families and communities, and
8. fragmented, redundant, and inefficient multidisciplinary efforts. (Sugai & Horner, 2001, p. 2)

As was Marzano (2003), Sugai and Horner were concerned with protecting instructional time, establishing effective discipline, maintaining order throughout the school community, and addressing the behavioral needs of students with appropriate practices. In their work, Sugai and Horner made a strong argument that building a positive school climate that supports social competence requires a systematic schoolwide approach (i.e., systematically working to improve student behavior). The relationship between climate and behavior was supported by Tableman, who wrote the following in a *Best Practice Brief* published by Michigan State University:

> These various aspects of school climate do not operate independently of one another. For example, the physical environment can encourage or discourage social interaction. Similarly, social interaction facilitates a warm, affective environment. Collectively, the physical, social and affective environments contribute to, and are impacted by, the academic environment. (Tableman, 2004, p. 5)

This finding also echoed the two-way relationship between school climate and student achievement posited by Hoy et al. (1998).

Chen and Weikart (2009) found similar results in their study of New York City middle schools. The researchers developed their own model, which focused on school disorder and student achievement relative to a school climate framework. Using structural equations modeling analysis, the researchers found that, based upon test statistics and goodness of fit indices, the model fit the data well and supported their hypothesis that poverty and minority status of student population predict school disorder, which in turn diminishes student achievement, especially when combined with poor attendance rates. They identified a correlation between high disorder with low attendance and negative school climate. Additionally, they corroborated research that found SES to be a significant factor in both student achievement and school climate. Although Chen and Weikart also found that smaller schools tend to have lower disorder and higher learning, they determined school size was not statistically significant when isolated from other variables. The researchers concluded that school climate, when framed through the lens of school disorder and attendance rates, had a significant impact on achievement; therefore, they suggested that leaders who can improve the level of disorder and attendance in their schools can in turn improve their climate and increase student achievement.

The research identifying behavior as a factor of school climate was extensive. Beyond those studies already cited, others supported the notion that creating a positive school climate, in particular for at-risk students, can alleviate academic, emotional, and behavioral issues (Felner et al., 1995; Haynes, Emmons, & Ben-Avie, 1997). In an

earlier study Edmonds (1979) identified an orderly school environment as one of five factors that contribute to student achievement. With regard to measuring climate factors, Creemers and Reezigt (1999) utilized four instruments designed to measure school and classroom climate in Dutch schools. They stated,

> We took the main concepts and items from the set and restated them as topics for schools and teachers to consider when they want to discuss their climate factors. The inventory also placed a heavy emphasis on student outcomes and expectations as well as on teacher behavior, in particular with regard to student behavior and achievement. (Creemers & Reezigt, 1999, pp. 40-41)

Throughout the literature, student behavior has been connected to school climate; therefore, research has provided support for the use of student behavior as a proxy measure of school climate in this study.

Poverty or socioeconomic status. Many of the studies previously cited in this chapter included SES as a variable in their examinations of climate, student achievement, or both. Based on review of the research, there is little doubt that SES plays a role in the achievement of students. The impact of SES has long been a central concern for educational researchers. Smith (2005) noted a wide range of studies that had addressed the relationship between student SES and academic achievement. Decades of research have been developed on the topic (Benson, 2003; Brookover et al., 1978; Bulach, Malone & Castleman, 1995; Coleman et al., 1966; Considine & Zappala, 2002; Hoy et al., 1998; Spence, 2003; Weber, 1971). What does SES entail? Ainley et al. defined it as "a person's overall social position…to which attainment in both the social and economic domain contribute" (Ainley et al., 1995, p. ix). Considine and Zappala described it as "determined by an individual's achievements in education; employment and occupational status; and income and wealth" (Considine & Zappala, 2002, p. 130). Those descriptors

do not apply to school-age children; hence, their SES is defined by their parents. Children have little power to change their SES. As the researchers noted, SES is one factor that impacts who they are and how they approach education. As this study examined school-level SES, framed as the rate per 100 students receiving free or reduced-price lunch in a school, not every student in a school with a high-poverty rate was necessarily from a low-SES background. Conversely, not every student in a school with a low-poverty rate was from a high-SES background.

Nevertheless, does SES really affect students' performance in school? The sociological research conducted by Considine and Zappala (2002) established a strong relationship between SES and the academic performance of children. Their research confirmed the four-decades-old research of Coleman et al. (1966), who determined that the parents' SES was the best predictor of student achievement. Not all researchers have agreed. As a result of the Coleman Report, a number of researchers were spurred to further examine the factors that determine the effectiveness of a school and that enable educators to foster positive school climate (Bulach, Malone, & Castleman, 1995). After all, if parents' SES was the best predictor of achievement, what could any educator do to effectively address that issue? Researchers were able to identify other factors. For example, Weber (1971) examined four successful low-SES inner-city schools and found that achievement had been fostered through strong leadership, high expectations, and an orderly and pleasant environment (i.e., climate). In all cases, the factors identified by Weber (1971) empowered educators to act; they were factors that could be controlled at the school level.

As an outgrowth of Weber's (1971) study, the New York State Office of Education (NYSOE) undertook a performance review of low-SES schools in 1974. Their examination revealed that a low-SES school could experience academic success (Smith, 2005). The NYSOE (1974) reached their conclusions by conducting a case study of two inner-city low-SES elementary schools, one of which was considered high achieving despite having 99% of students eligible for free or reduced-price lunch, and one of which was considered low achieving with 90% of students eligible for free or reduced-price lunch. Student achievement was represented by student scores on both the Bank Street Informal Reader Placement Test and the MacMillan Textbook Test. Ensuring that the two schools were comparable with regard to ethnic breakdown and family income, the NYSOE conducted formal and informal interviews as well as classroom observations. Their conclusions are summarized as follows:

1. Difference in student performance was attributable to factors under each school's control.
2. The effectiveness of each school was impacted by administrative behaviors, policies, and practices.
3. The high-achieving school had administrators who were able to provide both strong management and sound instructional guidance.
4. The administration of the high-achieving school had developed and implemented a schoolwide plan for addressing reading deficiencies.
5. There was little difference in reading instruction at the two schools, and teachers in both schools struggled to teach and assess reading.

6. Staff in the low-achieving school, who attributed the reading challenges to nonschool factors, were skeptical that they could have an impact, hence an environment of low expectations arose; staff in the high-achieving school expressed a belief in their ability to make a difference, which raised expectations.
7. In both schools students responded to nonengaging learning activities as expected—with apathy, disruption, or absenteeism; activities of this nature occurred at greater frequency in the lower achieving school (NYSOE, 1974).

The NYSOE report gave credence to Weber's (1971) contention that SES does not predetermine student outcomes, but it also emphasized the significant challenges in low-SES schools. In addressing those challenges, the report noted that educators must be concerned with both instructional and climate factors. Because the study involved only two schools, however, the ability to generalize these results was limited.

More recently, Benson (2003) arrived at similar conclusions, identifying social class among many factors, including parental involvement, student engagement in learning, instructional methods, expectations for student achievement, and school leadership, as correlating with student achievement. Insisting that SES could not be ignored as a key factor, Hoy et al. concluded, "The socio-economic status of a community is always a strong predictor of student achievement" (Hoy et al., 1998, p. 353). Emphasizing the connection between achievement and climate, Brookover et al. (1978) determined that many schools considered to be low SES did not have a school climate that would foster student achievement. In fact, they stressed that in low-SES schools with high achievement—schools they noted were outside the norm—the

educators had taken care to develop a climate conducive to student achievement. Their findings support the assertion that SES is related to school climate and, therefore, can be used as a proxy measure of climate.

The same assertion was directly addressed by Benson (2003), who focused on determining the relationship between school climate and student achievement in low-SES schools. More specifically, one of her research questions addressed the idea that, among economically disadvantaged schools, a positive school climate correlates with higher student achievement. To answer the question, Benson designed her survey study to examine how eight dimensions of school climate—trust, respect, high morale, opportunity for input, continuous academic and social growth, cohesiveness, school renewal, and caring—impacted student achievement. She controlled for SES by selecting four schools in Southeastern Virginia with similar percentages of students receiving free or reduced-price lunch. She used the pass rates of students on the third-grade Virginia SOL tests to measure student achievement. She categorized the schools based on the achievement data as high, medium, or low achieving. Based on the survey results, Benson concluded that there was a positive relationship between school climate and student achievement. In fact, when she ranked the four schools based on their achievement data, she found that the order from highest to lowest was exactly the same as the rank order of the schools' climate scores. Although both the Benson study and the NYSOE study used small samples ($N = 4$ and $N = 2$, respectively), making them difficult to generalize, the findings in both studies corroborate and enrich the body of research connecting SES and climate.

Spence (2003) also studied the relationship between school climate and student achievement, specifically how achievement varied in low-SES schools with different climates. As did previous studies cited in this chapter, Spence's study focused on how teachers perceived the climate of their school, the relationship between climate and student achievement on Virginia SOL tests, and the differences in climate and achievement. He administered the Organizational Health Inventory for Elementary Schools (OHI-E) to 286 faculty members in 11 schools to measure total climate as well as five dimensions of climate including institutional integrity, resource influence, collegial leadership, teacher affiliation, and academic emphasis. Spence concluded from his analysis that there was a positive relationship between climate and achievement in the subject schools, in particular for the climate dimensions of teacher affiliation and academic emphasis. His results, which affirmed those of Benson (2003), also suggest that SES is a factor in climate (i.e., SES may be used as one element in describing a school's climate). As such, those schools that face significant challenges of poverty and economic disadvantage must focus more energy on developing a climate conducive to achievement. As shown in much of the previously cited research, left unattended, climate in low-SES schools will tend toward the negative, whereas climate in high-SES schools will tend toward the positive. Hence, for the purposes of this study, due to its connection with school climate, SES was used as a proxy measure of climate.

School size. Kaczor (2006) examined the relationships between student achievement and school climate with regard to school size within four poverty levels in middle schools in South Carolina. She drew all data from the South Carolina State Department of Education (SCDOE) 2004 School Report Card, including student

achievement in language arts and mathematics on the South Carolina state tests, socioeconomic data from the poverty level index provided by the SCDOE, climate data from nine survey responses included on the report card, and school size information as defined by average daily membership on the report card. Kaczor conducted multiple analyses of the relationships between school size and climate, school size and achievement, and school size within SES groupings and climate and achievement using data from 173 schools. Although Kaczor found little direct impact of school size on student achievement, using Pearson correlations she did find that school size was highly related to virtually every climate variable she used in her study.

Given the correlation between school size and climate identified by Kaczor (2006), school size was considered another proxy measure of school climate for the purposes of this study and was used as a variable in the cluster analysis described in Chapter 3. The use of school size as a component of school climate is not unprecedented. Bedford (1987) also included school size as a variable in developing his conception of school climate as he studied the impact of climate on achievement in Georgia schools. To do so, Bedford first determined the components of schools that could be used to determine the climate of a school; school size was prominent among those components.

The Case for Using Existing Data

The body of research indicated a small to nonexistent number of researchers who examined school climate and culture without using point-in-time data. Most climate studies typically attempt to measure climate through surveys, interviews, questionnaires, and other analyses that draw data from a specific point in time. There is precedent, however, for examining the climate of a school by using existing data descriptive of

factors that can be used to form a climate index. In a 1997 study, *Education Week* researchers "used class size, ratio of pupils to teachers in secondary schools, school organization, and school safety as criteria for giving a grade of A to F on how positive the climate [of a school] was" (Freiberg & Stein, 1999, p. 14). The following year, 1998, a *Teacher Magazine* article "reported another climate 'report card' using class size and student engagement (student absenteeism, tardiness, and classroom misbehavior) criteria" (Freiberg & Stein, 1999, p.14). Both studies lend credence to the idea that climate can be measured without perception-based data. The variables used in each study have a significant bearing on the variables that were used in this study. As discussed throughout the chapter, the variables identified for the CI were used as proxy measures of climate.

These studies, conducted by two major voices in the education field, are supported by a powerful meta-analysis conducted in 1993 by Wang, Haertel, and Walberg that "created a database of nearly 11,000 statistical findings from which they determined the most significant influences on learning" (Freiberg & Stein, 1999, p. 16). One conclusion that Wang et al. reached was noted as follows: "When averaged together, the different kinds of instruction and climate had nearly as much impact in learning as the student aptitude categories" (Wang et al., 1993, p. 289). Wang et al. collected thousands of data points in a variety of categories related to education and conducted the meta-analysis to determine where the greatest impact on learning occurred: "The implications are significant in this meta-analysis," supporting "the idea that climate is a real factor in the lives of learners and that it is measurable, malleable and material to those that work and learn in schools" (Wang et al., 1993, p. 291). One key finding significant for this study was that the climate of a school has a tangible impact on student achievement, and

another was that climate can be quantitatively measured using existing data, which in this study the researchers drew from 179 handbook chapters and reviews and 91 research syntheses to try to determine factors with the most significant influences on learning.

Based on the review of the literature and within the context of the theoretical framework developed by Hoy and Hannum (1997) and refined by Hoy, Hannum, and Tschannen-Moran (1998), the operational definition of climate for the purposes of this study is as follows: The climate of a school as described by factors including student discipline, student attendance, school SES, and school size is a function of organizational health, which is formed by the quality of relationships (student discipline and attendance), the level of emphasis on academic excellence (student achievement), the quality of leadership (student discipline and attendance), and the influence of external factors (SES and school size).

Summary and Key Themes

Educational theorists such as Deal and Peterson (1999), Marzano (2003), and Freiberg (1999) have given considerable attention to the problem of developing and measuring climate in schools. These researchers fundamentally agreed that climate must be a concern for school leaders as they strive to maximize achievement. Their work with climate is seminal among the body of research examining climate in schools.

The review of the literature in this chapter has revealed the following key themes:

1. School climate has a relationship with student achievement.
2. Student behavior, student attendance, school SES, and school size are related to school climate, and can therefore be used as proxy measures of school climate.

3. Middle schools have unique achievement challenges.
4. A quantitative analysis of the relationship between school climate and student achievement using existing, easily accessible, noninvasive, publicly reported data, can be undertaken.

To date, no such study had been undertaken at the middle school level. Absent from the literature was the formulation of a process for quantitatively determining the impact of climate on achievement using only publicly available data, in particular at the middle school level. This study undertook to fill that gap.

The next chapter provides an overview of the methodology to be used to examine the relationship between school climate and achievement at middle schools in the Commonwealth of Virginia.

Chapter 3

Methodology

One alternative to measuring climate through the use of surveys and other perception-based data was to develop a quantitative study of the relationship between climate and achievement using publicly available state-reported data. This approach provided a noninvasive method for the study of school climate and eliminated the need to control for variations of routine behaviors that might influence survey responses and skew results (Smith, 2005). This chapter describes the quantitative approach used in this study. The researcher in this study built a Climate Index (CI) comprising factors determined to correlate with climate that served as proxy measures of climate. This study, however, focused solely on factors for which existing data had been gathered, and the researcher used that data to develop the CI. The data were categorized through the CI and analyzed to determine whether there was a relationship between climate and achievement in the schools being studied.

Research Questions

The primary research question guiding this study was the following:

Is there a relationship between the climate of Virginia middle schools, as measured by the Climate Index (CI), and the achievement of students in those schools? The primary research question was divided into subquestions as follows:

a. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in English–reading in those schools?

b. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in mathematics in those schools?
c. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in history–social science in those schools?
d. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in science in those schools?

The Case for Replication

As previously noted, this study is a replication of a study conducted by Smith (2005). The study had been replicated twice already, once by Warren (2007), and most recently by Phillips (2010). Whereas Smith (2005) focused his climate study on school divisions in the Commonwealth of Virginia, Warren focused her study on school divisions in four states including Virginia, Maryland, Pennsylvania, and New Jersey, and Phillips focused his study on elementary schools in the Commonwealth of Virginia. All three studies used cluster analysis as the primary statistical methodology.

In their *Introduction to Research in Education*, Ary, Jacobs, and Razavieh (1996) provided several reasons that a researcher might replicate a previous study. The first two included the following: "Reviewing of previous research helps us formulate research questions that are the next logical step from previous investigations," and "Review of previous research may stimulate a researcher to see whether the procedures employed can be adapted to solving other problems, or whether a similar study could be conducted in a different field or subject area, or with different groups of subjects" (Ary et al., 1996, p.

49). Both of these reasons for replication applied in the case of this study. First, as Smith and Warren both focused on school divisions, and Phillips focused on elementary schools, the next logical step in the research was to focus on middle schools. Prior to this study, there had been no study in the literature that applied this methodology to determine the relationship between middle school climate and achievement. The impact of climate on achievement in middle schools was the underlying basis for the research questions in this study. Additionally, this study focused on a different data set from those in the previous studies, that is, middle schools.

The current study also provided the researcher the opportunity to add to the findings of previous research to provide confirmation, which was consistent with the third reason provided by Ary et al.: "Reviewing previous research may suggest the desirability of replication to confirm previous findings" (Ary et al., 1996, p. 49). Finally, the authors provided yet another reason that a researcher might undertake replication: "Reviewing previous research may result in detecting inconsistencies and contradictions or in dissatisfaction with the conceptualization, methodology, measuring instruments, and statistical analysis used" (Ary et al., 1996, p. 50). One basis for conducting the current study was that the researcher believed the previous studies, particularly those of Smith (2005) and Warren (2007), erred in focusing on school divisions. By focusing on school divisions, Smith and Warren disregarded the variance in climate and achievement from school to school within a division. Their results, therefore, are not necessarily generalizable to the school level. Additionally, by including truancy as a variable, which Smith did, the influence in high schools, where truancy is relatively common in comparison to elementary and middle schools, where truancy is relatively nonexistent, is

profound. In this case the results are not necessarily generalizable to elementary and middle schools. Hence, the current study applied the same methodology to schools rather than divisions. In the case of the current study, replication provided opportunity to make valid contributions to the literature.

Methodology

Research design. Isaac and Michael defined descriptive research as systematically describing the "facts and characteristics of a given population or area of interest, factually and accurately" (Isaac & Michael, 1971, p. 18). Because this study sought to describe the relationship between school climate and the level of student achievement of middle schools in the Commonwealth of Virginia, the study was descriptive in nature. More specifically, this study involved a nonexperimental design; Dannels stated that nonexperimental designs "are used…in situations where the primary purpose is to describe the current status of the variables of interest" (Dannels, 2010, p. 343). The goal of the researcher was to analyze existing and publicly available data using two separate statistical methods to determine whether a relationship exists between the independent and dependent variables.

As previously noted, this study focused on middle schools in the Commonwealth of Virginia. To build the sample, data were drawn from all middle schools in the state. Middle schools were the population for the study. Certain middle schools, however, were excluded from the study: those schools that served more than traditional middle school students (e.g., schools that included grades one through eight or that included high school students). All data used in this study were drawn from the VDOE, which reported whole

school data, making it difficult to separate the data of elementary or high school grade levels from middle grades. A total of 335 schools were included in the study.

In this study, the variables were analyzed through two statistical methods. As discussed in Chapter 2, there was a compelling case for a study of school climate using preexisting data rather than perception-based point-in-time data. One primary purpose for conducting a quantitative analysis of the relationship between climate and achievement using only existing data was to attempt to control for factors that might influence the outcome of the study—factors ranging from timing to state of mind of respondents. Hence, this study used indirect measures, which, according to Freiberg and Stein, are data that "[do] not require direct interactions with individuals and [minimize] or [eliminate] the need to insert the data collector into the daily lives of teachers or students" (Freiberg & Stein, 1999, p. 23). The data that were indicators of school climate and that functioned as indirect measures generally were drawn from existing data sources,

> including attendance records of students and teachers; visits to the nurse's office (these are effective measures of student stress level); discipline referrals to the office; suspensions and expulsions; teacher and administrator turnover rates; student achievement; student mobility rates and the like. (Freiberg & Stein, 1999, p. 23)

For the purposes of this study, the primary source of data consisted of reports generated by the VDOE.

How does a researcher quantitatively measure the climate of a school using only publicly available data to draw conclusions about how that climate affects student achievement? Smith (2005) utilized a hierarchical cluster analysis. Smith cited Everitt (1993) who

> described the hierarchical cluster method as a process of classifying groups and repeating the process at different levels creating a dendrogram. The dendrograms are then used to illustrate clustered groups made at each successive level, and each cluster is based on like factors or similarities. (as cited in Smith, 2005, p. 44)

Whereas Smith clustered school divisions in his study, this study used the same process to cluster all middle schools in the Commonwealth of Virginia based on the identified variables. The researcher used a heuristic method to determine the number of clusters, specifically Ward's Method using Euclidian Distance, "a subjective pruning of the tree" (Aldenderfer & Blashfield, 2004, p. 54), or dendrogram. Middle schools were clustered into groups based on a CI. Once the schools were clustered, the clusters were analyzed to determine whether a relationship exists between climate and student achievement. Achievement data were drawn from data provided in School Report Cards published yearly by the VDOE.

Although Smith (2005) conducted only a hierarchical cluster analysis in his study of climate and achievement, the researcher in this study conducted the hierarchical cluster analysis side-by-side with a multiple regression analysis. Kelley and Maxwell called multiple regression "one of the most important and widely used statistical methods in social science research," the purpose of which is "to relate a set of regressor (independent or predictor) variables to a criterion (dependent or outcome) variable for the purposes of explanation and/or prediction" (Kelley & Maxwell, 2010, p. 281). For the purposes of this study, the multiple regression analysis was conducted to enable the researcher to examine whether two different quantitative methods yielded similar results. Multiple regression analysis in this case was conducted for explanatory purposes using the same independent variables as those used to build the CI in the hierarchical cluster analysis. By using both methods, the researcher attempted to build a predictive model.

In light of the discussion of key variables in this chapter as well as the operational definition of climate developed in Chapter 2, data available from the VDOE, including student discipline, school size, attendance rate, and school SES (i.e., the percentage of students at a school designated as economically disadvantaged by virtue of receiving free or reduced-price lunch), were the independent variables utilized to form the CI in the hierarchical cluster analysis. The schools were clustered based on CI scores. The clusters were then analyzed according to student achievement, also determined by data available from VDOE, in this case achievement scores on the Virginia SOL tests in the four core academic areas: English–reading, mathematics, history–social science, and science.

The same independent variables used in the cluster analysis functioned as the independent variables in the multiple regression analysis. The same student achievement data used in the cluster analysis functioned as the dependent variable in the multiple regression analysis.

