

2010

The Effect of Class Size on Student Achievement in a Rural State

Michael Kornfeld
University of Vermont

Follow this and additional works at: <https://scholarworks.uvm.edu/graddis>

Recommended Citation

Kornfeld, Michael, "The Effect of Class Size on Student Achievement in a Rural State" (2010). *Graduate College Dissertations and Theses*. 128.

<https://scholarworks.uvm.edu/graddis/128>

This Dissertation is brought to you for free and open access by the Dissertations and Theses at ScholarWorks @ UVM. It has been accepted for inclusion in Graduate College Dissertations and Theses by an authorized administrator of ScholarWorks @ UVM. For more information, please contact donna.omalley@uvm.edu.

THE EFFECTS OF CLASS SIZE ON
STUDENT ACADEMIC ACHIEVEMENT IN A RURAL STATE

A Dissertation Presented

by

Michael Kornfeld

to

The Faculty of the Graduate College

of

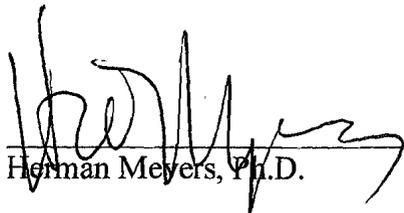
The University of Vermont

In Partial Fulfillment of the Requirements
for the Degree of Doctor of Education
Specializing in Educational Leadership and Policy Studies

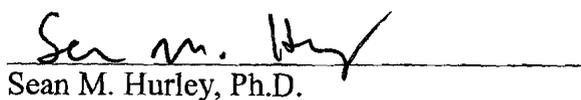
February, 2010

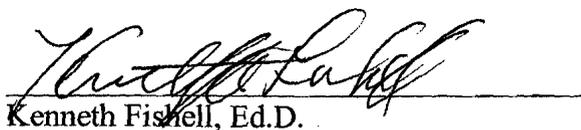
Accepted by the Faculty of the Graduate College, The University of Vermont, in partial fulfillment of the requirements for the degree of Doctor of Education specializing in Educational Leadership and Policy Studies.

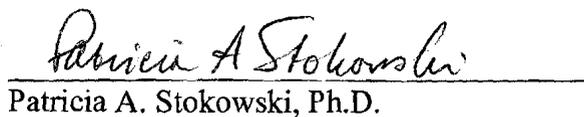
Dissertation Examination Committee:


Herman Meyers, Ph.D.

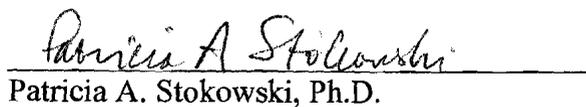
Advisor


Sean M. Hurley, Ph.D.


Kenneth Fishell, Ed.D.


Patricia A. Stokowski, Ph.D.

Chairperson


Patricia A. Stokowski, Ph.D.

Associate Dean,
Graduate College

Date: November 30, 2009

ABSTRACT

The thesis addresses the relationship of class size to student performance in a rural state. It presents findings from a longitudinal study of a cohort of students who were tested with state assessments at grade 4 in 2000, again at grade 8 in 2004 and, finally at grade 10 in 2006. Graduation rates for five large-class sized schools and five small-class sized school populations were established in 2008. All scores (n=1137) were matched across time enabling students from similar socioeconomic backgrounds from schools that were considered small (average class size, n=11) to schools that were large (average, n= 20). The paper's focus is on the extent that students from schools that maintained large and small classes differed in selected opportunities to learn and educational outcomes. The approach to the study utilized both large scale state databases for student backgrounds and outcomes and interviews with school personnel in order to identify school policy and practices that might be linked to performance differences.

The primary goal of this research study was to determine if small classes resulted in improved student achievement compared to those students in larger classes. Although Vermont does not have the large class sizes of the quasi-experimental studies and policy initiatives cited in the literature, it does have a wide range of average class sizes. The targeted high school math and English classes of this study ranged from an average of 11 students in the average small class to 20 in the average large class. If class size were a critical influence on students' academic achievement, one would expect to see significant differences between students who were educated in classes nearly twice as large as other classes. This study concludes that there was no such difference. In terms of academic achievement, with the exception of 10th grade math scores, students in larger classes performed the same or better than students in smaller classes. Students in larger classes had slightly higher graduation rates, and a larger proportion planned to attend two or four year colleges.