Sample. The sample for this study was 335 public middle schools in the Commonwealth of Virginia. Middle schools that included any grade level outside grades 6 through 8 were excluded from the study. For the purposes of this study, selected data submitted by each public school division on behalf of individual schools to the VDOE and reported by the VDOE through School Report Cards available to the public online were used.

Data collection. Data used to describe the independent variables were drawn from the NSLP Free and Reduced-Price Eligibility Report and the VDOE School Report Cards. Data collected from the results of the 2010-2011 Virginia SOL tests were used as

the measure of student achievement, which functioned as the dependent variable. The four content areas (English–reading, mathematics, history–social science, and science) were included as part of this study. Student performance on the Virginia SOL tests was used to measure student achievement.

Two reports—the VDOE School Report Cards and the VDOE NSLP Free and Reduced-Price Eligibility Report—provided the data included in this study. The School Report Cards provided achievement data, discipline data, school size data, and attendance data. The NSLP Free and Reduced-Price Eligibility Report showed the percentage of students receiving free or reduced-price lunch at each school. These data were used to determine SES for each school. Data collected during the 2010-2011 school year were included in this study.

Student achievement data for this study were drawn from data collected by the VDOE in the Commonwealth of Virginia. Since the implementation of the No Child Left Behind Act (NCLB, 2002), states have been required to collect and report data to be accountable to the parameters set forth in the legislation. The VDOE reports data for each school in the state on an annual basis through School Report Cards.

Because all data were drawn from the VDOE, reliability is strong. The data the VDOE collects are not based on self-reports or surveys. Instead, the VDOE uses a consistent collection process that draws data from all schools in Virginia and reports it publicly in a consistent format. As such, the procedures used in this study easily can be repeated from year to year as new data sets become available. The strong reliability of the data lends strength to the validity of the experimental design.

Data management. Everitt (1993) identified the cluster analysis as a method commonly used to separate data into basic groups. According to Everitt, several types of clustering methods, including hierarchical, optimization-partitioning, density, and clumping can be used to group individuals or to group variables. The hierarchical cluster method was selected for this study.

Everitt (1993) described the hierarchical clustering method as a process of classifying groups and repeating the process at different levels to create a dendrogram. The dendrograms are then used to illustrate clustered groups formed at each successive level, and each cluster is based on like factors or similarities. For the hierarchical cluster analysis in this study, clusters were created using raw data from each middle school (N = 335) in the following categories: (a) discipline data, which were drawn from the School Report Cards in the areas of weapons offenses, offenses against students, offenses against staff, other offenses against persons, alcohol, tobacco, and other drug offenses, property offenses, and disorderly or disruptive behavior offenses; (b) attendance rate drawn from the School Report Cards; (c) school size drawn from the School Report Cards, (d) and SES expressed in terms of students eligible for free or reduced-price lunch included in the NSLP Free and Reduced-Price Eligibility Report.

In preparation for the clustering process, the researcher downloaded to an Excel database descriptive data provided by the VDOE. Raw discipline data were rescaled based on infractions per 100 students for each middle school. The number of students receiving free or reduced-price lunch also was rescaled on a per-pupil scale of 100 for each middle school. Using rescaled data, a mean score and standard deviation score were calculated for each reporting category. Rescaled data then were used to calculate *z*-

scores. The *z*-scores were developed to standardize the data to be analyzed so that comparisons could be made. A separate *z*-score was determined for each school in each reporting category and entered in SPSS version 11.0. To group schools according to like factors, a hierarchical cluster analysis was conducted (Smith, 2005). The cluster analysis was conducted multiple times, each time varying the order in which the independent variables were entered into SPSS. Using Ward's Method with Euclidian Distance, each replication of the method revealed five clusters. The researcher also conducted ANOVAs of each of the CI variables. The ANOVAs were not interpreted for statistical significance, but instead to determine the strength of each of the variables in establishing the clusters and in differentiating one from another

For the multiple regression analysis, the *z*-scores calculated for the cluster analysis also were used. Again, the rescaled data for the independent variables of student discipline, school size, attendance rate, and school SES were input into SPSS version 11.0. Data for the dependent variable of student achievement in each content area were input into SPSS as well, and the regression analysis was conducted. Each of the variables used was continuous.

Data analysis. In the hierarchical cluster analysis, each of the clusters was analyzed relative to achievement data in each content area. The achievement scores were averaged in each content area across each cluster. The purpose of the analysis was to determine whether a relationship between middle school climate and student achievement exists. The first step was to conduct ANOVAs for mean achievement in each content area across the clusters. Because the five clusters varied in size, the Levene test for equality of variance was conducted. Based on the results of the Levene test, appropriate post hoc

tests were conducted. Finally, effect size was determined by calculating the eta squared and the omega squared which provided a range of the percentage of the variance in the dependent variable accounted for by variance in the CI variables.

During the multiple regression procedure, data analysis included the calculation of Pearson's correlation coefficient (r), and the regression statistic (R^2), which "quantifies the proportion of variance of Y that can be accounted for by K regressor variables" (Kelley & Maxwell, 2010, p. 284) or the degree to which differences in the dependent variable can be correlated to the independent variables. Finally, the researcher conducted ANOVAs to determine whether the differences in achievement across clusters were significant.

Summary

The purpose of this study was to determine the relationship between school climate and student achievement of middle schools in the Commonwealth of Virginia. The sample for this study was 335 public middle schools in Virginia. Results from the 2010-2011 Virginia SOL tests were used to measure student achievement in each content area (English–reading, mathematics, history–social science, and science). Data collected from two reports (NSLP Free and Reduced-Price Eligibility Report and VDOE School Report Cards) were used to create a CI. To form the CI, both discipline data and student eligibility for free and reduced-price lunch data were rescaled to reflect a per-pupil scale of 100. A hierarchical cluster analysis using Ward's Method with Euclidean Distance was conducted to group middle schools according to like factors or similarities. Five clusters were formed and analyzed to determine whether a relationship between middle school climate and middle school student achievement exists.

Additionally, the same data sets used for the cluster analysis provided data for the independent variables in the multiple regression analysis. The analysis was conducted using re-scaled data. First, Pearson's correlation coefficient was calculated. The regression analysis revealed the percentage of variance (R Square) in achievement in each content area explained by the CI. Significance of the differences in the percentage of variance was determined by conducting ANOVAs. Results of the significance tests were used to determine whether there is a correlation between the climate variables and student achievement.

The findings from the hierarchical cluster analysis and the multiple regression analysis are discussed in Chapter 4.

Chapter 4

Presentation of Data

Introduction

Included in Chapter 4 is a brief introduction, restating the purpose and describing the population of this study, followed by research questions and a review of the methodology. Also included is a presentation of data followed by concluding remarks.

The purpose of this study was to determine if there is a relationship between middle school climate and student achievement in the Commonwealth of Virginia. The sample for this study was 335 public middle schools. The following primary research question was studied through both hierarchical cluster and multiple regression analyses:

> Is there a relationship between the climate of Virginia middle schools, as measured by the Climate Index (CI), and the achievement of students in those schools?

To answer the overarching question, the primary research question was divided into subquestions to be analyzed similarly as follows:

a. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in English–reading in those schools?
b. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in mathematics in those schools?

c. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in history–social science in those schools?

d. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in science in those schools?

For the purpose of this study, hierarchical clusters were created using raw data from each Virginia middle school (N = 335) in the following reporting categories: (a) school size, (b) attendance rate, (c) discipline incidents per 100 students, and (d) SES as measured by the number of students receiving free or reduced-price lunch per 100 students. School size, attendance rate, and discipline data were collected from the Virginia School Report Cards produced and published by the VDOE. SES data were collected from the 2010-2011 NSLP Free and Reduced-Price Eligibility Report produced and published by the VDOE.

Schools were clustered based on like factors or similarities. The number of clusters was determined using Ward's Method with Euclidean Distance. As a result, five clusters were formed.

All data were downloaded to an Excel database. Raw data for discipline were rescaled based on infractions per 100 students for each middle school. The number of students who received free or reduced-price lunch was also rescaled on a per-pupil scale of 100 for each middle school. Using the rescaled data, a mean score and a standard deviation score were calculated for each reporting category. Rescaled data were then used to calculate *z*-scores. A separate *z*-score was determined for each middle school in each reporting category and entered in SPSS version 11.0. To group middle schools

according to like factors, a hierarchical clustering method was applied using Ward's Method. The clustering process was conducted several times, each time varying the order of the variables. Results were consistent. Schools were clustered according to like factors based on the data entered in SPSS, thereby forming five clusters of middle schools and creating a CI representing 335 public middle schools in the Commonwealth of Virginia (Cluster One, $n = 47$; Cluster Two, $n = 63$; Cluster Three, $n = 100$; Cluster Four, $n = 118$; and Cluster Five, $n = 7$).

Student achievement data also were drawn from the Virginia School Report Cards published by VDOE. Results from the 2010-2011 Virginia Standards of Learning (SOL) tests were used as student achievement measures. Accreditation status for each school for the 2011-2012 school year was based on the test results from the 2010-2011 school year. Pass rates for each middle school in each content area (English–reading, mathematics, history–social science, and science) were entered into Excel, and a mean and a standard deviation were calculated for each cluster in each content area. A mean score and a standard deviation score also were calculated for the entire sample ($N = 335$) in each content area. Finally, using the achievement data, each cluster was analyzed in comparison to the others to determine if there was a relationship between school climate, as measured by the CI, and student achievement of middle schools in the Commonwealth of Virginia. To determine the significance of the relationship, an ANOVA was run to analyze the difference in means for each cluster in each content area. Because of the wide variance in the sample size of each cluster, the Levene homogeneity of variance test was calculated, and based on those results the appropriate post hoc tests were conducted. Finally, effect sizes were determined for each content area.

Based upon the same data entered into Excel and SPSS, correlations using the Pearson product-moment coefficient were calculated for each reporting category for each content area. A multiple regression analysis was then conducted in SPSS to determine the significance of the relationship between the collective factors that made up the CI and student achievement in each content area. The results of the multiple regression analysis were then reported and compared to the results of the hierarchical cluster analysis.

Presentation of Data from the Hierarchical Cluster Analysis

Primary research question. Is there a relationship between the climate of Virginia middle schools, as measured by the Climate Index (CI), and the achievement of students in those schools?

Mean and standard deviation data for student achievement for each cluster of middle schools in each content area are presented in Table 4. Included are state mean and standard deviation data for student achievement for middle schools in each content area.

Table 4. *Mean and Standard Deviation of Student Achievement by Cluster Groups*

Cluster	N	English		Mathematics		History		Science	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	47	82.79	4.48	75.83	8.05	77.23	5.48	89.76	3.47
2	63	86.79	4.69	80.68	6.73	81.08	7.06	91.19	5.36
3	100	89.62	3.47	83.72	5.90	83.71	5.24	94.05	2.76
4	118	92.88	4.10	86.99	7.17	88.64	6.33	95.19	3.52
5	7	79.75	6.35	77.29	5.38	72.00	7.37	82.57	6.02
State	335	89.07	5.54	83.06	7.80	83.80	7.43	93.07	4.55

The state VASOL mean pass rate and standard deviation for each content area were as follows: English–reading, *M* = 89.07 (*SD* = 5.54); mathematics, *M* = 83.06 (*SD* = 7.80); history–social science, *M* = 83.80 (*SD* = 7.43); and science, *M* = 93.07 (*SD* = 4.55). Mean VASOL pass rates in Cluster Four were higher than the state mean in all content areas. Mean VASOL pass rates in Cluster Three were higher than the state mean in all content areas except history–social science. Mean VASOL pass rates in Cluster One, Cluster Two, and Cluster Five were lower than the state mean in all content areas.

Cluster One, *n* = 47 (Appendix A), scored below Cluster Two (*n* = 63), Cluster Three (*n* = 100), and Cluster Four (*n* = 118) in each content area. Cluster One scored higher than Cluster Five (*n* = 7) in each content area with the exception of mathematics. Achievement scores for Cluster One, as measured by VASOL, pass rates were as follows: English–reading had a mean score of 82.79 (*SD* = 4.48); mathematics had a mean score of 75.83 (*SD* = 8.05); history–social science had a mean score of 77.23 (*SD* = 5.48); and science had a mean score of 89.76 (*SD* = 3.47). In each content area, Cluster One scored below the state mean score.

Cluster Two, *n* = 63 (Appendix C), scored below Cluster Three (*n* = 100) and Cluster Four (*n* = 118) in all content areas but had higher student achievement scores than Cluster One (*n* = 47) and Cluster Five (*n* = 7) in each content area. Achievement scores for Cluster Two, as measured by VASOL pass rates, were as follows: English–reading had a mean score of 86.97 (*SD* = 4.69); mathematics had a mean score of 80.68 (*SD* = 6.73); history–social science had a mean score of 81.08 (*SD* = 7.06); and science had a mean score of 91.19 (*SD* = 5.36). In each content area, Cluster Two scored below the state mean score.

Cluster Three, *n* = 100 (Appendix E), scored above Cluster One (*n* = 47), Cluster Two (*n* = 63), and Cluster Five (*n* = 7) in all content areas but had lower achievement scores than Cluster Four (*n* = 118) in each content area. Achievement scores for Cluster Three, as measured by VASOL pass rates, were as follows: English–reading had a mean score of 89.62 (*SD* = 3.47); mathematics had a mean score of 83.72 (*SD* = 5.90); history–social science had a mean score of 83.71 (*SD* = 5.24); and science had a mean score of 94.05 (*SD* = 2.76). In each content area, with the exception of history–social science, Cluster Three scored above the state mean score.

Cluster Four, *n* = 118 (Appendix G), had the highest student achievement score in each content area. Achievement scores for Cluster Four, as measured by VASOL pass rates, were as follows: English–reading had a mean score of 92.88 (*SD* = 4.10); mathematics had a mean score of 86.99 (*SD* = 7.17); history–social science had a mean score of 88.64 (*SD* = 6.33); and science had a mean score of 95.19 (*SD* = 3.52). In each content area, Cluster Four scored above the state mean score.

Cluster Five, *n* = 7 (Appendix I), had the lowest achievement score in each content area with the exception of mathematics. Cluster Five scored higher then Cluster One (*n* = 47) in mathematics. Achievement scores for Cluster Five, as measured by VASOL pass rates, were as follows: English–reading had a mean score of 79.75 (*SD* = 6.35); mathematics had a mean score of 77.29 (*SD* = 5.38); history–social science had a mean score of 72.00 (*SD* = 7.37); and science had a mean score of 82.57 (*SD* = 6.02). In each content area, Cluster Five scored below the state mean score.

Is there a relationship between the climate of Virginia middle schools, as measured by the Climate Index (CI), and the achievement of students in those schools?

The results from the hierarchical cluster analysis are presented in Table 5. The CI includes the mean score and standard deviation score for each cluster and for the state in each reporting category (school size, attendance rate, discipline, and SES). For discipline, data were based on number of infractions per 100 students. For SES, data were based on the number of students receiving free or reduced-price lunch per 100 students.

Table 5. *Climate Index: Mean and Standard Deviation Score by Cluster Group*

Cluster	School Size		Attendance Rate		Discipline		SES	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	768.04	228.58	94.91	0.93	55.33	14.94	63.14	12.79
2	397.19	135.42	94.84	1.37	25.39	16.58	58.09	10.52
3	619.87	159.86	95.63	0.92	15.82	8.42	36.53	11.02
4	1042.21	224.31	96.22	0.80	12.32	8.98	24.64	15.47
5	554.86	121.13	93.43	0.79	122.29	27.34	82.81	8.07
State	747.43	309.58	95.26	1.16	24.08	23.53	40.97	20.72

Note. Mean and standard deviation scores for discipline and free or reduced-price lunch are based on a per-pupil scale of 100.

The state mean score and standard deviation for each reporting category on the CI were as follows: school size (M = 747.43, SD = 309.58); attendance rate (M = 95.26, SD = 1.16); discipline (M = 24.08, SD = 23.53); and SES (M = 40.97, SD = 20.72).

Of the five clusters on the CI, Cluster One had the second largest school size (M = 768.04, SD = 228.58) and the third highest attendance rate (M = 94.91, SD = 0.93). School size for Cluster One was above the state mean whereas attendance rate was below the state mean. In comparison to the other clusters, Cluster One also had the second highest number of discipline infractions per 100 students (M = 55.33, SD = 14.94) and

the second-highest number of students receiving free or reduced-price lunch per 100 students (M = 63.14, SD = 12.79). Both discipline and SES means for Cluster One were above the state mean.

Of the five clusters, Cluster Two had the smallest school size (M = 397.19, SD = 135.42) and the second lowest attendance rate (M = 94.84, SD = 1.37). School size and attendance rate for Cluster Two were below the state mean. In comparison to the other clusters, Cluster Two also had the third highest number of discipline infractions per 100 students (M = 25.39, SD = 16.58) and the third highest number of students receiving free or reduced-price lunch per 100 students (M = 58.09, SD = 10.52). Both discipline and SES for Cluster Two were above the state mean.

Of the five clusters, Cluster Three had the third largest school size (M = 619.87, SD = 159.86) and the second highest attendance rate (M = 95.63, SD = 0.92). School size for Cluster Three was below the state mean whereas attendance rate was above the state mean. In comparison to the other clusters, Cluster Three also had the second lowest number of discipline infractions per 100 students (M = 15.82, SD = 8.42) and the second lowest number of students receiving free or reduced-price lunch per 100 students (M = 36.53, SD = 11.02). Both discipline and SES for Cluster Three were below the state mean.

Of the five clusters, Cluster Four had the largest school size (M = 1042.21, SD = 224.31) and the highest attendance rate (M = 96.22, SD = 0.80). Both school size and attendance rate for Cluster Four were above the state mean. In comparison to the other clusters, Cluster Four also had the lowest number of discipline infractions per 100 students (M = 12.32, SD = 8.98) and the lowest number of students receiving free or

reduced-price lunch per 100 students (M = 24.64, SD = 15.47). Both discipline and SES for Cluster Four were below the state mean.

Finally, of the five clusters, Cluster Five had the second lowest school size (M = 554.86, SD = 121.13) and the lowest attendance rate (M = 93.43, SD = 0.79). Both school size and attendance rate for Cluster Five were below the state mean. In comparison to the other clusters, Cluster Five also had the highest number of discipline infractions per 100 students (M = 122.29, SD = 27.34) and the highest number of students receiving free or reduced-price lunch per 100 students (M = 82.81, SD = 8.07). Both discipline and SES for Cluster Five were above the state mean.

Based on the data, the clusters were described as follows:

1. Cluster One – Negative Climate (medium low attendance, medium high SES, medium high discipline, medium high school size)
2. Cluster Two – Neutral Climate (medium attendance, medium SES, medium discipline, low school size)
3. Cluster Three – Positive Climate (medium high attendance, medium low SES, medium low discipline, medium school size)
4. Cluster Four – Highly Positive Climate (high attendance, low SES, low discipline, high school size)
5. Cluster Five – Highly Negative Climate (low attendance, high SES, high discipline, medium low school size)

Based on the way SES was reported through the data used for this study, a high SES school refers to a school with a high number of students per 100 receiving free and

reduced lunch. Therefore, a high SES school in this study is a high poverty school, and conversely a low SES school is a low poverty school.

In order to determine the strength of each of the independent variables in determining the membership of the clusters, an ANOVA was conducted for each of the variables. The ANOVAs for discipline ($p = .0001$), attendance ($p = .0001$), and SES ($p = .0001$) were significant, which indicated that each had a meaningful impact on the make-up of the five clusters. School size ($p = .145$), however, was not significant, which suggested it had little or no impact on the make-up of the clusters. Results of the cluster analysis to follow seem to corroborate the relative weakness of school size as a climate variable.

In summary, Cluster One scored below the state mean score in each content area, had a lower achievement score in three content areas than did three of the four other clusters, and had the lowest achievement score in mathematics of all the clusters. Additionally, Cluster One scored above the state mean score in three of the four reporting categories on the CI (school size, discipline, and SES) but below the state mean in one category (attendance rate). Cluster Two also scored below the state mean score in each of the four content areas but above two of the other clusters. Cluster Two scored above the state mean score in two of the four reporting categories on the CI (discipline and SES) and below the state mean in two categories (school size and attendance rate). With the exception of history–social science, Cluster Three scored above the state mean in the content areas and had the second highest achievement scores among the clusters in all content areas. On the CI, Cluster Three scored below the state mean in three of the four reporting categories (school size, discipline, and SES) and scored above the state mean in

one category (attendance rate). Cluster Four scored above the state mean score in each content area and had the highest achievement scores among the clusters in all content areas. Cluster Four scored above the state mean in two reporting categories (school size and attendance rate) and below the state mean in two categories (discipline and SES). Finally, Cluster Five scored below the state mean in each content area and had the lowest achievement scores among the clusters in all areas except math, for which it had the second lowest score. Additionally, Cluster Five scored above the state mean in two reporting categories on the CI (discipline and SES) and below the state mean in two categories (school size and attendance rate).

Research Subquestion A. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in English–reading in those schools?

The results from the hierarchical cluster analysis for English–reading are presented in Table 6. The CI includes the mean score and standard deviation score for each cluster in the content area of English–reading and for each CI variable (school size, attendance rate, discipline, and SES). Incidents of discipline were based on infractions per 100 students. The number of students who received free or reduced-price lunch was also measured on a per-pupil scale of 100.

Table 6. *English–Reading: Climate Index Mean and Standard Deviation Score by Cluster Group*

	English–reading		School size		Attendance rate		Discipline		SES	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Cluster 1	82.79	4.48	768.04	228.58	94.91	0.93	55.33	14.94	63.14	12.79
Cluster 2	86.79	4.69	397.19	135.42	94.84	1.37	25.39	16.58	58.09	10.52

Cluster 3	89.62	3.47	619.87	159.86	95.63	0.92	15.82	8.42	36.53	11.02
Cluster 4	92.88	4.10	1042.21	224.31	96.22	0.80	12.32	8.98	24.64	15.47
Cluster 5	79.57	6.35	554.86	121.13	93.43	0.79	122.29	27.34	82.81	8.07

Note. English–reading mean and standard deviation scores are based on the student pass percentage rate for each cluster. Mean and standard deviation scores for discipline and free or reduced-price lunch are based on a per-pupil scale of 100.

In the content area of English–reading, Cluster One (n = 47) recorded the second lowest student achievement score (M = 82.79, SD = 4.48) of the five clusters, which was below the state mean score of 89.07 (SD = 5.54). On the CI, Cluster One had the second highest school size (M = 768.04, SD = 228.58) and the third highest attendance rate (M = 94.91, SD = 0.93). Cluster One had a larger mean school size than the state (M = 747.43, SD = 309.58) and a lower attendance rate than the state (M = 95.26, SD = 1.16). Additionally, Cluster One had the second highest discipline rate (M = 55.33, SD = 14.94) and the second highest rate of students receiving free or reduced-price lunch (M = 63.14, SD = 12.79). Cluster One had a higher discipline rate than the state (M = 24.08, SD = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (M = 40.97, SD = 20.72).

In the content area of English–reading, Cluster Two (n = 63) recorded the third highest student achievement score (M = 86.79, SD = 4.69) of the five clusters, which was below the state mean score of 89.07 (SD = 5.54). On the CI, Cluster Two had the lowest school size (M = 397.19, SD = 135.42) and the second lowest attendance rate (M = 94.84, SD = 1.37). Cluster Two had a smaller mean school size than the state (M = 747.43, SD = 309.58) and a lower attendance rate than the state (M = 95.26, SD = 1.16). Additionally, Cluster Two had the third highest discipline rate (M = 25.39, SD = 16.58) and the third highest rate of students receiving free or reduced-price lunch (M = 58.09,

SD = 10.52). Cluster Two had a higher discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of English–reading, Cluster Three (*n* = 100) recorded the second highest student achievement score (*M* = 89.62, *SD* = 3.47) of the five clusters, which was above the state mean score of 89.07 (*SD* = 5.54). On the CI, Cluster Three had the third largest school size (*M* = 619.87, *SD* = 159.86) and the second highest attendance rate (*M* = 95.63, *SD* = 0.92). Cluster Three had a smaller mean school size than the state (*M* = 747.43, *SD* = 309.58) and a higher attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Three had the second lowest discipline rate (*M* = 15.82, *SD* = 8.42), and the second lowest rate of students receiving free or reduced-price lunch (*M* = 36.53, *SD* = 11.02). Cluster Three had a lower discipline rate than the state (*M* = 24.08, *SD* = 23.53), and a lower rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of English–reading, Cluster Four (*n* = 118) recorded the highest student achievement score (*M* = 92.88, *SD* = 4.10) of the five clusters, which was above the state mean score of 89.07 (*SD* = 5.54). On the CI, Cluster Four had the largest school size (*M* = 1042.21, *SD* = 159.86) and the highest attendance rate (*M* = 96.22, *SD* = 0.80). Cluster Four had a larger mean school size than the state (*M* = 747.43, *SD* = 309.58) and a higher attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Four had the lowest discipline rate (*M* = 12.32, *SD* = 8.98) and the lowest rate of students receiving free or reduced-price lunch (*M* = 24.64, *SD* = 15.47). Cluster Four had

a lower discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a lower rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of English–reading, Cluster Five (*n* = 7) recorded the lowest student achievement score (*M* = 79.57, *SD* = 6.35) of the five clusters, which was below the state mean score of 89.07 (*SD* = 5.54). On the CI, Cluster Five had the second smallest school size (*M* = 554.86, *SD* = 121.13) and the lowest attendance rate (*M* = 93.43, *SD* = 0.79). Cluster Five had a smaller mean school size than the state (*M* = 747.43, *SD* = 309.58) and a lower attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Five had the highest discipline rate (*M* = 122.29, *SD* = 27.34) and the highest rate of students receiving free or reduced-price lunch (*M* = 82.81, *SD* = 8.07). Cluster Five had a higher discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In summary, Cluster Five had the lowest achievement score (*M* = 77.11, *SD* = 7.86), and Cluster Four had the highest achievement score (*M* = 92.88, *SD* = 4.10) in the content area of English–reading. In addition to the lowest achievement score, Cluster Five reported the highest discipline rate (*M* = 122.29, *SD* = 27.34), the highest number of students receiving free or reduced-price lunch (*M* = 82.81, *SD* = 8.07), and the lowest attendance rate (*M* = 93.43, *SD* = 0.79). Cluster Five also reported the second lowest school size (*M* = 554.86, *SD* = 121.13). Conversely, Cluster Four, while reporting the highest level of achievement in English–reading, also reported the lowest discipline rate (*M* = 12.32, *SD* = 8.98), the lowest number of students receiving free or reduced-price lunch (*M* = 24.64, *SD* = 15.47), the highest attendance rate (*M* = 96.22, *SD* = 0.80), and

the largest school size (*M* = 1042.21, *SD* = 224.31). A summary of the data trends is illustrated in Figure 2, with clusters ordered from lowest to highest by student achievement in English–reading.

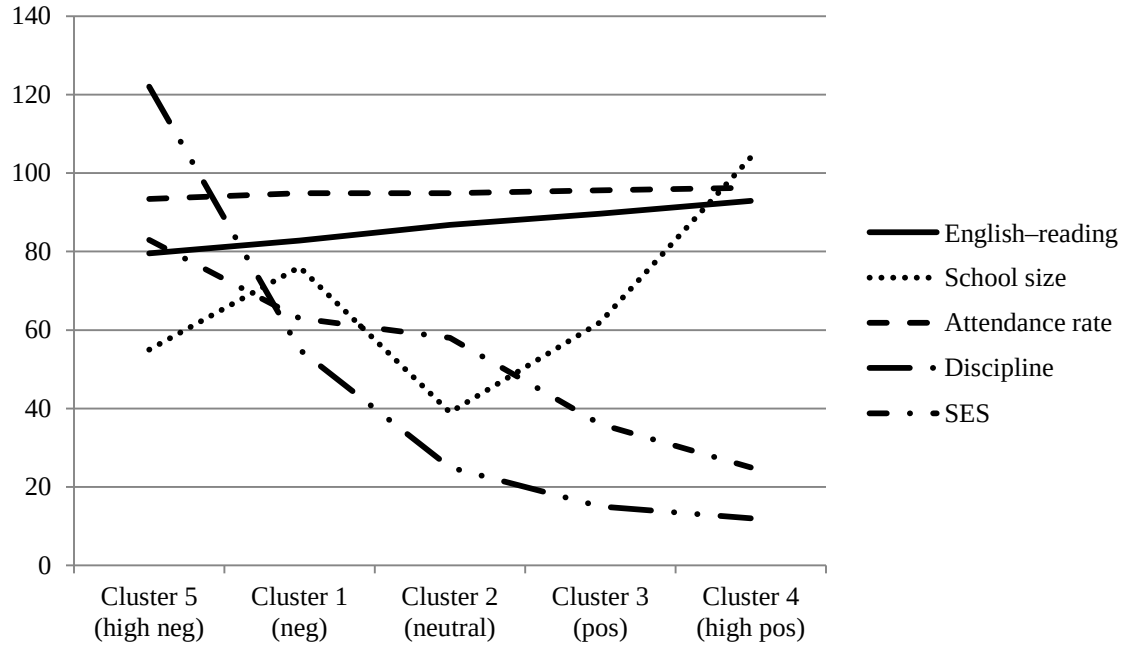

Figure 2. Data trends by cluster using English–reading achievement as the trend line.

Based on the trend line in Figure 2, student achievement in English–reading rises as school climate becomes more positive. To examine whether or not the differences in the means for achievement in each content area between clusters was significant, one-way ANOVAs were conducted. In each content area the ANOVA was significant: English-reading ($F = 66.107$, $p < .001$), mathematics ($F = 26.299$, $p < .001$), history–social science ($F = 42.100$, $p < .001$), and science ($F = 36.565$, $p < .001$). In all cases two of three statistical assumptions were met. Because the data collected for each school in the sample were independent from other schools' data, the assumption of independence was met. The assumption of normality was also met because the sample

size was sufficient (*N = 335*). The assumption of equality of variances, however, required testing because of the variability in sample sizes between clusters. The Levene homogeneity of variance test was conducted for each content area. The resulting data for the Levene and follow-up statistical tests in English–reading are reported here. Data for other content areas are reported in subsequent sections.

In English–reading, the Levene was not significant (*F = 1.787, p = .131*). Due to the nonsignificance of the Levene, the assumption of equality of variances was met. To determine where the differences in cluster means occurred the Ryan-Q test was conducted. Table 7 displays the results of the Ryan-Q test.

Table 7. *Ryan-Q Results for English–Reading (mean values are shown in each column)*

		Subset for alpha = .05			
Cluster	*N*	1	2	3	4
5	7	79.57			
1	47	82.79			
2	63		86.79		
3	100			89.62	
4	118				92.88

The results of the Ryan-Q test showed that the difference in the mean achievement scores in English–reading between Cluster Five and Cluster One is nonsignificant because the means are paired together in the same subset. Otherwise, mean student achievement in English–reading is significantly different for each cluster when compared to the other clusters. Finally, the effect size calculation showed 43-44% of the variance in achievement was accounted for by the changes in the variables of the CI. The results of

the Ryan-Q and the effect size support the assertion that, as school climate becomes more positive, student achievement in English–reading rises.

Research Subquestion B. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in mathematics in those schools?

The results from the hierarchical cluster analysis for mathematics are presented in Table 8. The CI includes the mean score and standard deviation score for each cluster in the content area of mathematics and for each CI variable (school size, attendance rate, discipline, and SES). Incidents of discipline were based on infractions per 100 students. The number of students who received free or reduced-price lunch was also measured on a per-pupil scale of 100.

Table 8. *Mathematics: Climate Index Mean and Standard Deviation Score by Cluster Group*

	Mathematics		School size		Attendance rate		Discipline		SES	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Cluster 1	75.83	8.05	768.04	228.58	94.91	0.93	55.33	14.94	63.14	12.79
Cluster 2	80.68	6.73	397.19	135.42	94.84	1.37	25.39	16.58	58.09	10.52
Cluster 3	83.72	5.90	619.87	159.86	95.63	0.92	15.82	8.42	36.53	11.02
Cluster 4	86.99	7.17	1042.21	224.31	96.22	0.80	12.32	8.98	24.64	15.47
Cluster 5	77.29	5.38	554.86	121.13	93.43	0.79	122.29	27.34	82.81	8.07

Note. Mathematics mean and standard deviation scores are based on the student pass percentage rate for each cluster. Mean and standard deviation scores for discipline and SES are based on a per-pupil scale of 100.

In the content area of mathematics, Cluster One (n = 47) recorded the lowest student achievement score (M = 75.83, SD = 8.05) of the five clusters, which was below

the state mean score of 83.06 (*SD* = 7.80). On the CI, Cluster One had the second highest school size (*M* = 768.04, *SD* = 228.58) and the third highest attendance rate (*M* = 94.91, *SD* = 0.93). Cluster One had a larger mean school size than the state (*M* = 747.43, *SD* = 309.58) and a lower attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster One had the second highest discipline rate (*M* = 55.33, *SD* = 14.94) and the second highest rate of students receiving free or reduced-price lunch (*M* = 63.14, *SD* = 12.79). Cluster One had a higher discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of mathematics, Cluster Two (*n* = 63) recorded the third highest student achievement score (*M* = 80.68, *SD* = 6.73) of the five clusters, which was below the state mean score of 83.06 (*SD* = 7.80). On the CI, Cluster Two had the lowest school size (*M* = 397.19, *SD* = 135.42) and the second lowest attendance rate (*M* = 94.84, *SD* = 1.37). Cluster Two had a smaller mean school size than the state (*M* = 747.43, *SD* = 309.58) and a lower attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Two had the third highest discipline rate (*M* = 25.39, *SD* = 16.58), and the third highest rate of students receiving free or reduced-price lunch (*M* = 58.09, *SD* = 10.52). Cluster Two had a higher discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of mathematics, Cluster Three (*n* = 100) recorded the second highest student achievement score (*M* = 83.72, *SD* = 5.90) of the five clusters, which was above the state mean score of 83.06 (*SD* = 7.80). On the CI, Cluster Three had the third

largest school size (*M* = 619.87, *SD* = 159.86) and the second highest attendance rate (*M* = 95.63, *SD* = 0.92). Cluster Three had a smaller mean school size than the state (*M* = 747.43, *SD* = 309.58) and a higher attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Three had the second lowest discipline rate (*M* = 15.82, *SD* = 8.42) and the second lowest rate of students receiving free or reduced-price lunch (*M* = 36.53, *SD* = 11.02). Cluster Three had a lower discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a lower rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of mathematics, Cluster Four (*n* = 118) recorded the highest student achievement score (*M* = 86.99, *SD* = 7.17) of the five clusters, which was above the state mean score of 83.06 (*SD* = 7.80). On the CI, Cluster Four had the largest school size (*M* = 1042.21, *SD* = 224.31) and the highest attendance rate (*M* = 96.22, *SD* = 0.80). Cluster Four had a larger mean school size than the state (*M* = 747.43, *SD* = 309.58) and a higher attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Four had the lowest discipline rate (*M* = 12.32, *SD* = 8.98) and the lowest rate of students receiving free or reduced-price lunch (*M* = 24.64, *SD* = 15.47). Cluster Four had a lower discipline rate than the state (*M* = 24.08, *SD* = 23.53), and a lower rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of mathematics, Cluster Five (*n* = 7) recorded the second lowest student achievement score (*M* = 77.29, *SD* = 5.38) of the five clusters, which was below the state mean score of 83.06 (*SD* = 7.80). On the CI, Cluster Five had the second smallest school size (*M* = 554.86, *SD* = 121.13) and the lowest attendance rate (*M* = 93.43, *SD* = 0.79). Cluster Five had a smaller mean school size than the state (*M* =

747.43, *SD* = 309.58) and a lower attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Five had the highest discipline rate (*M* = 122.29, *SD* = 27.34) and the highest rate of students receiving free or reduced-price lunch (*M* = 82.81, *SD* = 8.07). Cluster Five had a higher discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In summary, Cluster One had the lowest achievement score (*M* = 75.83, *SD* = 8.05) and Cluster Four had the highest achievement score (*M* = 86.99, *SD* = 7.17) in the content area of mathematics. In addition to the lowest achievement score, Cluster One reported the second highest discipline rate (*M* = 55.33, *SD* = 14.94), the second highest number of students receiving free or reduced-price lunch (*M* = 63.14, *SD* = 12.79), and the third highest attendance rate (*M* = 94.91, *SD* = 0.93). Cluster One also reported the second highest school size (*M* = 768.04, *SD* = 228.58). Conversely, Cluster Four, while reporting the highest level of achievement in mathematics, also reported the lowest discipline rate (*M* = 12.32, *SD* = 8.98), the lowest number of students receiving free or reduced-price lunch (*M* = 24.64, *SD* = 15.47), the highest attendance rate (*M* = 96.22, *SD* = 0.80), and the largest school size (*M* = 1042.21, *SD* = 224.31). A summary of the data trends is illustrated in Figure 3, with clusters ordered from lowest to highest by student achievement in mathematics.

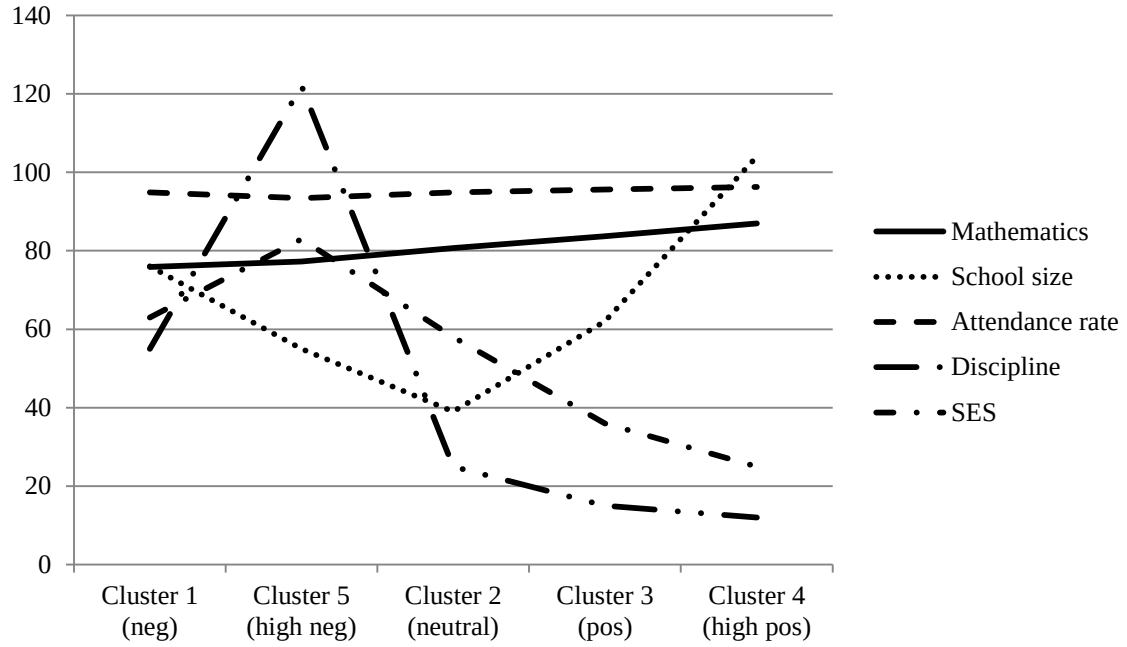

Figure 3. Data trends by cluster using mathematics achievement as the trend line.

Based on the trend line in Figure 3, student achievement in mathematics rises as school climate becomes more positive. The ANOVA for mathematics was significant (*F = 26.299, p < .001*). In mathematics, the Levene was not significant (*F = 1.209, p = .307*). Due to the nonsignificance of the Levene, the assumption of equality of variances was met. To determine where the differences in cluster means occurred the Ryan-Q test was conducted. Table 9 displays the results of the Ryan-Q test.

Table 9. *Ryan-Q Results for Mathematics (mean values are shown in each column)*

		Subset for alpha = .05			
Cluster	*N*	1	2	3	4
1	47	75.83			
5	7	77.29	77.29		
2	63		80.68		
3	100			83.72	
4	118				86.99

The results of the Ryan-Q test showed that the difference in the mean achievement scores in mathematics between Cluster Five and Cluster One, and Cluster Five and Cluster Two are nonsignificant because the means are paired together in the same subsets. Cluster Two, however, is significantly different than Cluster One. Otherwise, mean student achievement in mathematics is significantly different for the remaining clusters when compared to the other clusters. Finally, the effect size calculation showed 23-24% of the variance in achievement was accounted for by the changes in the variables of the CI. The results of the Ryan-Q and the effect size support the assertion that, as school climate becomes more positive, student achievement in mathematics rises, although in the case of mathematics, achievement is only impacted at the most positive end of the climate scale.

Research Subquestion C. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in history–social science in those schools?

The results from the hierarchical cluster analysis for history–social science are presented in Table 10. The CI includes the mean score and standard deviation score for each cluster in the content area of history–social science and for each CI variable (school size, attendance rate, discipline, and SES). Incidents of discipline were based on infractions per 100 students. The number of students who received free or reduced-price lunch was also measured on a per-pupil scale of 100.

Table 10. *History–Social science: Climate Index Mean and Standard Deviation Score by Cluster Group*

	History		School size		Attendance rate		Discipline		SES	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Cluster 1	77.23	5.48	768.04	228.58	94.91	0.93	55.33	14.94	63.14	12.79
Cluster 2	81.08	7.06	397.19	135.42	94.84	1.37	25.39	16.58	58.09	10.52
Cluster 3	83.71	5.24	619.87	159.86	95.63	0.92	15.82	8.42	36.53	11.02
Cluster 4	88.64	6.33	1042.21	224.31	96.22	0.80	12.32	8.98	24.64	15.47
Cluster 5	72.00	7.37	554.86	121.13	93.43	0.79	122.29	27.34	82.81	8.07

Note. History–social science mean and standard deviation scores are based on the student pass percentage rate for each cluster. Mean and standard deviation scores for discipline and SES are based on a per-pupil scale of 100.

In the content area of history–social science, Cluster One (n = 47) recorded the second lowest student achievement score (M = 77.23, SD = 5.48) of the five clusters, which was below the state mean score of 83.80 (SD = 7.43). On the CI, Cluster One had the second highest school size (M = 768.04, SD = 228.58) and the third highest attendance rate (M = 94.91, SD = 0.93). Cluster One had a larger mean school size than the state (M = 747.43, SD = 309.58) and a lower attendance rate than the state (M = 95.26, SD = 1.16). Additionally, Cluster One had the second highest discipline rate (M = 55.33, SD = 14.94) and the second highest rate of students receiving free or reduced-price lunch (M = 63.14, SD = 12.79). Cluster One had a higher discipline rate than the state (M = 24.08, SD = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (M = 40.97, SD = 20.72).

In the content area of history–social science, Cluster Two (n = 63) recorded the third highest student achievement score (M = 81.08, SD = 7.06) of the five clusters, which was below the state mean score of 83.80 (SD = 7.43). On the CI, Cluster Two had

the lowest school size (*M* = 397.19, *SD* = 135.42) and the second lowest attendance rate (*M* = 94.84, *SD* = 1.37). Cluster Two had a smaller mean school size than the state (*M* = 747.43, *SD* = 309.58) and a lower attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Two had the third highest discipline rate (*M* = 25.39, *SD* = 16.58) and the third highest rate of students receiving free or reduced-price lunch (*M* = 58.09, *SD* = 10.52). Cluster Two had a higher discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of history–social science, Cluster Three (*n* = 100) recorded the second highest student achievement score (*M* = 83.71, *SD* = 5.24) of the five clusters, which was below the state mean score of 83.80 (*SD* = 7.43). On the CI, Cluster Three had the third largest school size (*M* = 619.87, *SD* = 159.86) and the second highest attendance rate (*M* = 95.63, *SD* = 0.92). Cluster Three had a smaller mean school size than the state (*M* = 747.43, *SD* = 309.58) and a higher attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Three had the second lowest discipline rate (*M* = 15.82, *SD* = 8.42) and the second lowest rate of students receiving free or reduced-price lunch (*M* = 36.53, *SD* = 11.02). Cluster Three had a lower discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a lower rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of history–social science, Cluster Four (*n* = 118) recorded the highest student achievement score (*M* = 88.64, *SD* = 6.33) of the five clusters, which was above the state mean score of 83.80 (*SD* = 7.43). On the CI, Cluster Four had the largest school size (*M* = 1042.21, *SD* = 224.31) and the highest attendance rate (*M* = 96.22, *SD* =

0.80). Cluster Four had a larger mean school size than the state (M = 747.43, SD = 309.58) and a higher attendance rate than the state (M = 95.26, SD = 1.16). Additionally, Cluster Four had the lowest discipline rate (M = 12.32, SD = 8.98) and the lowest rate of students receiving free or reduced-price lunch (M = 24.64, SD = 15.47). Cluster Four had a lower discipline rate than the state (M = 24.08, SD = 23.53) and a lower rate of students receiving free or reduced-price lunch than the state (M = 40.97, SD = 20.72).