DEDICATION

This dissertation is dedicated to my grandparents, Edith Raab, Adolph Raab, Ann Kornfeld and Jack Kornfeld. They each embodied integrity, hard work, and the value and joy of learning. They remain sources of inspiration and gratitude.

I would also like to dedicate this to my children, Hannah and Jacob. May you embody the qualities of your great grandparents and help make the world a better place.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my advisor, Herman "Bud" Meyers. His supervision and guidance throughout the conception, data collection, analysis, and writing phases were always insightful, thorough and extremely helpful. My heartfelt thanks to my committee members, Sean Hurley and Ken Fishell for their helpful contributions and time on this project.

I would also like to thank my family for their encouragement throughout this journey. To my parents, Judith and Marvin Kornfeld, for raising me to appreciate and value education and commitment. To my mother in-law, Margaret McCann, the consummate life-long learner who always expressed interest and enthusiasm in my research. To my sister in-law, Joanne Thomas and my brother, Steven Kornfeld for their gusto and humor. And of course, to my wonderful wife, Jeannie, for her love and support in all of my endeavors.

TABLE OF CONTENTS

DEDICATION	ii
ACKNOWLEDGEMENTS	iii
LIST OF TABLES	vi
CHAPTER 1: INTRODUCTION	1
Background of the Study	1
Relevance	2
Purpose of the Study	3
Research Questions	8
Significance of the Study	9
Definition of Terms.....	11
Limitations of the Study.....	13
Limitation of Qualitative Data	16
Organization of the Study	17
CHAPTER 2: LITERATURE REVIEW	18
Historical Approaches to Class Size	18
Small Classes for Students in Early Grades.....	19
Small Classes for Impoverished and/or Minority Students	20
STAR	20
SAGE	22
California CSR.....	23
The Impact of Student and Teacher Behavior	24
Defining a Small Class.....	27
The Role of Economic Theory.....	28
Other Benefits of Small Classes	30
Summary of the Literature	31
CHAPTER 3: METHODOLOGY	34
Mixed Methods	34
Research Questions.....	35
The Target Population.....	39
Selection of Students.....	40
Data Sources and Data Collection	41
Quantitative Procedures	42
Qualitative Procedures	42

CHAPTER 4: RESULTS	44
Quantitative Results	44
RQ 1a	45
RQ 1b	46
RQ 2a	47
RQ 2b	49
RQ 2c	50
Qualitative Results	53
Teacher Experience.....	57
The Teacher-Student Relationship.....	60
Teacher Skill, Practice and Knowledge	60
Other Factors.....	61
School Organization.....	61
Promoting Strong Teacher-Student Relationships	62
Advisory Programs	62
Other Practices	62
Teacher Collaboration.....	64
Other Educational Outcomes	66
Other “High School on the Move” Goals	67
Course Offerings	68
Summary of the Findings.....	69
CHAPTER 5: DISCUSSION.....	70
Research Questions and Related Topics	70
Summary of Findings in this Study	71
Conclusions.....	72
Popular Support for Small Classes; the World is a Different Place	72
Limitations of the Research	74
Implications.....	74
Potential Effects	74
Consequences of Maintaining the Status Quo	75
The Elephant in the Room: Funding.....	75
Recommendations for Further Research.....	77
Attracting and Retaining Quality Teachers.....	77
Special Education: Inclusion/Mainstreaming	77
Teacher Quality and Teacher-Student Relationships.....	78
School Size.....	78
Limitations of Small Schools.....	79
REFERENCES	80
APPENDIXES	87

LIST OF TABLES

Table 1: Orange Windsor Supervisory Union Enrollment, 1996-20023
Table 2: Free and Reduced Lunch Rate, 20066
Table 3: Post-Secondary Plans45
Table 4: Cohort Graduation Rate, 200847
Table 5: Descriptives, 10th Grade Math NSREs48
Table 6: 10th Grade NSRE Math Scores48
Table 7: Descriptives, English/Language Arts.....49
Table 8: Opportunities to Learn52
Table 9: Average Teacher-Student Ratio55
Table 10: Teacher Experience.....58
Table 11: Per Pupil Spending FY 2008.....76