In the content area of history–social science, Cluster Five (n = 7) recorded the lowest student achievement score (M = 72.00, SD = 7.37) of the five clusters, which was below the state mean score of 83.80 (SD = 7.43). On the CI, Cluster Five had the second smallest school size (M = 554.86, SD = 121.13) and the lowest attendance rate (M = 93.43, SD = 0.79). Cluster Five had a smaller mean school size than the state (M = 747.43, SD = 309.58) and a lower attendance rate than the state (M = 95.26, SD = 1.16). Additionally, Cluster Five had the highest discipline rate (M = 122.29, SD = 27.34) and the highest rate of students receiving free or reduced-price lunch (M = 82.81, SD = 8.07). Cluster Five had a higher discipline rate than the state (M = 24.08, SD = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (M = 40.97, SD = 20.72).

In summary, Cluster Five had the lowest achievement score (M = 72.00, SD = 7.37) and Cluster Four had the highest achievement score (M = 88.64, SD = 6.33) in the content area of history–social science. In addition to the lowest achievement score, Cluster Five reported the highest discipline rate (M = 122.29, SD = 27.34), the highest number of students receiving free or reduced-price lunch (M = 82.81, SD = 8.07), and the lowest attendance rate (M = 93.43, SD = 0.79). Cluster Five also reported the second

lowest school size (*M* = 554.86, *SD* = 121.13). Conversely, Cluster Four, while reporting the highest level of achievement in history–social science, also reported the lowest discipline rate (*M* = 12.32, *SD* = 8.98), the lowest number of students receiving free or reduced-price lunch (*M* = 24.64, *SD* = 15.47), the highest attendance rate (*M* = 96.22, *SD* = 0.80), and the largest school size (*M* = 1042.21, *SD* = 224.31). A summary of the data trends is illustrated in Figure 4, with clusters ordered from lowest to highest by student achievement in history–social science.

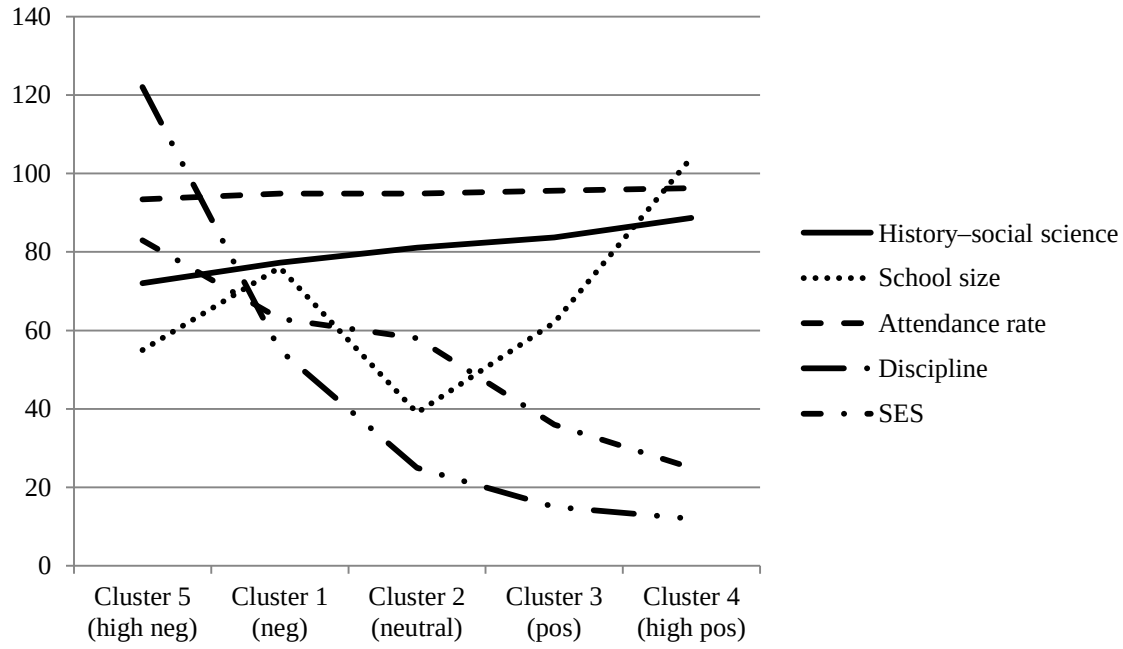

Figure 4. Data trends by cluster using history–social science achievement as the trend line.

Based on the trend line in Figure 4, student achievement in history-social science rises as school climate becomes more positive. The ANOVA for history-social science was significant (*F = 42.100, p < .001*). In history-social science, the Levene was not significant (*F = 1.507, p = .200*). Due to the nonsignificance of the Levene, the assumption of equality of variances was met. To determine where the differences in

cluster means occurred the Ryan-Q test was conducted. Table 11 displays the results of the Ryan-Q test.

Table 11. *Ryan-Q Results for History–Social Science (mean values are shown in each column)*

		Subset for alpha = .05			
Cluster	*N*	1	2	3	4
5	7	72.00			
1	47	77.23			
2	63		81.08		
3	100			83.71	
4	118				88.64

The results of the Ryan-Q test showed that the difference in the mean achievement scores in history–social science between Cluster Five and Cluster One is nonsignificant because the means are paired together in the same subset. Otherwise, mean student achievement in history–social science is significantly different for each cluster when compared to the other clusters. Finally, the effect size calculation showed 33-34% of the variance in achievement was accounted for by the changes in the variables of the CI. The results of the Ryan-Q and the effect size support the assertion that, as school climate becomes more positive, student achievement in history–social science rises.

Research Subquestion D. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in science in those schools?

The results from the hierarchical cluster analysis for science are presented in Table 12. The CI includes the mean score and standard deviation score for each cluster

in the content area of science and for each CI variable (school size, attendance rate, discipline, and SES). Incidents of discipline were based on infractions per 100 students. The number of students who received free or reduced-price lunch was also measured on a per-pupil scale of 100.

Table 12. *Science: Climate Index Mean and Standard Deviation Score by Cluster Group*

	Science		School size		Attendance rate		Discipline		SES	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Cluster 1	89.76	3.47	768.04	228.58	94.91	0.93	55.33	14.94	63.14	12.79
Cluster 2	91.19	5.36	397.19	135.42	94.84	1.37	25.39	16.58	58.09	10.52
Cluster 3	94.05	2.76	619.87	159.86	95.63	0.92	15.82	8.42	36.53	11.02
Cluster 4	95.19	3.52	1042.21	224.31	96.22	0.80	12.32	8.98	24.64	15.47
Cluster 5	82.57	6.02	554.86	121.13	93.43	0.79	122.29	27.34	82.81	8.07

*Note. S*cience mean and standard deviation scores are based on the student pass percentage rate for each cluster. Mean and standard deviation scores for discipline and SES are based on a per-pupil scale of 100.

In the content area of science, Cluster One (n = 47) recorded the second lowest student achievement score (M = 89.76, SD = 3.47) of the five clusters, which was below the state mean score of 93.07 (SD = 4.55). On the CI, Cluster One had the second highest school size (M = 768.04, SD = 228.58) and the third highest attendance rate (M = 94.91, SD = 0.93). Cluster One had a larger mean school size than the state (M = 747.43, SD = 309.58) and a lower attendance rate than the state (M = 95.26, SD = 1.16). Additionally, Cluster One had the second highest discipline rate (M = 55.33, SD = 14.94) and the second highest rate of students receiving free or reduced-price lunch (M = 63.14, SD = 12.79). Cluster One had a higher discipline rate than the state (M = 24.08, SD = 23.53)

and a higher rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of science, Cluster Two (*n* = 63) recorded the third highest student achievement score (*M* = 91.19, *SD* = 5.36) of the five clusters, which was below the state mean score of 93.07 (*SD* = 4.55). On the CI, Cluster Two had the lowest school size (*M* = 397.19, *SD* = 135.42) and the second lowest attendance rate (*M* = 94.84, *SD* = 1.37). Cluster Two had a smaller mean school size than the state (*M* = 747.43, *SD* = 309.58) and a lower attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Two had the third highest discipline rate (*M* = 25.39, *SD* = 16.58) and the third highest rate of students receiving free or reduced-price lunch (*M* = 58.09, *SD* = 10.52). Cluster Two had a higher discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of science, Cluster Three (*n* = 100) recorded the second highest student achievement score (*M* = 94.05, *SD* = 2.76) of the five clusters, which was above the state mean score of 93.07 (*SD* = 4.55). On the CI, Cluster Three had the third largest school size (*M* = 619.87, *SD* = 159.86) and the second highest attendance rate (*M* = 95.63, *SD* = 0.92). Cluster Three had a smaller mean school size than the state (*M* = 747.43, *SD* = 309.58) and a higher attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Three had the second lowest discipline rate (*M* = 15.82, *SD* = 8.42) and the second lowest rate of students receiving free or reduced-price lunch (*M* = 36.53, *SD* = 11.02). Cluster Three had a lower discipline rate than the state (*M* = 24.08, *SD* =

23.53) and a lower rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of science, Cluster Four (*n* = 118) recorded the highest student achievement score (*M* = 95.19, *SD* = 3.52) of the five clusters, which was above the state mean score of 93.07 (*SD* = 4.55). On the CI, Cluster Four had the largest school size (*M* = 1042.21, *SD* = 224.31) and the highest attendance rate (*M* = 96.22, *SD* = 0.80). Cluster Four had a larger mean school size than the state (*M* = 747.43, *SD* = 309.58) and a higher attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Four had the lowest discipline rate (*M* = 12.32, *SD* = 8.98) and the lowest rate of students receiving free or reduced-price lunch (*M* = 24.64, *SD* = 15.47). Cluster Four had a lower discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a lower rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In the content area of science, Cluster Five (*n* = 7) recorded the lowest student achievement score (*M* = 82.57, *SD* = 6.02) of the five clusters, which was below the state mean score of 93.07 (*SD* = 4.55). On the CI, Cluster Five had the second smallest school size (*M* = 554.86, *SD* = 121.13) and the lowest attendance rate (*M* = 93.43, *SD* = 0.79). Cluster Five had a smaller mean school size than the state (*M* = 747.43, *SD* = 309.58) and a lower attendance rate than the state (*M* = 95.26, *SD* = 1.16). Additionally, Cluster Five had the highest discipline rate (*M* = 122.29, *SD* = 27.34) and the highest rate of students receiving free or reduced-price lunch (*M* = 82.81, *SD* = 8.07). Cluster Five had a higher discipline rate than the state (*M* = 24.08, *SD* = 23.53) and a higher rate of students receiving free or reduced-price lunch than the state (*M* = 40.97, *SD* = 20.72).

In summary, Cluster Five had the lowest achievement score (*M* = 82.57, *SD* = 6.02) and Cluster Four had the highest achievement score (*M* = 95.19, *SD* = 3.52) in the content area of science. In addition to the lowest achievement score, Cluster Five reported the highest discipline rate (*M* = 122.29, *SD* = 27.34), the highest number of students receiving free or reduced-price lunch (*M* = 82.81, *SD* = 8.07), and the lowest attendance rate (*M* = 93.43, *SD* = 0.79). Cluster Five also reported the second lowest school size (M = 554.86, SD = 121.13). Conversely, Cluster Four, while reporting the highest level of achievement in science, also reported the lowest discipline rate (M = 12.32, SD = 8.98), the lowest number of students receiving free or reduced-price lunch (M = 24.64, SD = 15.47), the highest attendance rate (M = 96.22, SD = 0.80), and the largest school size (M = 1042.21, SD = 224.31). A summary of the data trends is illustrated in Figure 5, with clusters ordered from lowest to highest by student achievement in science.

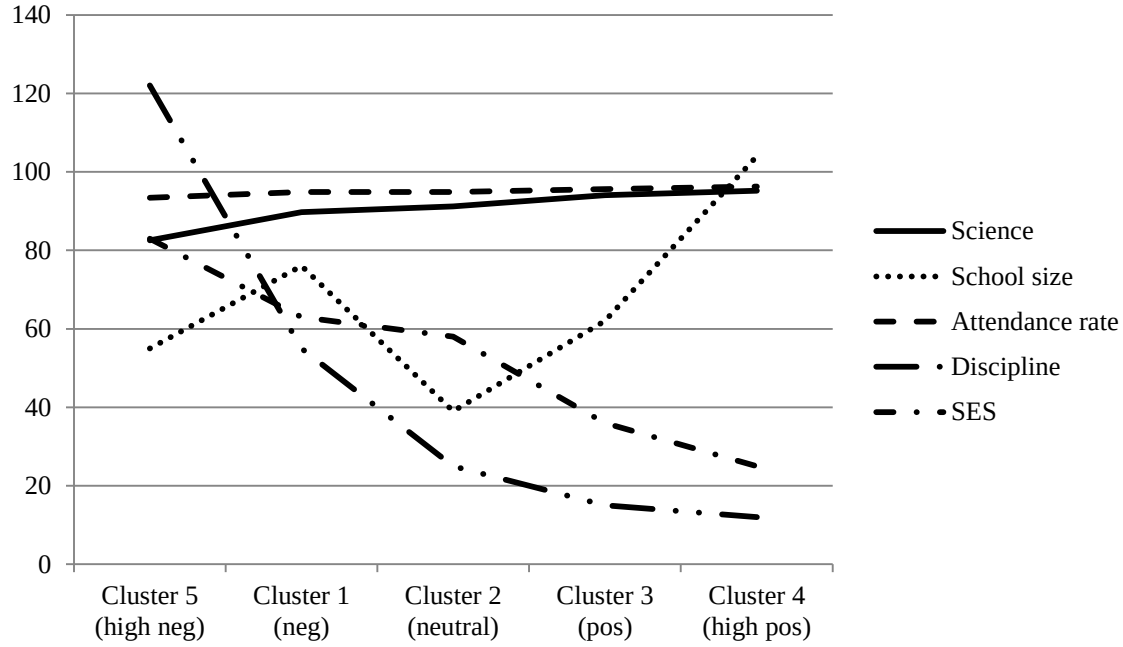

Figure 5. Data trends by cluster using science achievement as the trend line.

Based on the trend line in Figure 5, student achievement in science rises as school climate becomes more positive. The ANOVA for science was significant ($F = 36.565$, $p < .001$). In science, the Levene was also significant ($F = 6.174$, $p < .001$). Due to the significance of the Levene, the assumption of equality of variances was not met. To determine where the differences in cluster means occurred the Games-Howell post hoc test, which does not assume equal variances, was conducted. Table 13 displays the results of the Games-Howell test.

Table 13. *Games-Howell Results for Science*

(I) Cluster	(J) Cluster	Mean Difference	Standard Error	Sig.
1	2	-1.43	.852	.450
	3	-4.29*	.584	.000
	4	-5.43*	.606	.000
	5	7.19	2.334	.098
2	3	-2.86*	.736	.002
	4	-3.99*	.755	.000
	5	8.62*	2.376	.046
3	4	-1.14	.429	.065
	5	11.48*	2.294	.013
4	5	12.62*	2.300	.008

The results of the Games-Howell test showed that the difference in the mean achievement scores in science between Cluster Five and Cluster One, and Cluster Two and Cluster One is nonsignificant as indicated by missing asterisks in the Mean Difference column of Table 13. Additionally, Cluster Three and Cluster Four do not have significantly

different means. An examination of the clusters that are significantly different, however, shows a meaningful upward improvement in achievement as climate becomes more positive. Cluster Five, which represents a Highly Negative climate, is significantly different from Clusters Two, Three, and Four, which trend from Neutral to Highly Positive climates. Additionally, the effect size calculation showed 30-31% of the variance in achievement was accounted for by the changes in the variables of the CI. The results of the Games-Howell and the effect size support the assertion that as school climate becomes more positive student achievement in science rises.

The following tables provide summary data for each CI variable, including achievement data for each cluster in each content area. Table 14 is an illustration of the CI for school size. Also included are mean scores and standard deviation scores for student achievement in each content area for each cluster.

Table 14. *CI: Mean and Standard Deviation of School Size and Student Achievement by Cluster Group*

Cluster	School size		English–reading		Mathematics		History		Science	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	768.04	228.58	82.79	4.48	75.83	8.05	77.23	5.48	89.76	3.47
2	397.19	135.42	86.79	4.69	80.68	6.73	81.08	7.06	91.19	5.36
3	619.87	159.86	89.62	3.47	83.72	5.90	83.71	5.24	94.05	2.76
4	1042.21	224.31	92.88	4.10	86.99	7.17	88.64	6.33	95.19	3.52
5	554.86	121.13	79.75	6.35	77.29	5.38	72.00	7.37	82.57	6.02
Total	747.43	309.58	89.07	5.54	83.06	7.80	83.80	7.43	93.07	4.55

Table 15 is an illustration of the CI for attendance rate. Also included are mean scores and standard deviation scores for student achievement in each content area for each cluster.

Table 15. *CI: Mean and Standard Deviation of Attendance Rate and Student Achievement by Cluster Groups*

Cluster	Attendance rate		English–reading		Mathematics		History		Science	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	94.91	0.93	82.79	4.48	75.83	8.05	77.23	5.48	89.76	3.47
2	94.84	1.37	86.79	4.69	80.68	6.73	81.08	7.06	91.19	5.36
3	95.63	0.92	89.62	3.47	83.72	5.90	83.71	5.24	94.05	2.76
4	96.22	0.80	92.88	4.10	86.99	7.17	88.64	6.33	95.19	3.52
5	93.43	0.79	79.75	6.35	77.29	5.38	72.00	7.37	82.57	6.02
Total	95.26	1.16	89.07	5.54	83.06	7.80	83.80	7.43	93.07	4.55

Table 16 is an illustration of the CI for incidents of discipline. Also included are mean scores and standard deviation scores for student achievement in each content area for each cluster.

Table 16. CI: *Mean and Standard Deviation of Discipline and Student Achievement by Cluster Group*

Cluster	Discipline		English–reading		Mathematics		History		Science	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	55.33	14.94	82.79	4.48	75.83	8.05	77.23	5.48	89.76	3.47
2	25.39	16.58	86.79	4.69	80.68	6.73	81.08	7.06	91.19	5.36
3	15.82	8.42	89.62	3.47	83.72	5.90	83.71	5.24	94.05	2.76
4	12.32	8.98	92.88	4.10	86.99	7.17	88.64	6.33	95.19	3.52
5	122.29	27.34	79.75	6.35	77.29	5.38	72.00	7.37	82.57	6.02
Total	24.08	23.53	89.07	5.54	83.06	7.80	83.80	7.43	93.07	4.55

Table 17 is an illustration of the CI for students receiving free or reduced-price lunch. Also included are mean scores and standard deviation scores for student achievement in each content area for each cluster.

Table 17. *CI: Mean and Standard Deviation of SES and Student Achievement by Cluster Group*

Cluster	SES		English–reading		Mathematics		History		Science	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	63.14	12.79	82.79	4.48	75.83	8.05	77.23	5.48	89.76	3.47
2	58.09	10.52	86.79	4.69	80.68	6.73	81.08	7.06	91.19	5.36
3	36.53	11.02	89.62	3.47	83.72	5.90	83.71	5.24	94.05	2.76
4	24.64	15.47	92.88	4.10	86.99	7.17	88.64	6.33	95.19	3.52
5	82.81	8.07	79.75	6.35	77.29	5.38	72.00	7.37	82.57	6.02
Total	40.97	20.72	89.07	5.54	83.06	7.80	83.80	7.43	93.07	4.55

Presentation of Data From the Multiple Regression Analysis

Primary research question. Is there a relationship between the climate of Virginia middle schools, as measured by the Climate Index (CI), and the achievement of students in those schools?

The results from the correlation analysis for each climate variable with achievement in each content area are presented in Table 18.

Table 18. *Pearson's Correlation (*r*) and Significance for Each Climate Variable and Content Area*

	School size		Attendance rate		Discipline		SES	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*
English	.265	.0001	.486	.0001	-.675	.0001	-.785	.0001

Mathematics	.167	.002	.318	.0001	-.441	.0001	-.615	.0001
History–social science	.272	.0001	.480	.0001	-.552	.0001	-.706	.0001
Science	.189	.001	.397	.0001	-.591	.0001	-.682	.0001

Note. alpha = .05

The correlation for each climate variable with each content area was significant at the .05 level. The weakest correlation with each content area, however, was school size: English–reading (r = .265, p = .0001), mathematics (r = .167, p = .002), history–social science (r = .272, p = .0001), and science (r = .189, p = .001). This positive correlation suggests that as school size increases so does achievement. SES, as measured in this study by number of students receiving free or reduced-price lunch per 100 students, showed the strongest correlation with achievement in each content area. In this case, the correlation was negative, suggesting the higher the number of students receiving free or reduced-price lunch the lower the achievement: English–reading (r = -.785, p = .0001), mathematics (r = -.615, p = .0001), history–social science (r = -.706, p = .0001), and science (r = -.682, p = .0001). Similarly, discipline, as measured by the number of incidents per 100 students, showed a strong negative correlation with achievement in each content area, although not as strong as SES: English–reading (r = -.675, p = .0001), mathematics (r = -.441, p = .0001), history–social science (r = -.552, p = .0001), and science (r = -.591, p = .0001). Finally, attendance rate showed a weak positive correlation with achievement in all content areas, suggesting that achievement increases as attendance rate increases: English–reading (r = .486, p = .0001), mathematics (r =

.318, p = .0001), history–social science (r = .480, p = .0001), and science (r = .397, p = .0001).

The multiple regression analysis was conducted to determine the amount of variance in achievement that can be explained by the CI. The results of this analysis are shown in Table 19.

Table 19. *Percentage of Variance (*R Square*) in Achievement Explained by the CI*

	English	Mathematics	History–social science	Science
R Square	.671	.390	.532	.509

The *R Square* is a measure of the collective influence of the variables of the CI on student achievement in each content area. The highest percentage of variance explained by the CI was in English (R = .671), which suggests that 67% of the variance in achievement is explained by variability in the climate factors of the CI. The percentage of variance in achievement explained by the CI was lowest in mathematics (R = .390). Achievement in history–social science (R = .532) and science (R = .509) were close, and in both cases more than 50% of the variability in achievement was explained by variability in the CI.

Finally, an examination of the ANOVA table produced in the regression analysis presents an F-statistic, which is a measure of the linearity of the relationships among the variables. An F-statistic is significant at the .05 level. The results of the ANOVA are shown in Table 20.

Table 20. *ANOVA Determining Linearity of Relationship (*F*) and Significance*

	English	Mathematics	History–social science	Science
F-statistic	168.554	52.829	93.756	83.958
p	.0001	.0001	.0001	.0001

Note. The *F*-statistic is significant at the .05 level.

In all content areas the *F*-statistic is significant (*p = .0001*), thereby suggesting both that the relationship between the variables is linear and that there is greater than a 99% chance the relationship between the variables is not due to chance. These results suggest that the aforementioned regression data are significant.

Research Subquestion A. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in English–reading in those schools?

The data in Table 19 suggest that 67% of the variance in achievement in English–reading is accounted for by variance in the CI, and the *F*-statistic in Table 20 suggests that the regression model is significant. An analysis of the influence of the individual climate variables (predictor variables) on achievement in English–reading (criterion variable) is shown in Table 21.

Table 21. *Regression Coefficient (B) and Statistical Significance (t) of Each CI Variable for English–Reading*

	B	*t*	*p*
(Constant)	89.012	501.119	.0001

School size	-.266	-1.351	.178
Attendance rate	.512	2.481	.014
Discipline	-1.407	-5.862	.0001
SES	-3.312	-12.818	.0001

Note. Significance is also determined at the .05 level.

The regression coefficient (*B*) describes the amount of change in each variable required to change the constant, which is the expected level of achievement if each variable is at zero. In Table 21, a decrease in school size ($B = -.266$, $p = .178$), discipline ($B = -1.407$, $p = .0001$), and SES ($B = -3.312$, $p = .0001$) coincides with an increase in student achievement in English–reading, whereas an increase in attendance rate ($B = .512$, $p < .05$) coincides with an increase in student achievement in English–reading. School size, however, is not significant in this model, and therefore is not contributing. Attendance, discipline, and SES are all significant, and are therefore contributing.

Research Subquestion B. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in mathematics in those schools?

The data in Table 19 suggest that 39% of the variance in achievement in mathematics is accounted for by variance in the CI, and the *F*-statistic in Table 20 suggests that the regression model is significant. An analysis of the influence of the individual climate variables (predictor variables) on achievement in mathematics (criterion variable) is shown in Table 22.

Table 22. *Regression Coefficient (B) and Statistical Significance (t) of Each CI Variable for Mathematics*

	B	*t*	Significance

(Constant)	83.053	243.709	.0001
School size	-.809	-2.145	.033
Attendance rate	.219	.553	.581
Discipline	-.358	-.778	.437
SES	-4.819	-9.720	.0001

Note. Significance is also determined at the .05 level.

In Table 22, a decrease in school size (B = -.809, p = .033), discipline (B = -.358, p=> .437), and SES (B = -4.819, p = .0001) coincides with an increase in student achievement in mathematics, whereas an increase in attendance rate (B = .219, p = .581) coincides with an increase in student achievement in mathematics. Attendance rate and discipline, however, are not significant in this model, and therefore are not contributing. School size and SES are significant, and are therefore contributing.

Research Subquestion C. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in history–social science in those schools?

The data in Table 19 suggest that 53% of the variance in achievement in history–social science is accounted for by variance in the CI, and the F-statistic in Table 20 suggests that the regression model is significant. An analysis of the influence of the individual climate variables (predictor variables) on achievement in history–social science (criterion variable) is shown in Table 23.

Table 23. *Regression Coefficient (*B*) and Statistical Significance (*t*) of Each CI Variable for History–Social Science*

	B	*t*	Significance
(Constant)	83.639	294.172	.0001

School size	-.186	-.590	.555
Attendance rate	1.183	3.578	.0001
Discipline	-.860	-2.238	.026
SES	-4.209	-10.175	.0001

Note. Significance is also determined at the .05 level.

In Table 23, a decrease in school size (B = -.186, p = .555), discipline (B = -.860, p = .026) and SES (B = -4.209, p = .0001) coincides with an increase in student achievement in history–social science, whereas an increase in attendance rate (B = 1.183, p = .0001) coincides with an increase in student achievement in history–social science. School size, however, is not significant in this model, and is therefore not contributing. Discipline, attendance rate, and SES are significant, and are therefore contributing.

Research Subquestion D. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in science in those schools?

The data in Table 19 suggest that 51% of the variance in achievement in science is accounted for by variance in the CI, and the F-statistic in Table 20 suggests that the regression model is significant. An analysis of the influence of the individual climate variables (predictor variables) on achievement in science (criterion variable) is shown in Table 24.

Table 24. *Regression Coefficient (*B*) and Statistical Significance (*t*) of Each CI Variable for Science*

	B	*t*	Significance
(Constant)	93.037	516.360	.0001
School size	-.398	-2.003	.046
Attendance rate	.238	1.142	.254

Discipline	-1.019	-4.191	.0001
SES	-2.483	-9.492	.0001

Note. Significance is also determined at the .05 level.

In Table 24, a decrease in school size (B = -.398, p = .046), discipline (B = -.1.019, p = .0001), or SES (B = -2.483, p < .0001) coincides with an increase student achievement in science, whereas an increase in attendance rate (B = .238, p = .254) coincides with an increase in student achievement in science. Attendance rate, however, is not significant in this model, and is therefore not contributing. School size, discipline, and SES are significant, and are therefore contributing.

Summary

The purpose of this study was to determine the relationship between student achievement and the climate of middle schools in the Commonwealth of Virginia. The population for this study was 335 public middle schools in Virginia.

Results from the 2010-2011 Virginia SOL tests were used to measure student achievement. To assess school climate, a CI was created using preexisting data provided by the VDOE for individual middle schools via the School Report Card and the NSLP Free or Reduced-Price Eligibility Report. A hierarchical cluster analysis was used to categorize middle schools into five clusters according to the similarities of their climate variables. The clusters were analyzed to determine the relationship between school climate and student achievement for school divisions in the Commonwealth of Virginia. Finally, a multiple regression analysis was conducted for the purpose of comparing the results to the hierarchical cluster analysis.

An analysis of each cluster revealed several findings. Cluster Five (n = 7) had the lowest student achievement rate in each content area except mathematics, which was second lowest, when compared to the remaining clusters. Notably, Cluster Five also had the highest discipline rate of incidents per 100 students (M = 122.29, SD = 27.34) and the highest SES as measured by the number of students receiving free or reduced-price lunch per 100 students (M = 82.81, SD = 8.07). Additionally, Cluster Five had the lowest attendance rate (M = 93.43, SD = 0.79). By contrast, Cluster Four (n = 118) had the highest achievement rate in each content area when compared to the remaining clusters. Also, Cluster Four had the lowest discipline rate (M = 12.32, SD = 8.98), the lowest SES (M = 24.64, SD = 15.47), and the highest attendance rate (M = 96.22, SD = 0.80). Based on the CI, the clusters were labeled as follows: Cluster Five – Highly Negative; Cluster One – Negative; Cluster Two – Neutral; Cluster Three – Positive; and Cluster Five – Highly Positive. The trend lines in each content area consistently demonstrate a pattern showing increased achievement by cluster as attendance rises, discipline drops, and SES drops. School size, on the other hand, did not show a consistent pattern relative to student achievement. Finally, one-way ANOVAs and related post hoc tests, as well as effect sizes calculated for each content area showed that the differences in the means between the clusters are significant enough to support the assertion that as climate becomes more positive, student achievement rises in each of the four core content areas.

The multiple regression analysis seems to corroborate the results of the cluster analysis. First, in all four content areas, the regression model, which used the climate variables that made up the CI as the predictor variables and student achievement in each content area as the criterion variable, was shown to be significant at the .05 level. The

amount of variance in student achievement in each content area accounted for by variance in the CI was as follows: English–reading (R^2 = .671), mathematics (R^2 = .390), history–social science (R^2 = .532), and science (R^2 = .509). An analysis of the influence of each predictor variable in each content area showed that SES, as measured by the number of students receiving free or reduced-price lunch per 100 students, was consistently the strongest correlate across all content areas and significant in all content areas at the .05 level. Discipline was strong and significant at the .05 level in all content areas except mathematics. Attendance rate was strong and significant at the .05 level in English–reading and history–social science but did not show significance in mathematics and science. School size was weaker, but still significant at the .05 level in mathematics and science but did not show significance in English–reading and history–social science.

The findings of the hierarchical cluster analysis and the multiple regression analysis serve as the basis for a summary of this study, an analysis of data, a discussion of the findings, and recommendations for future studies, all of which are presented in Chapter 5.

Chapter 5

Interpretations, Conclusions, and Recommendations

Introduction

The purpose of this study was to determine whether or not there was a relationship between school climate and student achievement in the middle schools of the Commonwealth of Virginia. The existing literature suggested that each of four factors for which existing public data were available was related to school climate. These factors included school size (Bedford, 1987; Kaczor, 2006), attendance rate, discipline rate (Allodi, 2002; DiPaola & Tschannen-Moran, 2001; Hoy & Hannum, 1997; Kuperminc et al., 2001; Sugai & Horner, 2001), and socioeconomic status (Benson, 2003; Brookover et al., 1978; Bulach et al., 1995; Coleman et al., 1966; Considine & Zappala, 2002; Hoy et al., 1998; Spence, 2003; Weber, 1971); the four factors were used to build the Climate Index (CI). Student achievement was defined by pass rates per school on VASOL Tests in English–reading, mathematics, history–social science, and science. The relationship between school climate and student achievement was examined through the use of two statistical methodologies: a hierarchical cluster analysis based on the CI and a multiple regression analysis using a regression model built on the same factors used for the CI.

The literature suggested that a relationship exists between school climate and student achievement (Anderson, 1982; Brookover et al., 1978; Bulach et al., 1995; Deal & Peterson, 1999; Freiberg & Stein, 1999; Gayton, 1999; Hoy et al., 1991; Smith, 2005). Although climate had been defined in a variety of ways throughout the research, for the purposes of this study, based on the review of the literature and the theoretical framework developed by Hoy and Hannum (1997) describing climate in terms of organizational

health, the operational definition of climate was as follows: The climate of a school as described by factors including student discipline, student attendance, student SES, and school size is a function of organizational health, which is formed by the quality of relationships (student discipline and attendance), the level of emphasis on academic excellence (student achievement), the quality of leadership (student discipline and attendance), and the influence of external factors (SES, school size).

It was important to study the impact of school climate on student achievement as well as to identify the factors that make up a school's climate to enable school leaders to understand the climate of their schools and to consciously plan and implement strategies designed to improve their schools' climates. It was also timely and relevant to study school climate and its impact on student achievement because of the increasingly high stakes for underachievement. Although climate had been studied through a variety of methodologies and defined in a variety of ways, it remained imperative to find ways to define and understand how climate impacts students. Although the body of research was large, the research had not translated sufficiently into improved policy, practice, and teacher and leadership preparation programs with regard to school climate (Cohen et al., 2009). The literature presented and explored in Chapter 2 suggested that climate impacts achievement and that a variety of factors impact and define climate. This study focused on the factors for which descriptive data existed, replicated a methodology (hierarchical cluster analysis) utilized in one previous climate study (Smith, 2005), and attempted to validate that methodology through multiple regression analysis.

In the review of related literature, no studies were found that utilized the methodological approach used in this study. The sample for this study was 335 public

middle schools in the Commonwealth of Virginia. The following primary research question was studied through both hierarchical cluster and multiple regression analyses:

> Is there a relationship between the climate of Virginia middle schools, as measured by the Climate Index (CI), and the achievement of students in those schools?

Although the broad purpose of cluster analysis is to sort data into classifications, cluster analysis also may be used to create specific-purpose classifications: "Scientists often make classifications with the specific purpose in mind of investigating their relation to other variables. The variables may be (1) qualitative or (2) quantitative" (Romesburg, 2004, p. 59). In this study, the cluster analysis was used to determine the relationship between the clustered variables of the CI and student achievement as measured by state test data. Similarly, multiple regression analysis was used "to relate a set of regressor (independent or predictor) variables to a criterion (dependent or outcome) variable" (Kelley & Maxwell, 2010, p. 281). To answer the overarching question, the primary research question was divided into subquestions to be analyzed similarly as follows:

a. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and Virginia Standards of Learning (VASOL) achievement in English–reading in those schools?
b. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in mathematics in those schools?

c. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in history–social science in those schools?

d. Is there a relationship between the climate of Virginia middle schools, as measured by the CI, and VASOL achievement in science in those schools?

The general hypothesis that guided this study was that all aspects of school health (i.e., those factors included in the climate index), as framed by Hoy and Hannum (1997), are positively related to student achievement: the stronger the organizational health of a middle school in Virginia, the greater the achievement of students.

Summary of Results

The results of the hierarchical cluster analysis revealed a statistically significant relationship between the CI and student achievement in middle schools. Similarly, the regression model built on the same climate factors as the CI indicated a statistically significant relationship between school climate and student achievement in each content area. When examined individually within the regression model, only SES and discipline rate reflected a statistically significant relationship across all content areas, with SES emerging as the most influential factor. The trend lines produced by the hierarchical cluster analysis showed similar results, with SES having the strongest relationship to student achievement and school size the weakest relationship. In fact, in the cluster analysis, the jagged nature of the trend line suggested little if any relationship between school size and student achievement. The multiple regression results corroborated the finding that school size has the least statistically significant relationship with achievement. Although attendance rate showed a consistent trend line in the cluster

analysis, rising as achievement rose, it was inconsistent in the multiple regression analysis. The critical finding of this study is that the climate factors, when studied as a whole, showed a statistically significant relationship with student achievement in both the hierarchical cluster analysis and the multiple regression analysis. The following section provides interpretation and discussion of the findings with regard to each research question.

Interpretation of Findings

With regard to the overarching research question, the hierarchical cluster analysis suggested that, based on the CI, there is a relationship between middle school climate and student achievement in the Commonwealth of Virginia. This finding was supported by the results of the multiple regression analysis, which used the factors making up the CI as predictor variables of student achievement. This regression model suggested a relationship between school climate and student achievement in Virginia's middle schools. To more fully study the primary question of this study, the researcher examined the impact of school climate on student achievement in each of the four core content areas: English–reading, mathematics, history–social science, and science.

Findings were relatively consistent across all four core content areas. The results of the hierarchical cluster analysis showed that in the area of English–reading, student achievement was higher in schools with higher attendance rates and lower discipline rates and SES rates, as measured by the number of students per 100 receiving free or reduced-price lunch. The same trend was evident across the remaining three content areas. The multiple regression analysis corroborated these results, revealing a significant relationship between the climate factors when applied as a whole and student

achievement. The strongest relationship between climate factors and student achievement was in English–reading and the weakest in mathematics. Nonetheless, the relationship in mathematics was significant. These results are consistent with the findings of the study replicated here (Smith, 2005).

The four factors used both for the CI and as predictor variables in the regression model were shown to have a significant relationship with student achievement when viewed as a whole, but they generated more varied results when examined individually. In both the hierarchical cluster analysis, for which the trend line was erratic, and the multiple regression analysis, school size was the least significant climate factor. In fact, according to the regression results, school size was not significant in the content areas of English–reading and history–social science. Additionally, the ANOVA conducted on school size was non-significant, which also suggested school size is not meaningful in determining either the make-up of the clusters or student achievement. This finding contradicts results found by Benson (1987) and Kaczor (2006).

Attendance rate reflected a consistent trend line in the hierarchical cluster analysis, rising as achievement rose. The multiple regression analysis did not fully support this finding, as attendance rate did not generate significance in the areas of science and mathematics. Similarly, discipline rate reflected a consistent trend line in the cluster analysis, dropping as achievement rose; but, again, the findings in the regression analysis did not fully support this result, as discipline rate did not show significance in the area of mathematics. With the exception of the regression results in mathematics, the findings for both analyses support previous research (Allodi, 2002; DiPaola &

Tschannen-Moran, 2001; Hoy & Hannum, 1997; Kuperminc et al., 2001; Sugai & Horner, 2001).

SES, as measured by the number of students per 100 receiving free or reduced-price lunch, also reflected a consistent trend line in the cluster analysis, dropping as achievement rose. In this case, the regression analysis fully supported the finding, as SES was a significant predictor variable in all four content areas. These findings support previous research on SES (Benson, 2003; Brookover et al., 1978; Bulach et al., 1995; Coleman et al., 1966; Considine & Zappala, 2002; Hoy et al., 1998; Spence, 2003; Weber, 1971). Along with discipline rate, SES emerged as the strongest predictor of student achievement.

Implications for Practice

The study of school climate is problematic in that climate consists of a conglomeration of factors (Hoy & Hannum, 1997). Although it is useful for school leaders to examine specific climate factors to plan for how to control them, the organizational health of a school cannot be defined by one factor, and in the context of climate, it is not as effective to consider the impact of various climate factors on student achievement in isolation. Although many factors form the climate of a school, certain factors are controllable whereas others are not. School leaders must determine which factors are controllable and then develop and implement plans to control them. The findings of this study describe the impact of climate on achievement while isolating factors that school leaders who want to change the climate of their schools can use as focal points for planning. For example, a school leader might implement a schoolwide behavior initiative designed to increase student engagement and reduce classroom

disruptions and time out of class, use data to focus resources for intervention on underachieving students receiving free or reduced-price lunch, or develop an incentive system to increase student attendance. If each of these factors is successfully addressed, the overall climate of a school will strengthen, and student achievement will rise.

The effect sizes revealed by the cluster analysis were too large to disregard. Ranging from 23-24% in mathematics to 43-44% in English-reading, the effect sizes of the collective variables of the CI on student achievement suggest that school leaders can significantly improve students' results by identifying meaningful climate factors and developing and implementing plans for managing them. The findings of this study also support the notion that climate cannot be reduced to one variable; the clustered variables have a more significant impact than any one of the individual variables. Additionally, certain climate factors can be directly influenced while others must be managed.

Based on this study, the most significant variable school leaders must manage is SES. This result is not surprising considering how prominent a role SES played in studies examined throughout Chapter 2. The most obvious problem for leadership is that SES is not a variable that can easily be changed at the school level. It can, however, be managed by a school leader who takes the time to understand what the SES of his/her school is, and to recognize and address the problems and challenges commonly faced in high poverty schools. Savvy school leaders will take the time to identify students of poverty, examine data regarding their achievement, and develop and implement plans for intervention to ensure the educational risk factors of poverty are mitigated.

Similarly, school size is not a variable that can be controlled by leaders at the school level. The results of this study, however, suggest that it is not a variable with

which school leaders should concern themselves. Though size issues can be mitigated by clever scheduling and thoughtful staffing, the relative insignificance of school size as a variable that impacts achievement is notable. School leaders who overly concern themselves with the size of their schools may be wasting energy, time, and resources better used elsewhere.

The remaining variables examined in this study, discipline and attendance, are controllable by leaders at the school level. Both variables arise throughout the studies examined in Chapter 2 as meaningful for improving both achievement and climate. At the most basic level, this study supports the idea that a school students want to attend and where they feel safe in an environment consistently conducive to learning is a school with a highly positive climate and students achieving at their best. For school leaders the goal of reducing discipline and increasing attendance presents a myriad of challenges and opportunities. From improving the quality of instruction and student engagement in the classroom to developing positive behavior plans and incentives for attendance, school leaders have both the tools and the mandate to productively put time and resources into improving discipline and attendance. The results of this study suggest the efforts would be well worth it, and that students would ultimately benefit through improved achievement.

Of course, the CI developed for this study is not exhaustive. There are other meaningful climate factors that were not part of this methodology, factors described in Chapter 2 from mobility indices to per pupil spending, and from perceptions of principal support to perceptions of teacher engagement. Over the course of this study, the complexity of studying school climate, which can only be defined and described by the

factors and variables determined to influence climate, became increasingly evident. The goal of this study ultimately became to provide a new statistical methodology for studying climate that was as effective as previous methodologies, but that enabled researchers or practitioners to use publicly available, non-invasive data to draw conclusions about how climate was impacting students. Though the results of this study were compelling, there are several ways in which it could be refined or extended. The following are recommendations for taking this study forward.

Recommendations for Future Studies

Based on the findings of this study, the recommendations for future studies in the area of school climate and student achievement are as follows:

1. It is recommended that a study of convergent validity of this study's methodology be undertaken to determine the predictive utility of using the CI relative to more traditional methodological approaches in climate studies.
2. It is recommended that this study be replicated with high schools in the Commonwealth of Virginia. Additional achievement data, including graduation rates, mathematics and reading scores on norm-referenced tests such as the SAT, and achievement on Advanced Placement tests might reveal different results.
3. It is recommended that the study be replicated with elementary schools in the Commonwealth of Virginia.
4. It is recommended that the study be replicated with additional climate variables included in the CI. As this study focused only on publicly available data describing only portions of the organizational health framework

developed by Hoy and Hannum (1998), other variables could be defined by data collected through other means and added to the CI: for example, teacher perceptions, student perceptions, community perceptions, leadership inventories, and other variables that relate to each of the domains of the organizational health framework.

5. It is recommended that the study be replicated with a focus on the achievement of subgroups of students as defined in the federal accountability system: disabled students, African American students, Hispanic students, economically disadvantaged students, and English language learners.
6. It is recommended that the study be replicated excluding the Free or Reduced-Price Eligibility Report data from the CI.
7. It is recommended that the study be replicated using subsets of schools. For example, a study might examine the CI in the context of schools of similar size or schools with similar demographics, including SES.

Summary

To realize the highest level of student achievement, school leaders must pay attention to and intentionally plan for the improvement of the climate of their schools. The successful function of a school depends upon the presence of a strong and positive climate (Deal & Peterson, 1999; Freiberg & Stein, 1999). This study, which focused on the impact of school climate, as framed by a theory of organizational health, revealed a significant relationship between positive school climate and high student achievement.