CHAPTER 1: INTRODUCTION

Background of the Study

By the end of 2008, the total Vermont school population decreased by 1,542 students or 1.64 percent from the previous year, making it the 13th consecutive year of declining student enrollment in Vermont (Kumka, 2009). Since 1997, Vermont has had a 13 percent decline in student enrollment (Kumka). This is in stark contrast to the national trend. According to the National Center of Education Statistics (2009), the United States' public school enrollment in pre-kindergarten through 8th grade rose from 29.9 million in the fall of 1990 to 34.2 million in 2003, and is expected to be 34.9 million for fall of 2008. Public secondary school enrollment in the upper grades rose from 11.3 million in 1990, to 15.1 million in 2006, with a projected enrollment of 14.9 million for 2008.

Current Vermont Commissioner of Education Vilaseca asserted that Vermont's pattern of declining enrollment has resulted in political and economic concerns about the viability of small classes and small schools (Hirschfeld, 2009). Data from the Vermont Department of Education show that decreasing enrollment in many Vermont schools has led to even smaller class sizes and thus higher per-pupil spending since many Vermont public school students are educated in small classes housed in small schools (FY 2008 per pupil spending by school type, 2009). During the 2007-2008 school year, Vermont's 94,116 students were taught by 8,728 classroom teachers (full-time equivalents) resulting in a student-teacher ratio of 11.2 pupils per teacher (Vermont teacher/staff full-time equivalent and salary report 2007-2008 School Year). Are Vermonters willing to continue to pay for small classes? Are students educated in small classes more likely to

graduate, enroll in post secondary education, and perform better on tests measuring academic achievement than students in large classes?

Relevance

From 2003-2008, I served as principal of the Tunbridge Central School, a kindergarten-8th grade school in Tunbridge, Vermont and part of the Orange Windsor Supervisory Union. Each year, similar to the state of Vermont, Tunbridge's enrollment decreased resulting in an austere budget and new ways to configure classes. As Table 1 indicates, the other four schools in the Orange Windsor Supervisory Union, Chelsea (k-12), Sharon (k-6), South Royalton (k-12) and Strafford (k-8) had seen similar, and sometimes more pronounced decreases in enrollment over the past 12 years.

Some researchers have asserted that small classes have benefited younger students (Biddle & Berliner, 2002; Mosteller, 1995), and impoverished and minority students (Biddle & Berliner; Nye, Hedges, & Konstantopoulos, 2004). In 2007, the Tunbridge Central School had three classes of 10 or fewer students. I wondered as I worked each year to draft a frugal budget and contemplated reassigning and reducing staff: If we *could* have such small classes, were there substantial educational benefits? If we *could* afford to have classes of 10 or fewer pupils, would there be benefits not realized in classes of 18 or 22?

Table 1: Orange Windsor Supervisory Union enrollment, 1996-2008

	<u>1996</u>	<u>2000</u>	<u>2002</u>	<u>2004</u>	<u>2006</u>	<u>2008</u>	<u>% change 1996-2008</u>
Chelsea	324	301	257	236	204	174	-46%
Newton	170	152	144	109	110	109	-36%
Sharon	143	138	125	130	125	85	-41%
South Royalton	576	502	504	505	443	426	-26%
Tunbridge	146	151	139	132	126	105	-28%

Source: Vermont Department of Education, School Data and Reports: Vermont Public School Enrollment 5 year comparison charts, 2009.

Purpose of the Study

One test of truth is consistency in findings among the scientists who conduct and analyze the studies. A second test is how well the findings hold up to peer review and scientific critique (Achilles, 2003). As the literature reveals, studies and claims have supported the belief that class size significantly impacts student achievement, and other research asserted that the impact of class size on student achievement was minimal or nonexistent. These disagreements are what have made it so problematic to determine the truth about the class size effect. As Lazear wrote (2001), to claim that class size makes no difference is unfounded. Otherwise, why is a kindergarten cohort of 120 pupils divided into four, six or eight classrooms rather than one classroom of 120 if class size does not matter? (Lazear, p. 778). Further, class size varies with the age of the student; there is much more likely to be a college lecture class containing 120 students than a

kindergarten class of the same number. Class size must have some relevance to student achievement (Lazear).

Reichardt (2000) posited that even after years of research, there were more questions and disagreements than answers and agreements about the effects of class size on student achievement. One cause was the inherent difficulties of conducting research in schools. Hoxby (2000) declared, “The vast majority of variation in class size is the result of *choices* made by parents, school providers, or courts, and legislatures. Thus most of the observed variation in class size is correlated with other determinants and is likely to produce biased results” (pp. 1240-1241).

Ehrenberg, Brewer, Gamoran, and Willms (2001) suggested that although school administrators, teachers, and parents have long thought the number of children in a classroom affects the learning that occurs, it has proven difficult to pin down the precise effects of class size on student achievement. They cited factors such as the classroom and school environment, students’ background and motivation, and community influences as key variables that affected the amount of student learning that cannot readily be separated from class size.

Since smaller classes require more teachers and more classrooms, they cost more money to maintain (Brewer, Krop, Gill, & Reichardt, 1999; Hanushek, 1999). There were differing opinions among those researchers concerning the amount of difference in student outcomes that must be observed before the benefit was considered worth the cost. Further, regardless of its effectiveness, since class size was often easier to manipulate

than other school inputs, reducing class size has been a popular policy (Angrist & Lavy, 1999; Ehrenberg et al., 2001).

Several noted researchers called for longitudinal analyses that follow students into later schooling (Graue, Oen, Hatch, Rao, & Fadali, 2005; Achilles, 2002; Biddle & Berliner, 2002; and Molnar, Smith, Zajorik, Palmer, Halbach, & Ehrle, 1999). Pedder (2006) maintained that we needed further research to better understand strategies and knowledge that teachers can adapt to promote quality learning for all students in different classes and different class size configurations.

Although researchers have long studied class size effects, the literature lacked a longitudinal study that examined the effects of class size over a number of years (Mosteller, 1999). This study of the effects of class size on student academic achievement in Vermont would accomplish this. Unlike the quasi experimental studies such as Project STAR (Biddle & Berliner, 2002; Finn, 2002; Hanushek cited in Bohrnstedt & Stecher, 2002; Nye et al., 2004), California Class Size Reduction (Bohrnstedt & Stecher), and SAGE (Graue et al., 2005; Molnar, Smith, Zajorik, Palmer, Halbach, & Ehrle, 1999;), the subjects in this Vermont study did not know they were part of a research study.

The purpose of this research was to contribute to the available body of knowledge available to educators, policymakers, and researchers about the effects of class size on student achievement and other outcomes. This research incorporated a longitudinal study of the effects of class size on selected student outcomes related to academic achievement. The research studied a cohort that began as 3,107 4th graders in the year 2000. Additional

data such as graduation rates and post-graduation plans were collected for the senior class of 2008, from those same schools.

Table 2 indicates that the schools from which the students were selected shared a common socio-economic indicator. Approximately 30 percent of students from each of the selected schools qualified for free or reduced lunch, the most common measure of socio-economic status used in Vermont schools and close to the state average.

Table 2: Free and Reduced Lunch Rates in Grade 10

	Small High Schools		
	Eligible for free and reduced lunch	Ineligible for free and reduced lunch	Total number of students
Number of students	49	20	69
% of 10 th grade small school students	71.0%	29.0%	100.0%
% of students eligible for free and reduced lunch within total of 10 th grade students	8.0%	8.1%	8.0%
% of all 10 th grade students	5.7%	2.3%	8.0%
	Large High Schools		
Number of students	564	226	790
% of students within all of grade 10 eligible for free and reduced lunch	71.4%	28.6%	100.0%
% of students eligible for free and reduced lunch within total of 10 th grade students	92.0%	91.9%	92.0%
% of all 10 th grade students	65.7%	26.3%	92.0%
	Total		
Total number of 10 th grade students	613	246	859
% of students within Grade 10	71.4%	28.6%	100.0%

This study intended to determine whether students in small classes are more likely to graduate, enroll in post secondary education, and perform better on tests measuring academic achievement than students in larger classes. As the literature review revealed, many scholars and researchers have offered recommendations to educators and policymakers regarding class size. However, the literature on the impact of class size on student outcomes was inconclusive at best and often contradictory. This longitudinal research is needed to ascertain the true effects of class size on student outcomes in Vermont. Vermont lawmakers, taxpayers and educators would greatly benefit from relevant data about the effects of class size as they consider ways to address the state's declining student enrollment.