The results are not surprising given the existing body of climate research. From the early 20th century (Perry, 1908) to the present day, the climate of organizations,

including schools, has been a focus of concern and study. Recent studies have defined climate in a variety of ways and examined it through a variety of measures, and the overwhelming majority have indicated that a strong school climate is positively correlated with student achievement (Anderson, 1982; Brookover et al., 1978; Bulach et al., 1995; Deal & Peterson, 1999; Freiberg & Stein, 1999; Gayton, 1999; Hoy et al., 1991; Hoy and Hannum, 1997; Smith, 2005). This study provided another methodological approach or research model for the study of climate and found results similar to those of previous studies. Analysis and discussion of this study's findings were presented in Chapter 5, and recommendations for further study were made.

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Appendix A

VASOL Test Results

Cluster 1

2010-2011

Division	School name	Eng	Math	Hist	Sci
Accomack	Arcadia MS	85	80	83	93
Norfolk	Azalea Gardens MS	79	70	74	87
Virginia Beach	Bayside MS	85	60	80	91
Williamsburg-JCC	Berkeley MS	90	87	84	92
Richmond City	Binford MS	80	73	77	83
Norfolk	Blair MS	80	74	76	90
Henrico	Brookland MS	86	76	72	89
Richmond City	Brown MS	85	77	76	89
Montgomery	Christiansburg MS	87	81	82	86
Portsmouth	Churchland MS	81	78	72	84
Newport News	Crittenden MS	83	76	71	92
Hampton	Davis MS	81	73	81	90
Richmond City	Elkhardt MS	76	71	75	94
Henrico	Elko MS	84	79	79	94
Henrico	Fairfield MS	82	70	84	92
Chesterfield	Falling Creek MS	84	75	77	85
Halifax	Halifax MS	78	74	78	85
Harrisonburg	Harrison MS	88	84	79	90
Newport News	Hines MS	85	79	78	87
Newport News	Huntington MS	80	85	82	89
Chesapeake	Indian River MS	88	86	86	90

Division	School name	Eng	Math	Hist	Sci
Roanoke City	Jackson MS	85	83	75	92
Norfolk	Lake Taylor MS	73	63	73	82
Henry	Laurel Park MS	90	87	82	96
Hampton	Lindsay MS	77	77	75	87
Lynchburg	Linkhorne MS	89	77	85	95
Roanoke City	Madison MS	82	78	71	91
Norfolk	Northside MS	84	79	76	90
Norfolk	Norview MS	78	73	71	89
Nottoway	Nottoway MS	87	81	78	90
Chesapeake	Oscar Smith MS	87	81	76	89
Petersburg	Peabody MS	77	51	70	X
Prince Edward	Prince Edward MS	85	85	81	88
Chesterfield	Providence MS	85	82	81	90
Henrico	Rolfe MS	83	76	72	89
Norfolk	Ruffner MS	71	65	61	84
Chesterfield	Salem Church MS	87	87	75	90
Lynchburg	Sandusky MS	81	59	73	93
Southampton	Southampton MS	82	76	88	95
Hampton	Syms MS	84	76	86	94
Richmond City	Thompson MS	76	69	70	83

Division	School name	Eng	Math	Hist	Sci
Fredericksburg	Walker-Grant MS	87	77	86	94
Portsmouth	Waters MS	86	79	76	91
Danville	Westwood MS	88	86	83	92
Henrico	Wilder MS	75	58	72	90
Roanoke City	Wilson MS	83	75	74	94
Hopewell	Woodson MS	82	76	74	89

Appendix B

Climate Index Data

Cluster 1

2010-2011

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Accomack	Arcadia MS	467	-0.91	95	-0.31
Norfolk	Azalea Gardens MS	914	0.54	96	0.55
Virginia Beach	Bayside MS	1008	0.84	96	0.55
Williamsburg-JCC	Berkeley MS	886	0.45	95	-0.31
Richmond City	Binford MS	422	-1.05	95	-0.31
Norfolk	Blair MS	1127	1.23	95	-0.31
Henrico	Brookland MS	982	0.76	96	0.55
Richmond City	Brown MS	727	-0.07	96	0.55
Montgomery	Christiansburg MS	808	0.20	94	-1.17
Portsmouth	Churchland MS	851	0.33	95	-0.31
Newport News	Crittenden MS	796	0.16	95	-0.31
Hampton	Davis MS	643	-0.34	95	-0.31
Richmond City	Elkhardt MS	445	-0.98	94	-1.17
Henrico	Elko MS	909	0.52	94	-1.17
Henrico	Fairfield MS	820	0.23	96	0.55
Chesterfield	Falling Creek MS	1181	1.40	95	-0.31
Halifax	Halifax MS	1329	1.88	95	-0.31
Harrisonburg	Harrison MS	771	0.08	96	0.55
Newport News	Hines MS	876	0.42	95	-0.31
Newport News	Huntington MS	580	-0.54	94	-1.17

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Chesapeake	Indian River MS	761	0.04	95	-0.31
Roanoke City	Jackson MS	514	-0.75	93	-2.03
Norfolk	Lake Taylor MS	878	0.42	94	-1.17
Henry	Laurel Park MS	697	-0.16	96	0.55
Hampton	Lindsay MS	638	-0.35	94	-1.17
Lynchburg	Linkhorne MS	627	-0.39	96	0.55
Roanoke City	Madison MS	570	-0.57	94	-1.17
Norfolk	Northside MS	796	0.16	94	-1.17
Norfolk	Norview MS	1130	1.24	94	-1.17
Nottoway	Nottoway MS	345	-1.30	93	-2.03
Chesapeake	Oscar Smith MS	966	0.71	95	-0.31
Petersburg	Peabody MS	548	-0.64	94	-1.17
Prince Edward	Prince Edward MS	753	0.02	97	1.41
Chesterfield	Providence MS	864	0.38	95	-0.31
Henrico	Rolfe MS	1038	0.94	96	0.55
Norfolk	Ruffner MS	853	0.34	94	-1.17
Chesterfield	Salem Church MS	857	0.35	95	-0.31
Lynchburg	Sandusky MS	564	-0.59	95	-0.31
Southampton	Southampton MS	605	-0.46	94	-1.17
Hampton	Syms MS	1155	1.32	95	-0.31

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Richmond City	Thompson MS	563	-0.60	94	-1.17
Fredericksburg	Walker-Grant MS	622	-0.41	96	0.55
Portsmouth	Waters MS	547	-0.65	94	-1.17
Danville	Westwood MS	384	-1.17	95	-0.31
Henrico	Wilder MS	911	0.53	95	-0.31
Roanoke City	Wilson MS	492	-0.83	95	-0.31
Hopewell	Woodson MS	878	0.42	97	1.41

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	Z-score (SES)
Accomack	Arcadia MS	57.17	1.41	71.50	1.47
Norfolk	Azalea Gardens MS	63.68	1.68	62.30	1.03
Virginia Beach	Bayside MS	35.81	0.50	62.10	1.02
Williamsburg-JCC	Berkeley MS	31.04	0.30	38.70	-0.11
Richmond City	Binford MS	60.19	1.53	69.20	1.36
Norfolk	Blair MS	66.10	1.79	56.40	0.74
Henrico	Brookland MS	36.97	0.55	60.70	0.95
Richmond City	Brown MS	55.98	1.36	60.50	0.94
Montgomery	Christiansburg MS	62.50	1.63	42.20	0.06
Portsmouth	Churchland MS	69.80	1.94	49.00	0.39

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	Z-score (SES)
Newport News	Crittenden MS	62.56	1.64	64.20	1.12
Hampton	Davis MS	62.99	1.65	74.20	1.60
Richmond City	Elkhardt MS	77.08	2.25	80.50	1.91
Henrico	Elko MS	41.91	0.76	52.00	0.53
Henrico	Fairfield MS	44.63	0.87	63.00	1.06
Chesterfield	Falling Creek MS	54.95	1.31	60.10	0.92
Halifax	Halifax MS	52.14	1.19	63.00	1.06
Harrisonburg	Harrison MS	20.75	-0.14	62.30	1.03
Newport News	Hines MS	36.07	0.51	52.70	0.57
Newport News	Huntington MS	49.14	1.06	87.60	2.25
Chesapeake	Indian River MS	40.60	0.70	52.60	0.56
Roanoke City	Jackson MS	49.61	1.09	82.70	2.01
Norfolk	Lake Taylor MS	60.14	1.53	84.70	2.11
Henry	Laurel Park MS	29.70	0.24	61.20	0.98
Hampton	Lindsay MS	86.52	2.65	73.20	1.56
Lynchburg	Linkhorne MS	43.38	0.82	40.80	-0.01
Roanoke City	Madison MS	77.02	2.25	52.30	0.55
Norfolk	Northside MS	74.50	2.14	69.40	1.37
Norfolk	Norview MS	70.97	1.99	79.60	1.86

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	Z-score (SES)
Nottoway	Nottoway MS	71.30	2.01	56.70	0.76
Chesapeake	Oscar Smith MS	73.29	2.09	74.00	1.59
Petersburg	Peabody MS	45.07	0.89	76.10	1.70
Prince Edward	Prince Edward MS	34.00	0.42	63.10	1.07
Chesterfield	Providence MS	36.34	0.52	44.50	0.17
Henrico	Rolfe MS	55.49	1.33	55.50	0.70
Norfolk	Ruffner MS	59.44	1.50	84.50	2.10
Chesterfield	Salem Church MS	50.18	1.11	44.30	0.16
Lynchburg	Sandusky MS	67.55	1.85	63.90	1.11
Southampton	Southampton MS	78.51	2.31	44.40	0.17
Hampton	Syms MS	51.34	1.16	56.90	0.77
Richmond City	Thompson MS	52.40	1.20	79.60	1.86
Fredericksburg	Walker-Grant MS	56.43	1.37	52.30	0.55
Portsmouth	Waters MS	66.18	1.79	60.60	0.95
Danville	Westwood MS	56.77	1.39	77.20	1.75
Henrico	Wilder MS	71.24	2.00	75.70	1.68
Roanoke City	Wilson MS	60.57	1.55	55.50	0.70
Hopewell	Woodson MS	40.66	0.70	74.30	1.61

Appendix C

VASOL Test Results

Cluster 2

2010-2011

Division	School name	Eng	Math	Hist	Sci
Wise	Addington MS	86	85	89	92
Amelia	Amelia MS	90	80	78	90
Amherst	Amhert MS	86	78	81	91
Montgomery	Auburn MS	91	82	85	95
Mecklenburg	Bluestone MS	91	74	90	95
Roanoke City	Breckenridge MS	82	79	78	88
Buckingham	Buckingham County MS	88	93	91	93
Charlottesville	Buford MS	79	77	86	85
Charles City	Charles City County MS	90	74	89	91
Smyth	Chilhowie MS	91	85	90	96
Wise	Coeburn MS	81	85	85	95
Portsmouth	Cradock MS	80	80	72	74
Cumberland	Cumberland MS	88	85	86	95
Radford	Dalton MS	90	84	80	91
Washington	Damascus MS	92	75	94	93
Pittsylvania	Dan River MS	88	85	74	93
Lynchburg	Dunbar MS	84	70	78	90
Scott	Dungannon MS	82	79	75	94
Essex	Essex Intermediate	88	85	78	90
Wythe	Fort Chiswell MS	90	74	84	98

Division	School name	Eng	Math	Hist	Sci
Galax	Galax MS	84	76	74	79
Washington	Glade Spring MS	89	79	84	89
Tazewell	Graham MS	94	86	84	97
Pittsylvania	Gretna MS	90	78	84	98
Alexandria	Hammond 2 MS	89	71	85	88
Alexandria	Hammond 3 MS	88	70	85	92
Richmond City	Hill MS	93	91	93	97
Grayson	Independence MS	86	86	86	x
Surry	Jackson MS	88	84	79	88
Petersburg	Johns MS	69	85	56	78
Lee	Jonesville MS	88	82	83	95
Suffolk	Kennedy MS	82	74	75	91
Franklin City	King MS	81	71	73	84
Lancaster	Lancaster MS	82	80	73	81
Russell	Lebanon MS	96	89	89	95
Lunenburg	Lunenburg MS	86	76	74	91
Page	Luray MS	87	89	85	94
Smyth	Marion MS	84	79	76	92
Martinsville	Martinsville MS	86	86	83	88
Rockbridge	Maury River MS	87	77	78	98
Buena Vista	Mccluer MS	87	71	75	88

Division	School name	Eng	Math	Hist	Sci
Westmoreland	Montross MS	86	84	79	90
Accomack	Nandua MS	88	82	83	91
Northumberland	Northumberland MS	91	87	74	94
Smyth	Northwood MS	90	82	92	96
Page	Page County MS	78	58	66	89
Mecklenburg	Park View MS	89	86	87	94
Lee	Pennington MS	86	93	83	92
Pulaski	Pulaski MS	83	73	75	90
Tazewell	Richlands MS	86	81	77	94
Richmond County	Richmond County MS	92	81	82	95
Rockbridge	Rockbridge MS	91	88	79	96
Wythe	Rural Retreat MS	84	74	84	96
Brunswick	Russell MS	81	75	72	78
Scott	Rye Cove MS	98	93	89	98
Wythe	Scott Memorial MS	83	80	82	96
Montgomery	Shawsville MS	87	82	86	91
Harrisonburg	Skyline MS	87	86	81	91
Sussex	Sussex Central MS	84	77	81	80
Tazewell	Tazewell MS	88	78	80	94

Division	School name	Eng	Math	Hist	Sci
Bristol	Virginia MS	85	78	75	92
Middlesex	Walker MS	94	95	93	97
Greensville	Wyatt MS	84	81	71	88

Appendix D

Climate Index Data

Cluster 2

2010-2011

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Wise	Addington MS	487	-0.84	94	-1.17
Amelia	Amelia MS	575	-0.56	92	-2.90
Amherst	Amhert MS	438	-1.00	95	-0.31
Montgomery	Auburn MS	280	-1.51	95	-0.31
Mecklenburg	Bluestone MS	480	-0.86	95	-0.31
Roanoke City	Breckenridge MS	601	-0.47	95	-0.31
Buckingham	Buckingham County MS	445	-0.98	95	-0.31
Charlottesville	Buford MS	467	-0.91	97	1.41
Charles City	Charles City County MS	186	-1.81	97	1.41
Smyth	Chilhowie MS	338	-1.32	96	0.55
Wise	Coeburn MS	410	-1.09	94	-1.17
Portsmouth	Cradock MS	562	-0.60	92	-2.90
Cumberland	Cumberland MS	306	-1.43	94	-1.17
Radford	Dalton MS	249	-1.61	96	0.55
Washington	Damascus MS	204	-1.76	95	-0.31
Pittsylvania	Dan River MS	496	-0.81	95	-0.31
Lynchburg	Dunbar MS	644	-0.33	95	-0.31
Scott	Dungannon MS	77	-2.17	96	0.55
Essex	Essex Intermediate	469	-0.90	95	-0.31

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Wythe	Fort Chiswell MS	352	-1.28	94	-1.17
Galax	Galax MS	314	-1.40	96	0.55
Washington	Glade Spring MS	309	-1.42	95	-0.31
Tazewell	Graham MS	434	-1.01	94	-1.17
Pittsylvania	Gretna MS	451	-0.96	96	0.55
Alexandria	Hammond 2 MS	429	-1.03	96	0.55
Alexandria	Hammond 3 MS	412	-1.08	96	0.55
Richmond City	Hill MS	502	-0.79	96	0.55
Grayson	Independence MS	208	-1.74	96	0.55
Surry	Jackson MS	298	-1.45	97	1.41
Petersburg	Johns MS	694	-0.17	90	-4.62
Lee	Jonesville MS	250	-1.61	95	-0.31
Suffolk	Kennedy MS	610	-0.44	96	0.55
Franklin City	King MS	231	-1.67	96	0.55
Lancaster	Lancaster MS	494	-0.82	96	0.55
Russell	Lebanon MS	322	-1.37	94	-1.17
Lunenburg	Lunenburg MS	365	-1.24	94	-1.17
Page	Luray MS	351	-1.28	95	-0.31
Smyth	Marion MS	502	-0.79	94	-1.17
Martinsville	Martinsville MS	504	-0.79	96	0.55

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Rockbridge	Maury River MS	352	-1.28	94	-1.17
Buena Vista	Mccluer MS	365	-1.24	95	-0.31
Westmoreland	Montross MS	390	-1.15	97	1.41
Accomack	Nandua MS	472	-0.89	96	0.55
Northumberland	Northumberland MS	338	-1.32	95	-0.31
Smyth	Northwood MS	217	-1.71	94	-1.17
Page	Page County MS	437	-1.00	94	-1.17
Mecklenburg	Park View MS	604	-0.46	95	-0.31
Lee	Pennington MS	327	-1.36	92	-2.90
Pulaski	Pulaski MS	457	-0.94	95	-0.31
Tazewell	Richlands MS	589	-0.51	93	-2.03
Richmond County	Richmond County MS	267	-1.55	95	-0.31
Rockbridge	Rockbridge MS	205	-1.75	95	-0.31
Wythe	Rural Retreat MS	228	-1.68	95	-0.31
Brunswick	Russell MS	475	-0.88	95	-0.31
Scott	Rye Cove MS	189	-1.80	95	-0.31
Wythe	Scott Memorial MS	360	-1.25	96	0.55
Montgomery	Shawsville MS	216	-1.72	92	-2.90
Harrisonburg	Skyline MS	542	-0.66	96	0.55

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Sussex	Sussex Central MS	371	-1.22	96	0.55
Tazewell	Tazewell MS	484	-0.85	93	-2.03
Bristol	Virginia MS	550	-0.64	93	-2.03
Middlesex	Walker MS	265	-1.56	95	-0.31
Greensville	Wyatt MS	577	-0.55	94	-1.17

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Wise	Addington MS	14.58	-0.40	48.10	0.34
Amelia	Amelia MS	22.96	-0.05	46.70	0.28
Amherst	Amhert MS	17.58	-0.28	47.20	0.30
Montgomery	Auburn MS	3.21	-0.89	38.50	-0.12
Mecklenburg	Bluestone MS	35.63	0.49	56.00	0.73
Roanoke City	Breckenridge MS	34.61	0.45	70.70	1.43
Buckingham	Buckingham County MS	23.37	-0.03	63.40	1.08
Charlottesville	Buford MS	55.46	1.33	52.10	0.54
Charles City	Charles City County MS	12.90	-0.48	73.20	1.56
Smyth	Chilhowie MS	5.62	-0.78	49.60	0.42
Wise	Coeburn MS	34.15	0.43	57.80	0.81

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Portsmouth	Cradock MS	30.43	0.27	77.90	1.78
Cumberland	Cumberland MS	46.41	0.95	49.00	0.39
Radford	Dalton MS	11.65	-0.53	41.10	0.01
Washington	Damascus MS	11.27	-0.54	56.00	0.73
Pittsylvania	Dan River MS	35.48	0.48	58.60	0.85
Lynchburg	Dunbar MS	47.05	0.98	70.50	1.43
Scott	Dungannon MS	2.60	-0.91	70.10	1.41
Essex	Essex Intermediate	18.98	-0.22	63.10	1.07
Wythe	Fort Chiswell MS	14.77	-0.40	49.00	0.39
Galax	Galax MS	9.55	-0.62	55.20	0.69
Washington	Glade Spring MS	10.03	-0.60	53.30	0.60
Tazewell	Graham MS	12.67	-0.48	44.10	0.15
Pittsylvania	Gretna MS	39.25	0.64	64.00	1.11
Alexandria	Hammond 2 MS	26.57	0.11	66.70	1.24
Alexandria	Hammond 3 MS	17.96	-0.26	60.40	0.94
Richmond City	Hill MS	30.48	0.27	55.00	0.68
Grayson	Independence MS	2.88	-0.90	53.40	0.60
Surry	Jackson MS	77.85	2.29	58.30	0.84
Petersburg	Johns MS	68.88	1.90	67.70	1.29

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Lee	Jonesville MS	17.60	-0.28	51.60	0.51
Suffolk	Kennedy MS	38.52	0.61	61.60	1.00
Franklin City	King MS	48.05	1.02	73.60	1.57
Lancaster	Lancaster MS	51.42	1.16	69.70	1.39
Russell	Lebanon MS	7.14	-0.72	48.20	0.35
Lunenburg	Lunenburg MS	36.44	0.53	65.50	1.18
Page	Luray MS	15.38	-0.37	46.40	0.26
Smyth	Marion MS	22.51	-0.07	57.90	0.82
Martinsville	Martinsville MS	20.04	-0.17	69.50	1.38
Rockbridge	Maury River MS	4.55	-0.83	41.10	0.01
Buena Vista	Mccluer MS	18.90	-0.22	44.30	0.16
Westmoreland	Montross MS	35.13	0.47	70.50	1.43
Accomack	Nandua MS	49.36	1.07	76.90	1.73
Northumberland	Northumberland MS	16.27	-0.33	48.80	0.38
Smyth	Northwood MS	41.01	0.72	56.50	0.75
Page	Page County MS	4.81	-0.82	51.90	0.53
Mecklenburg	Park View MS	24.01	0.00	58.40	0.84
Lee	Pennington MS	23.24	-0.04	61.40	0.99
Pulaski	Pulaski MS	42.89	0.80	62.80	1.05
Tazewell	Richlands MS	6.45	-0.75	51.10	0.49

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Richmond County	Richmond County MS	11.24	-0.55	52.10	0.54
Rockbridge	Rockbridge MS	14.63	-0.40	42.70	0.08
Wythe	Rural Retreat MS	28.51	0.19	47.80	0.33
Brunswick	Russell MS	18.95	-0.22	81.80	1.97
Scott	Rye Cove MS	4.76	-0.82	64.60	1.14
Wythe	Scott Memorial MS	10.56	-0.57	46.50	0.27
Montgomery	Shawsville MS	40.74	0.71	54.40	0.65
Harrisonburg	Skyline MS	22.69	-0.06	69.00	1.35
Sussex	Sussex Central MS	41.24	0.73	79.20	1.85
Tazewell	Tazewell MS	19.63	-0.19	52.90	0.58
Bristol	Virginia MS	34.91	0.46	64.60	1.14
Middlesex	Walker MS	15.09	-0.38	51.30	0.50
Greensville	Wyatt MS	37.78	0.58	68.10	1.31

Appendix E

VASOL Test Results

Cluster 3

2010-2011

Division	School name	Eng	Math	Hist	Sci
Appomattox	Appomattox MS	86	73	85	94
Frederick	Aylor MS	92	88	89	95
Spotsylvania	Battlefield MS	88	77	84	92
Bedford	Bedford MS	86	72	73	93
Augusta	Beverley Manor MS	86	82	87	91
Culpeper	Binns MS	90	86	78	93
Montgomery	Blacksburg MS	93	83	90	95
Campbell	Brookville MS	92	87	87	95
Albemarle	Burley MS	91	90	77	93
Fauquier	Cedar Lee MS	89	83	76	96
Botetourt	Central Academy MS	93	91	86	95
Charlotte	Central MS	94	85	82	99
Spotsylvania	Chancellor MS	87	80	82	93
Pittsylvania	Chatham MS	87	80	74	95
Alleghany	Clifton MS	92	85	82	94
Waynesboro	Collins MS	80	75	79	90
Colonial Heights	Colonial Heights MS	88	83	90	95
Chesapeake	Crestwood MS	92	85	86	94
Chesapeake	Deep Creek MS	95	89	90	96

Division	School name	Eng	Math	Hist	Sci
Dinwiddie	Dinwiddie MS	82	66	69	x
Stafford	Dixon-Smith MS	91	85	85	96
Lexington	Downing MS	94	87	87	96
Stafford	Drew MS	90	81	80	95
Pulaski	Dublin MS	85	79	73	90
Hampton	Eaton MS	90	83	90	99
Rockingham	Elkton MS	94	89	84	96
Suffolk	Forest Glen MS	88	89	85	97
Franklin County	Franklin East MS	95	82	91	x
Franklin County	Franklin West MS	93	87	87	95
Frederick	Frederick County MS	84	75	82	93
Spotsylvania	Freedom MS	93	90	94	92
Scott	Gate City MS	94	93	89	96
Roanoke County	Glenvar MS	92	91	91	97
Goochland	Goochland MS	96	88	90	97
Prince William	Graham Park MS	91	86	82	97
Arlington	Gunston MS	89	76	81	91
Alexandria	GW 1 MS	87	82	76	87
Alexandria	GW 2 MS	87	76	80	90
Alexandria	Hammond 1 MS	86	72	90	94

Division	School name	Eng	Math	Hist	Sci
Stafford	Heim MS	88	86	81	97
Fairfax	Herndon MS	91	90	88	90
Rockingham	Hillyard MS	86	83	82	95
Fairfax	Holmes MS	94	96	92	97
King William	Holmes MS	89	81	85	97
Mathews	Hunter MS	90	75	85	87
Arlington	Jefferson MS	88	78	83	94
Clarke	Johnson-Williams MS	92	77	89	96
Hampton	Jones Magnet MS	90	87	82	95
Albemarle	Jouett MS	91	91	87	91
Virginia Beach	Kempsville MS	94	88	88	97
Arlington	Kenmore MS	85	75	81	86
Fairfax	Key MS	95	97	94	95
King George	King George MS	92	89	88	95
Salem	Lewis MS	96	90	91	98
Orange	Locust Grove MS	88	86	87	94
Manassas Park	Manassas Park MS	89	88	78	93
Fauquier	Marshall MS	89	84	76	93
Amherst	Monelison MS	87	81	82	95
Rockingham	Montevideo MS	88	86	79	95

Division	School name	Eng	Math	Hist	Sci
Shenandoah	Muhlenberg MS	92	91	88	97
Nelson	Nelson MS	90	88	86	93
New Kent	New Kent MS	89	84	86	92
Spotsylvania	Ni River MS	91	89	88	97
Shenandoah	North Fork MS	87	91	75	97
Roanoke County	Northside MS	94	92	86	96
Gloucester	Page MS	92	83	81	97
Gloucester	Peasley MS	90	81	85	95
Rockingham	Pence MS	90	87	78	95
Powhatan	Pocahontas MS	93	87	85	89
Spotsylvania	Post Oak MS	85	81	80	92
Wise	Powell Valley MS	86	84	78	89
Powhatan	Powhatan MS	95	92	89	98
Orange	Prospect Heights MS	84	80	82	90
York	Queen's Lake MS	90	88	87	91
Campbell	Rustburg MS	83	78	73	90
Staunton	Shelburne MS	87	82	78	96
Shenandoah	Signal Knob MS	89	85	83	96
Isle of Wight	Smithfield MS	92	90	91	96
Spotsylvania	Spotsylvania MS	89	82	84	92

Division	School name	Eng	Math	Hist	Sci
Stafford	Stafford MS	88	79	83	94
Washington	Stanley MS	89	82	86	97
Bedford	Staunton River MS	81	74	77	89
Loudon	Sterling MS	85	73	83	91
Augusta	Stewart MS	86	76	81	91
Augusta	Stuart's Draft MS	89	80	86	97
Fauquier	Taylor MS	90	81	75	93
Spotsylvania	Thornburg MS	89	82	80	94
Williamsburg-JCC	Toano MS	94	92	89	94
Pittsylvania	Tunstall MS	91	88	83	96
Virginia Beach	Virginia Beach MS	93	78	88	96
Washington	Wallace MS	91	86	90	92
Albemarle	Walton MS	84	80	77	92
Warren	Warren County MS	84	75	81	x
Newport News	Washington MS	92	83	88	93
West Point	West Point MS	95	92	84	98
Madison	Wetsel MS	87	78	79	92
Greene	William Monroe MS	89	87	79	95
Augusta	Wilson MS	90	81	87	94
Isle of Wight	Windsor MS	93	89	90	97

Division	School Name	Eng	Math	Hist	Sci
Frederick	Wood MS	90	82	81	94

Appendix F

Climate Index Data

Cluster 3

2010-2011

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Appomattox	Appomattox MS	546	-0.65	95	-0.31
Frederick	Aylor MS	594	-0.50	96	0.55
Spotsylvania	Battlefield MS	800	0.17	95	-0.31
Bedford	Bedford MS	475	-0.88	95	-0.31
Augusta	Beverley Manor MS	751	0.01	95	-0.31
Culpeper	Binns MS	719	-0.09	96	0.55
Montgomery	Blacksburg MS	826	0.25	95	-0.31
Campbell	Brookville MS	709	-0.12	96	0.55
Albemarle	Burley MS	498	-0.81	97	1.41
Fauquier	Cedar Lee MS	656	-0.30	95	-0.31
Botetourt	Central Academy MS	464	-0.92	96	0.55
Charlotte	Central MS	472	-0.89	95	-0.31
Spotsylvania	Chancellor MS	813	0.21	95	-0.31
Pittsylvania	Chatham MS	512	-0.76	95	-0.31
Alleghany	Clifton MS	678	-0.22	95	-0.31
Waynesboro	Collins MS	706	-0.13	99	3.14
Colonial Heights	Colonial Heights MS	696	-0.17	95	-0.31
Chesapeake	Crestwood MS	601	-0.47	96	0.55
Chesapeake	Deep Creek MS	470	-0.90	96	0.55

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Dinwiddie	Dinwiddie MS	685	-0.20	95	-0.31
Stafford	Dixon-Smith MS	889	0.46	95	-0.31
Lexington	Downing MS	169	-1.87	97	1.41
Stafford	Drew MS	465	-0.91	95	-0.31
Pulaski	Dublin MS	570	-0.57	95	-0.31
Hampton	Eaton MS	712	-0.11	97	1.41
Rockingham	Elkton MS	486	-0.84	95	-0.31
Suffolk	Forest Glen MS	402	-1.12	98	2.28
Franklin County	Franklin East MS	521	-0.73	96	0.55
Franklin County	Franklin West MS	834	0.28	95	-0.31
Frederick	Frederick County MS	685	-0.20	95	-0.31
Spotsylvania	Freedom MS	861	0.37	95	-0.31
Scott	Gate City MS	527	-0.71	96	0.55
Roanoke County	Glenvar MS	427	-1.04	95	-0.31
Goochland	Goochland MS	585	-0.52	96	0.55
Prince William	Graham Park MS	845	0.32	95	-0.31
Arlington	Gunston MS	755	0.02	96	0.55
Alexandria	GW 1 MS	484	-0.85	97	1.41
Alexandria	GW 2 MS	475	-0.88	98	2.28

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Alexandria	Hammond 1 MS	422	-1.05	97	1.41
Stafford	Heim MS	761	0.04	95	-0.31
Fairfax	Herndon MS	965	0.70	95	-0.31
Rockingham	Hillyard MS	760	0.04	96	0.55
Fairfax	Holmes MS	742	-0.02	96	0.55
King William	Holmes MS	498	-0.81	95	-0.31
Mathews	Hunter MS	373	-1.21	96	0.55
Arlington	Jefferson MS	640	-0.35	97	1.41
Clarke	Johnson-Williams MS	481	-0.86	95	-0.31
Hampton	Jones Magnet MS	695	-0.17	96	0.55
Albemarle	Jouett MS	580	-0.54	96	0.55
Virginia Beach	Kempsville MS	874	0.41	95	-0.31
Arlington	Kenmore MS	745	-0.01	96	0.55
Fairfax	Key MS	823	0.24	96	0.55
King George	King George MS	667	-0.26	94	-1.17
Salem	Lewis MS	908	0.52	95	-0.31
Orange	Locust Grove MS	798	0.16	95	-0.31
Manassas Park	Manassas Park MS	655	-0.30	96	0.55
Fauquier	Marshall MS	502	-0.79	96	0.55
Amherst	Monelison MS	630	-0.38	95	-0.31

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Rockingham	Montevideo MS	643	-0.34	96	0.55
Shenandoah	Muhlenberg MS	558	-0.61	96	0.55
Nelson	Nelson MS	442	-0.99	95	-0.31
New Kent	New Kent MS	666	-0.26	95	-0.31
Spotsylvania	Ni River MS	720	-0.09	95	-0.31
Shenandoah	North Fork MS	340	-1.32	96	0.55
Roanoke County	Northside MS	688	-0.19	97	1.41
Gloucester	Page MS	585	-0.52	96	0.55
Gloucester	Peasley MS	723	-0.08	95	-0.31
Rockingham	Pence MS	702	-0.15	97	1.41
Powhatan	Pocahontas MS	707	-0.13	95	-0.31
Spotsylvania	Post Oak MS	739	-0.03	94	-1.17
Wise	Powell Valley MS	506	-0.78	95	-0.31
Powhatan	Powhatan MS	698	-0.16	94	-1.17
Orange	Prospect Heights MS	529	-0.71	95	-0.31
York	Queen's Lake MS	473	-0.89	96	0.55
Campbell	Rustburg MS	617	-0.42	95	-0.31
Staunton	Shelburne MS	577	-0.55	96	0.55
Shenandoah	Signal Knob MS	494	-0.82	95	-0.31

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Isle of Wight	Smithfield MS	622	-0.41	96	0.55
Spotsylvania	Spotsylvania MS	818	0.23	95	-0.31
Stafford	Stafford MS	520	-0.73	96	0.55
Washington	Stanley MS	662	-0.28	95	-0.31
Bedford	Staunton River MS	809	0.20	96	0.55
Loudon	Sterling MS	859	0.36	96	0.55
Augusta	Stewart MS	604	-0.46	96	0.55
Augusta	Stuart's Draft MS	528	-0.71	95	-0.31
Fauquier	Taylor MS	393	-1.14	96	0.55
Spotsylvania	Thornburg MS	645	-0.33	95	-0.31
Williamsburg-JCC	Toano MS	678	-0.22	95	-0.31
Pittsylvania	Tunstall MS	699	-0.16	95	-0.31
Virginia Beach	Virginia Beach MS	751	0.01	95	-0.31
Washington	Wallace MS	436	-1.01	95	-0.31
Albemarle	Walton MS	402	-1.12	96	0.55
Warren	Warren County MS	863	0.37	94	-1.17
Newport News	Washington MS	434	-1.01	96	0.55
West Point	West Point MS	183	-1.82	96	0.55
Madison	Wetsel MS	402	-1.12	96	0.55
Greene	William Monroe MS	660	-0.28	99	3.14

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Augusta	Wilson MS	566	-0.59	96	0.55
Isle of Wight	Windsor MS	328	-1.35	96	0.55
Frederick	Wood MS	836	0.29	95	-0.31

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Appomattox	Appomattox MS	15.02	-0.39	48.70	0.37
Frederick	Aylor MS	9.26	-0.63	35.00	-0.29
Spotsylvania	Battlefield MS	18.25	-0.25	35.90	-0.24
Bedford	Bedford MS	27.37	0.14	46.70	0.28
Augusta	Beverley Manor MS	29.29	0.22	38.50	-0.12
Culpeper	Binns MS	21.56	-0.11	41.50	0.03
Montgomery	Blacksburg MS	18.52	-0.24	22.90	-0.87
Campbell	Brookville MS	12.13	-0.51	30.10	-0.52
Albemarle	Burley MS	7.63	-0.70	34.50	-0.31
Fauquier	Cedar Lee MS	27.59	0.15	33.20	-0.38
Botetourt	Central Academy MS	25.86	0.08	25.50	-0.75
Charlotte	Central MS	9.53	-0.62	54.50	0.65

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Spotsylvania	Chancellor MS	8.24	-0.67	31.20	-0.47
Pittsylvania	Chatham MS	5.27	-0.80	45.90	0.24
Alleghany	Clifton MS	11.80	-0.52	41.90	0.04
Waynesboro	Collins MS	30.74	0.28	60.00	0.92
Colonial Heights	Colonial Heights MS	18.10	-0.25	33.70	-0.35
Chesapeake	Crestwood MS	13.14	-0.46	47.60	0.32
Chesapeake	Deep Creek MS	15.96	-0.35	45.70	0.23
Dinwiddie	Dinwiddie MS	4.38	-0.84	52.90	0.58
Stafford	Dixon-Smith MS	10.91	-0.56	15.20	-1.24
Lexington	Downing MS	4.73	-0.82	17.30	-1.14
Stafford	Drew MS	17.63	-0.27	32.20	-0.42
Pulaski	Dublin MS	14.56	-0.40	45.00	0.19
Hampton	Eaton MS	13.76	-0.44	37.20	-0.18
Rockingham	Elkton MS	22.43	-0.07	32.60	-0.40
Suffolk	Forest Glen MS	14.68	-0.40	38.30	-0.13
Franklin County	Franklin East MS	10.94	-0.56	49.30	0.40
Franklin County	Franklin West MS	22.06	-0.09	46.40	0.26
Frederick	Frederick County MS	15.91	-0.35	28.70	-0.59
Spotsylvania	Freedom MS	6.62	-0.74	25.90	-0.73

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Scott	Gate City MS	12.71	-0.48	42.70	0.08
Roanoke County	Glenvar MS	7.49	-0.70	27.40	-0.65
Goochland	Goochland MS	2.74	-0.91	24.00	-0.82
Prince William	Graham Park MS	16.80	-0.31	45.50	0.22
Arlington	Gunston MS	2.65	-0.91	41.00	0.00
Alexandria	GW 1 MS	4.96	-0.81	51.90	0.53
Alexandria	GW 2 MS	3.37	-0.88	46.90	0.29
Alexandria	Hammond 1 MS	9.95	-0.60	59.30	0.88
Stafford	Heim MS	29.96	0.25	30.70	-0.50
Fairfax	Herndon MS	11.40	-0.54	30.20	-0.52
Rockingham	Hillyard MS	15.13	-0.38	41.30	0.02
Fairfax	Holmes MS	3.37	-0.88	53.30	0.60
King William	Holmes MS	13.65	-0.44	35.30	-0.27
Mathews	Hunter MS	8.85	-0.65	32.00	-0.43
Arlington	Jefferson MS	3.44	-0.88	66.30	1.22
Clarke	Johnson-Williams MS	2.29	-0.93	17.30	-1.14
Hampton	Jones Magnet MS	16.26	-0.33	45.70	0.23
Albemarle	Jouett MS	24.14	0.00	36.70	-0.21
Virginia Beach	Kempsville MS	13.04	-0.47	22.00	-0.92
Arlington	Kenmore MS	3.76	-0.86	54.60	0.66

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Fairfax	Key MS	5.22	-0.80	49.30	0.40
King George	King George MS	19.64	-0.19	24.80	-0.78
Salem	Lewis MS	1.54	-0.96	31.80	-0.44
Orange	Locust Grove MS	12.41	-0.50	31.00	-0.48
Manassas Park	Manassas Park MS	7.02	-0.72	51.30	0.50
Fauquier	Marshall MS	24.10	0.00	24.60	-0.79
Amherst	Monelison MS	23.02	-0.05	43.40	0.12
Rockingham	Montevideo MS	11.20	-0.55	36.80	-0.20
Shenandoah	Muhlenberg MS	13.44	-0.45	41.20	0.01
Nelson	Nelson MS	29.41	0.23	43.60	0.13
New Kent	New Kent MS	22.22	-0.08	20.20	-1.00
Spotsylvania	Ni River MS	18.47	-0.24	17.70	-1.12
Shenandoah	North Fork MS	33.24	0.39	45.90	0.24
Roanoke County	Northside MS	11.34	-0.54	28.20	-0.62
Gloucester	Page MS	17.26	-0.29	28.40	-0.61
Gloucester	Peasley MS	15.49	-0.37	31.70	-0.45
Rockingham	Pence MS	7.41	-0.71	36.30	-0.23
Powhatan	Pocahontas MS	11.32	-0.54	19.00	-1.06
Spotsylvania	Post Oak MS	20.16	-0.17	38.40	-0.12

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Wise	Powell Valley MS	15.61	-0.36	52.50	0.56
Powhatan	Powhatan MS	3.87	-0.86	14.60	-1.27
Orange	Prospect Heights MS	33.65	0.41	44.10	0.15
York	Queen's Lake MS	35.52	0.49	29.80	-0.54
Campbell	Rustburg MS	12.64	-0.49	43.90	0.14
Staunton	Shelburne MS	14.73	-0.40	50.30	0.45
Shenandoah	Signal Knob MS	26.72	0.11	36.80	-0.20
Isle of Wight	Smithfield MS	8.36	-0.67	31.60	-0.45
Spotsylvania	Spotsylvania MS	9.54	-0.62	25.90	-0.73
Stafford	Stafford MS	27.12	0.13	23.80	-0.83
Washington	Stanley MS	12.39	-0.50	34.10	-0.33
Bedford	Staunton River MS	25.59	0.06	46.50	0.27
Loudon	Sterling MS	11.41	-0.54	56.40	0.74
Augusta	Stewart MS	21.69	-0.10	36.80	-0.20
Augusta	Stuart's Draft MS	12.31	-0.50	32.50	-0.41
Fauquier	Taylor MS	13.23	-0.46	22.40	-0.90
Spotsylvania	Thornburg MS	27.75	0.16	26.90	-0.68
Williamsburg-JCC	Toano MS	19.62	-0.19	22.60	-0.89
Pittsylvania	Tunstall MS	18.03	-0.26	38.80	-0.10
Virginia Beach	Virginia Beach MS	21.84	-0.10	41.50	0.03

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Washington	Wallace MS	26.38	0.10	45.30	0.21
Albemarle	Walton MS	25.62	0.07	31.70	-0.45
Warren	Warren County MS	22.02	-0.09	35.90	-0.24
Newport News	Washington MS	15.67	-0.36	27.00	-0.67
West Point	West Point MS	9.84	-0.61	21.00	-0.96
Madison	Wetsel MS	25.62	0.07	34.10	-0.33
Greene	William Monroe MS	28.94	0.21	30.10	-0.52
Augusta	Wilson MS	10.07	-0.60	29.00	-0.58
Isle of Wight	Windsor MS	28.66	0.19	31.60	-0.45
Frederick	Wood MS	24.16	0.00	34.00	-0.34

Appendix G

VASOL Test Results

Cluster 4

2010-2011

Division	School Name	Eng	Math	Hist	Sci
Fauquier	Auburn MS	93	89	89	92
Chesterfield	Bailey Bridge MS	93	86	90	96
Loudon	Belmont Ridge MS	98	94	96	99
Prince William	Belville MS	87	76	71	91
Prince William	Benton MS	96	93	94	98
Loudon	Blue Ridge MS	98	91	93	99
Virginia Beach	Brandon MS	90	73	82	94
Prince William	Bull Run MS	97	90	93	98
Frederick	Byrd MS	90	84	87	93
Henrico	Byrd MS	90	81	85	96
Roanoke County	Byrd MS	92	89	91	94
Caroline	Caroline MS	81	72	87	89
Fairfax	Carson MS	98	96	97	98
Chesterfield	Carver MS	87	80	78	88
Roanoke County	Cave Spring MS	96	94	94	98
Hanover	Chickahominy MS	95	92	95	98
Prince George	Clements MS	89	93	85	95
Fairfax	Cooper MS	99	98	97	100
Virginia Beach	Corporate Landing MS	93	79	84	98
Culpeper	Culpeper MS	88	82	80	92

Division	School Name	Eng	Math	Hist	Sci
Chesterfield	Davis MS	91	88	88	96
Newport News	Dozier MS	85	78	83	87
Loudon	Eagle Ridge MS	96	88	93	98
Loudon	Farmwell Station MS	95	89	94	98
Henry	Fieldale-Collinsville MS	91	92	86	95
Fluvanna	Fluvanna MS	88	80	85	94
Bedford	Forest MS	94	91	90	97
Fairfax	Franklin MS	98	97	97	99
Fairfax	Frost MS	99	99	98	99
Prince William	Gainesville MS	96	89	92	98
Stafford	Gayle MS	88	86	88	93
Newport News	Gildersleeve MS	90	86	83	94
Fairfax	Glasgow MS	93	77	82	92
Prince William	Godwin MS	87	79	74	87
York	Grafton MS	95	92	89	96
Chesapeake	Great Bridge MS	95	92	94	97
Virginia Beach	Great Neck MS	94	93	93	97
Chesapeake	Greenbrier MS	94	88	92	94
Loudon	Harmony MS	95	86	91	98
Loudon	Harper Park MS	94	84	92	96

Division	School Name	Eng	Math	Hist	Sci
Falls Church	Henderson MS	97	90	94	93
Albemarle	Henley MS	97	96	92	96
Chesapeake	Hickory MS	96	91	94	99
Roanoke County	Hidden Valley MS	96	92	93	97
Henrico	Holman MS	96	90	97	99
Williamsburg-JCC	Hornsby MS	94	90	93	94
Fairfax	Hughes MS	94	93	90	93
Chesapeake	Hugo Owens MS	91	84	89	95
Henrico	Hungary Creek MS	89	73	84	96
Virginia Beach	Independence MS	92	79	90	95
Fairfax	Irving MS	96	95	96	97
Fairfax	Jackson MS	96	96	88	97
Hanover	Jackson MS	90	83	90	93
Chesapeake	Jolliff MS	92	86	88	94
Virginia Beach	Kemps Landing MS	100	99	100	100
Fairfax	Kilmer MS	98	97	99	99
Suffolk	King's Fork MS	84	79	78	93
Prince William	Lake Ridge MS	95	86	80	95
Virginia Beach	Landstown MS	94	87	91	97
Fairfax	Lanier MS	94	94	94	95

Division	School Name	Eng	Math	Hist	Sci
Virginia Beach	Larkspur MS	89	73	86	93
Fairfax	Liberty MS	96	97	93	96
Hanover	Liberty MS	91	85	87	95
Fairfax	Longfellow MS	98	98	97	98
Louisa	Louisa County MS	84	76	83	97
Prince William	Lynn MS	85	70	76	88
Virginia Beach	Lynnhaven MS	93	79	87	98
Chesterfield	Manchester MS	92	88	85	93
Prince William	Marstellar MS	93	84	89	94
Chesterfield	Matoaca MS	92	90	79	92
Loudon	Mercer MS	95	85	92	97
Manassas	Metz MS	84	82	72	83
Chesterfield	Midlothian MS	97	95	94	98
Henrico	Moody MS	92	82	90	95
Prince George	Moore MS	89	79	85	X
Winchester	Morgan MS	86	85	77	84
Hanover	Oak Knoll MS	95	93	94	97
Prince William	Parkside MS	88	79	76	96
Newport News	Passage MS	81	74	80	88
Virginia Beach	Plaza MS	91	74	86	96
Henrico	Pocahontas MS	97	91	95	98

Division	School Name	Eng	Math	Hist	Sci
Fairfax	Poe MS	93	90	87	94
Stafford	Poole MS	92	89	80	97
Poquoson	Poquoson MS	97	90	91	99
Prince William	Potomac MS	91	81	85	94
Virginia Beach	Princess Anne MS	95	86	89	99
Botetourt	Read Mountain MS	92	87	88	95
Prince William	Rippon MS	87	71	71	90
Loudon	River Bend MS	95	87	95	97
Chesterfield	Robious MS	96	95	91	94
Fairfax	Rocky Run MS	99	99	98	99
Virginia Beach	Salem MS	93	81	92	98
Fairfax	Sandburg MS	93	86	87	92
Prince William	Saunders MS	89	74	85	98
Loudon	Seneca Ridge MS	92	81	85	92
Henrico	Short Pump MS	99	95	96	100
Loudon	Simpson MS	93	85	91	96
Loudon	Smart's Mill MS	93	85	93	98
Loudon	Stone Hill MS	95	89	92	97
Fairfax	Stone MS	96	92	91	97
Prince William	Stonewall MS	87	80	80	88
Albemarle	Sutherland MS	96	95	92	95

Division	School Name	Eng	Math	Hist	Sci
Arlington	Swanson MS	97	93	95	98
Chesterfield	Swift Creek MS	94	91	90	96
York	Tabb MS	96	94	90	95
Stafford	Thompson MS	94	94	90	98
Fairfax	Thoreau MS	100	100	99	100
Chesterfield	Tomahawk Creek MS	98	94	95	98
Henrico	Tuckahoe MS	94	81	92	98
Fairfax	Twain MS	94	91	90	92
Fauquier	Warrenton MS	92	81	83	91
Chesapeake	Western Branch MS	90	80	86	94
Fairfax	Whitman MS	84	77	82	84
Arlington	Williamsburg MS	97	90	95	98
Prince William	Woodbridge MS	92	85	78	95
Stafford	Wright MS	94	92	87	95
Suffolk	Yeates MS	91	90	87	96
York	Yorktown MS	93	89	86	96

Appendix H

Climate Index Data

Cluster 4

2010-2011

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Fauquier	Auburn MS	607	-0.45	96	0.55
Chesterfield	Bailey Bridge MS	1426	2.19	96	0.55
Loudon	Belmont Ridge MS	1299	1.78	97	1.41
Prince William	Belville MS	1156	1.32	95	-0.31
Prince William	Benton MS	1295	1.77	96	0.55
Loudon	Blue Ridge MS	864	0.38	96	0.55
Virginia Beach	Brandon MS	1251	1.63	96	0.55
Prince William	Bull Run MS	1642	2.89	96	0.55
Frederick	Byrd MS	864	0.38	96	0.55
Henrico	Byrd MS	991	0.79	96	0.55
Roanoke County	Byrd MS	888	0.45	96	0.55
Caroline	Caroline MS	915	0.54	97	1.41
Fairfax	Carson MS	1290	1.75	97	1.41
Chesterfield	Carver MS	1122	1.21	96	0.55
Roanoke County	Cave Spring MS	633	-0.37	97	1.41
Hanover	Chickahominy MS	1243	1.60	98	2.28
Prince George	Clements MS	981	0.75	96	0.55
Fairfax	Cooper MS	842	0.31	95	-0.31
Virginia Beach	Corporate Landing MS	1353	1.96	95	-0.31
Culpeper	Culpeper MS	1012	0.85	96	0.55

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Chesterfield	Davis MS	1165	1.35	96	0.55
Newport News	Dozier MS	1123	1.21	95	-0.31
Loudon	Eagle Ridge MS	1057	1.00	97	1.41
Loudon	Farmwell Station MS	1195	1.45	97	1.41
Henry	Fieldale-Collinsville MS	891	0.46	95	-0.31
Fluvanna	Fluvanna MS	868	0.39	96	0.55
Bedford	Forest MS	1011	0.85	97	1.41
Fairfax	Franklin MS	897	0.48	96	0.55
Fairfax	Frost MS	1045	0.96	97	1.41
Prince William	Gainesville MS	1366	2.00	96	0.55
Stafford	Gayle MS	875	0.41	96	0.55
Newport News	Gildersleeve MS	1040	0.95	95	-0.31
Fairfax	Glasgow MS	1227	1.55	96	0.55
Prince William	Godwin MS	960	0.69	95	-0.31
York	Grafton MS	879	0.42	96	0.55
Chesapeake	Great Bridge MS	1171	1.37	96	0.55
Virginia Beach	Great Neck MS	1118	1.20	94	-1.17
Chesapeake	Greenbrier MS	906	0.51	97	1.41
Loudon	Harmony MS	1068	1.04	96	0.55

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Loudon	Harper Park MS	959	0.68	97	1.41
Falls Church	Henderson MS	472	-0.89	97	1.41
Albemarle	Henley MS	791	0.14	96	0.55
Chesapeake	Hickory MS	1713	3.12	97	1.41
Roanoke County	Hidden Valley MS	761	0.04	97	1.41
Henrico	Holman MS	740	-0.02	98	2.28
Williamsburg-JCC	Hornsby MS	890	0.46	96	0.55
Fairfax	Hughes MS	914	0.54	96	0.55
Chesapeake	Hugo Owens MS	1082	1.08	96	0.55
Henrico	Hungary Creek MS	908	0.52	97	1.41
Virginia Beach	Independence MS	1254	1.64	94	-1.17
Fairfax	Irving MS	1095	1.12	97	1.41
Fairfax	Jackson MS	1152	1.31	97	1.41
Hanover	Jackson MS	1146	1.29	97	1.41
Chesapeake	Jolliff MS	716	-0.10	96	0.55
Virginia Beach	Kemps Landing MS	596	-0.49	98	2.28
Fairfax	Kilmer MS	1040	0.95	97	1.41
Suffolk	King's Fork MS	1068	1.04	97	1.41
Prince William	Lake Ridge MS	1250	1.62	96	0.55
Virginia Beach	Landstown MS	1498	2.42	96	0.55

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Fairfax	Lanier MS	1250	1.62	97	1.41
Virginia Beach	Larkspur MS	1554	2.61	96	0.55
Fairfax	Liberty MS	1144	1.28	96	0.55
Hanover	Liberty MS	1093	1.12	97	1.41
Fairfax	Longfellow MS	1270	1.69	96	0.55
Louisa	Louisa County MS	1048	0.97	95	-0.31
Prince William	Lynn MS	917	0.55	95	-0.31
Virginia Beach	Lynnhaven MS	1229	1.56	96	0.55
Chesterfield	Manchester MS	1426	2.19	97	1.41
Prince William	Marstellar MS	1526	2.51	96	0.55
Chesterfield	Matoaca MS	1107	1.16	96	0.55
Loudon	Mercer MS	1326	1.87	97	1.41
Manassas	Metz MS	1023	0.89	95	-0.31
Chesterfield	Midlothian MS	1180	1.40	97	1.41
Henrico	Moody MS	1035	0.93	97	1.41
Prince George	Moore MS	1017	0.87	96	0.55
Winchester	Morgan MS	1089	1.10	95	-0.31
Hanover	Oak Knoll MS	847	0.32	97	1.41
Prince William	Parkside MS	1089	1.10	95	-0.31
Newport News	Passage MS	1027	0.90	95	-0.31

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Virginia Beach	Plaza MS	1097	1.13	97	1.41
Henrico	Pocahontas MS	893	0.47	97	1.41
Fairfax	Poe MS	1179	1.39	97	1.41
Stafford	Poole MS	891	0.46	96	0.55
Poquoson	Poquoson MS	588	-0.51	96	0.55
Prince William	Potomac MS	1100	1.14	96	0.55
Virginia Beach	Princess Anne MS	1390	2.08	96	0.55
Botetourt	Read Mountain MS	715	-0.10	96	0.55
Prince William	Rippon MS	953	0.66	95	-0.31
Loudon	River Bend MS	1146	1.29	96	0.55
Chesterfield	Robious MS	1324	1.86	96	0.55
Fairfax	Rocky Run MS	969	0.72	97	1.41
Virginia Beach	Salem MS	1057	1.00	96	0.55
Fairfax	Sandburg MS	1213	1.50	95	-0.31
Prince William	Saunders MS	1102	1.15	96	0.55
Loudon	Seneca Ridge MS	978	0.74	97	1.41
Henrico	Short Pump MS	778	0.10	98	2.28
Loudon	Simpson MS	985	0.77	96	0.55
Loudon	Smart's Mill MS	955	0.67	96	0.55
Loudon	Stone Hill MS	1251	1.63	97	1.41

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Fairfax	Stone MS	906	0.51	96	0.55
Prince William	Stonewall MS	1116	1.19	96	0.55
Albemarle	Sutherland MS	605	-0.46	97	1.41
Arlington	Swanson MS	954	0.67	96	0.55
Chesterfield	Swift Creek MS	974	0.73	96	0.55
York	Tabb MS	785	0.12	97	1.41
Stafford	Thompson MS	1154	1.31	96	0.55
Fairfax	Thoreau MS	778	0.10	96	0.55
Chesterfield	Tomahawk Creek MS	1155	1.32	97	1.41
Henrico	Tuckahoe MS	1020	0.88	96	0.55
Fairfax	Twain MS	815	0.22	96	0.55
Fauquier	Warrenton MS	791	0.14	96	0.55
Chesapeake	Western Branch MS	892	0.47	96	0.55
Fairfax	Whitman MS	991	0.79	95	-0.31
Arlington	Williamsburg MS	1013	0.86	97	1.41
Prince William	Woodbridge MS	1038	0.94	96	0.55
Stafford	Wright MS	773	0.08	96	0.55
Suffolk	Yeates MS	1132	1.24	98	2.28
York	Yorktown MS	747	0.00	96	0.55

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Fauquier	Auburn MS	5.93	-0.77	9.40	-1.52
Chesterfield	Bailey Bridge MS	18.93	-0.22	20.10	-1.01
Loudon	Belmont Ridge MS	2.08	-0.94	6.60	-1.66
Prince William	Belville MS	15.57	-0.36	52.50	0.56
Prince William	Benton MS	5.41	-0.79	10.60	-1.47
Loudon	Blue Ridge MS	1.39	-0.96	9.50	-1.52
Virginia Beach	Brandon MS	32.93	0.38	31.80	-0.44
Prince William	Bull Run MS	6.15	-0.76	13.50	-1.33
Frederick	Byrd MS	6.37	-0.75	22.80	-0.88
Henrico	Byrd MS	10.80	-0.56	35.70	-0.25
Roanoke County	Byrd MS	7.77	-0.69	26.90	-0.68
Caroline	Caroline MS	25.79	0.07	48.80	0.38
Fairfax	Carson MS	6.12	-0.76	8.30	-1.58
Chesterfield	Carver MS	40.02	0.68	33.10	-0.38
Roanoke County	Cave Spring MS	3.95	-0.86	15.60	-1.22
Hanover	Chickahominy MS	2.90	-0.90	8.00	-1.59
Prince George	Clements MS	33.64	0.41	32.50	-0.41
Fairfax	Cooper MS	2.97	-0.90	1.60	-1.90
Virginia Beach	Corporate Landing MS	23.13	-0.04	31.40	-0.46
Culpeper	Culpeper MS	27.47	0.14	33.90	-0.34

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Chesterfield	Davis MS	18.37	-0.24	22.60	-0.89
Newport News	Dozier MS	38.38	0.61	52.40	0.55
Loudon	Eagle Ridge MS	2.18	-0.93	4.40	-1.76
Loudon	Farmwell Station MS	3.10	-0.89	17.20	-1.15
Henry	Fieldale-Collinsville MS	27.38	0.14	60.30	0.93
Fluvanna	Fluvanna MS	14.52	-0.41	24.70	-0.79
Bedford	Forest MS	12.66	-0.49	14.80	-1.26
Fairfax	Franklin MS	5.35	-0.80	14.60	-1.27
Fairfax	Frost MS	3.16	-0.89	7.50	-1.62
Prince William	Gainesville MS	7.98	-0.68	12.20	-1.39
Stafford	Gayle MS	34.17	0.43	24.10	-0.81
Newport News	Gildersleeve MS	21.44	-0.11	34.20	-0.33
Fairfax	Glasgow MS	5.70	-0.78	58.60	0.85
Prince William	Godwin MS	11.04	-0.55	64.00	1.11
York	Grafton MS	12.51	-0.49	14.30	-1.29
Chesapeake	Great Bridge MS	10.93	-0.56	10.70	-1.46
Virginia Beach	Great Neck MS	11.36	-0.54	24.20	-0.81
Chesapeake	Greenbrier MS	6.73	-0.74	21.40	-0.94
Loudon	Harmony MS	5.90	-0.77	8.80	-1.55

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Loudon	Harper Park MS	2.29	-0.93	16.60	-1.18
Falls Church	Henderson MS	3.39	-0.88	6.10	-1.68
Albemarle	Henley MS	10.37	-0.58	12.20	-1.39
Chesapeake	Hickory MS	8.46	-0.66	7.70	-1.61
Roanoke County	Hidden Valley MS	6.96	-0.73	17.60	-1.13
Henrico	Holman MS	4.86	-0.82	8.50	-1.57
Williamsburg-JCC	Hornsby MS	10.22	-0.59	17.40	-1.14
Fairfax	Hughes MS	16.74	-0.31	33.80	-0.35
Chesapeake	Hugo Owens MS	18.48	-0.24	31.00	-0.48
Henrico	Hungary Creek MS	15.53	-0.36	23.70	-0.83
Virginia Beach	Independence MS	18.90	-0.22	32.20	-0.42
Fairfax	Irving MS	7.58	-0.70	13.20	-1.34
Fairfax	Jackson MS	9.38	-0.62	38.40	-0.12
Hanover	Jackson MS	7.07	-0.72	16.50	-1.18
Chesapeake	Jolliff MS	29.47	0.23	28.40	-0.61
Virginia Beach	Kemps Landing MS	1.01	-0.98	5.70	-1.70
Fairfax	Kilmer MS	1.25	-0.97	10.70	-1.46
Suffolk	King's Fork MS	29.40	0.23	49.60	0.42
Prince William	Lake Ridge MS	8.32	-0.67	27.60	-0.65
Virginia Beach	Landstown MS	13.75	-0.44	26.70	-0.69

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Fairfax	Lanier MS	9.28	-0.63	25.90	-0.73
Virginia Beach	Larkspur MS	20.40	-0.16	42.00	0.05
Fairfax	Liberty MS	9.79	-0.61	21.30	-0.95
Hanover	Liberty MS	9.70	-0.61	22.40	-0.90
Fairfax	Longfellow MS	3.54	-0.87	6.70	-1.65
Louisa	Louisa County MS	23.85	-0.01	45.90	0.24
Prince William	Lynn MS	12.54	-0.49	71.00	1.45
Virginia Beach	Lynnhaven MS	12.04	-0.51	25.60	-0.74
Chesterfield	Manchester MS	24.47	0.02	30.20	-0.52
Prince William	Marstellar MS	4.72	-0.82	19.30	-1.05
Chesterfield	Matoaca MS	21.86	-0.09	22.40	-0.90
Loudon	Mercer MS	6.94	-0.73	10.80	-1.46
Manassas	Metz MS	26.49	0.10	45.20	0.20
Chesterfield	Midlothian MS	4.49	-0.83	7.50	-1.62
Henrico	Moody MS	27.83	0.16	28.50	-0.60
Prince George	Moore MS	24.19	0.00	37.60	-0.16
Winchester	Morgan MS	5.69	-0.78	54.10	0.63
Hanover	Oak Knoll MS	6.61	-0.74	9.10	-1.54
Prince William	Parkside MS	9.27	-0.63	40.50	-0.02
Newport News	Passage MS	31.35	0.31	58.20	0.83

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Virginia Beach	Plaza MS	24.52	0.02	35.90	-0.24
Henrico	Pocahontas MS	8.17	-0.68	11.00	-1.45
Fairfax	Poe MS	19.59	-0.19	52.70	0.57
Stafford	Poole MS	19.64	-0.19	22.20	-0.91
Poquoson	Poquoson MS	7.65	-0.70	11.70	-1.41
Prince William	Potomac MS	10.00	-0.60	45.40	0.21
Virginia Beach	Princess Anne MS	8.20	-0.67	10.10	-1.49
Botetourt	Read Mountain MS	7.69	-0.70	15.90	-1.21
Prince William	Rippon MS	21.83	-0.10	52.70	0.57
Loudon	River Bend MS	7.50	-0.70	19.10	-1.06
Chesterfield	Robious MS	21.30	-0.12	15.20	-1.24
Fairfax	Rocky Run MS	2.58	-0.91	12.50	-1.37
Virginia Beach	Salem MS	7.19	-0.72	30.10	-0.52
Fairfax	Sandburg MS	16.82	-0.31	40.70	-0.01
Prince William	Saunders MS	5.81	-0.78	25.00	-0.77
Loudon	Seneca Ridge MS	6.65	-0.74	23.70	-0.83
Henrico	Short Pump MS	3.21	-0.89	3.90	-1.79
Loudon	Simpson MS	6.29	-0.76	18.80	-1.07
Loudon	Smart's Mill MS	9.11	-0.64	19.10	-1.06
Loudon	Stone Hill MS	5.04	-0.81	8.00	-1.59

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Fairfax	Stone MS	6.62	-0.74	19.40	-1.04
Prince William	Stonewall MS	13.17	-0.46	52.80	0.57
Albemarle	Sutherland MS	6.12	-0.76	13.00	-1.35
Arlington	Swanson MS	3.14	-0.89	15.30	-1.24
Chesterfield	Swift Creek MS	5.75	-0.78	15.60	-1.22
York	Tabb MS	11.59	-0.53	16.40	-1.19
Stafford	Thompson MS	13.17	-0.46	12.00	-1.40
Fairfax	Thoreau MS	3.86	-0.86	8.30	-1.58
Chesterfield	Tomahawk Creek MS	11.00	-0.56	7.90	-1.60
Henrico	Tuckahoe MS	18.53	-0.24	27.40	-0.65
Fairfax	Twain MS	10.80	-0.56	30.80	-0.49
Fauquier	Warrenton MS	2.91	-0.90	14.90	-1.26
Chesapeake	Western Branch MS	17.38	-0.28	26.30	-0.71
Fairfax	Whitman MS	16.55	-0.32	51.80	0.52
Arlington	Williamsburg MS	1.58	-0.96	13.00	-1.35
Prince William	Woodbridge MS	8.00	-0.68	46.50	0.27
Stafford	Wright MS	11.00	-0.56	19.40	-1.04
Suffolk	Yeates MS	10.25	-0.59	27.10	-0.67
York	Yorktown MS	12.58	-0.49	24.00	-0.82

Appendix I

VASOL Test Results

Cluster 5

2010-2011

Division	School Name	Eng	Math	Hist	Sci
Roanoke City	Addison MS	84	83	71	89
Danville	Bonner MS	90	82	83	91
Richmond City	Boushall MS	80	77	68	80
Danville	Gibson MS	81	83	78	85
Richmond City	Henderson MS	77	73	74	80
Richmond City	King Jr MS	71	71	70	74
Norfolk	Lafayette-Winona MS	74	72	60	79

Appendix J

Climate Index Data

Cluster 5

2010-2011

Division	School name	School size	*Z*-score (SS)	Att rate	*Z*-score (AR)
Roanoke City	Addison MS	511	-0.76	94	-1.17
Danville	Bonner MS	553	-0.63	94	-1.17
Richmond City	Boushall MS	429	-1.03	93	-2.03
Danville	Gibson MS	395	-1.14	94	-1.17
Richmond City	Henderson MS	604	-0.46	94	-1.17
Richmond City	King Jr MS	731	-0.05	92	-2.90
Norfolk	Lafayette-Winona MS	661	-0.28	93	-2.03

Division	School name	Disc/100	*Z*-score (D)	SES/ 100	*Z*-score (SES)
Roanoke City	Addison MS	102.74	3.34	82.60	2.01
Danville	Bonner MS	125.14	4.29	66.10	1.21
Richmond City	Boushall MS	105.13	3.44	87.10	2.23
Danville	Gibson MS	102.53	3.33	83.10	2.03
Richmond City	Henderson MS	134.77	4.70	88.40	2.29
Richmond City	King Jr MS	177.56	6.52	90.60	2.40
Norfolk	Lafayette-Winona MS	108.17	3.57	81.80	1.97