According to former Vermont Education Commissioner Richard Cate, the cost of an education boiled down to just two things: the teacher-student ratio and health care (Seiffert, 2007). "If we could change the student-teacher ratio by just three kids it would have a significant effect on cost.... For the 2004-2005 school year, Vermont's student-teacher ratio of 11.3 was the lowest in the nation..." (Seiffert, 2007).

As both Commissioner Cate and Commissioner Villaseca have stated (Hirschfeld, 2009), Vermont has a preponderance of very small classes. This research study will also demonstrate that typical class sizes are often smaller than those required by Vermont's School Quality Standards: "(b) At the elementary level, classes in grades K-3, when taken together, shall average fewer than 20 students per teacher. In grades 4-8, when taken together, classes shall average fewer than 25 students per teacher" (Vermont Department of Education (DOE), 2006).

Research Questions

The following research questions are the basis for this study:

1. How are the outcomes for Vermont students who are educated in small classes different from those educated in larger classes in respect to:
 - a. immediate post graduation plans of students?
 - b. graduation rate?

2. Are there statistically significant differences between large and small class sizes with respect to:
 - a. student achievement as measured by New Standards Reference Exam math test scores?
 - b. student achievement as measured by New Standards Reference Exam English/language arts test scores?
 - c. opportunities that students have to learn reading and mathematics as measured by a series of questions (Opportunities to Learn) concerning student experiences and the size of classes they actually experienced during high school? (The Opportunity to Learn questions used for this study were selected from the more than 20 questions asked since they had good reliability, real distributions and they discriminated. These questions have proven to be reliable in that they are good measures of student perception and serve as another data set to compare students in large classes with students in small classes.)

3. What is the typical class size for freshman and sophomore English and math classes in large and small schools?

4. What factors do principals think most affect student achievement?

5. Since class size appears to be shrinking due to declining enrollment and not policy decisions, were schools implementing practices to boost student achievement and if so, what were they doing?

6. Since class size and school size are linked in Vermont (small schools tend to have smaller classes and larger schools tend to have larger classes), what other differences exist between large secondary schools and small secondary schools that may impact student achievement?

Significance of the Study

Assuming that demographic trends continue, Vermont's class sizes will continue to decline. Stakeholders will continue to try to find affordable ways to provide high quality, affordable education to Vermont students. According to a 2007 report by the New England Policy Center:

Tax burdens for education are growing, in part because the costs of educating Vermont students are growing. Reporting to the General Assembly, the 2004 Joint Legislative Education Cost Containment Committee noted that despite declining student enrollment, education spending in Vermont grew faster than inflation between 1996 and 2002. In September 2006, the Vermont Joint Fiscal Office projected that education spending would grow by 5.6 percent in nominal

terms for FY2007 and FY2008, despite further projected declines in enrollment. (Saas, 2007)

Pressure may mount to close Vermont's small schools with small classes. This research will provide useful data and recommendations to educators, legislators, the Department of Education, and Vermont citizens as they make decisions about the future of Vermont's public schools. If the findings conclude that student outcomes are significantly more positive in smaller classes than larger ones, this may provide support to maintain the status quo of small classes in many Vermont schools.

Conversely, if there is no important difference in student outcomes between students in small and large classes, or students are found to achieve more in larger classes, this would suggest that it is both educationally and fiscally responsible to have larger classes. Larger classes would likely mean fewer teachers (under the current, common model of one teacher in a classroom) and fewer classrooms, thereby reducing labor and space costs. Taxpayers could realize substantial cost savings if classes were larger. Some funds that were formerly allocated for lower teacher salaries might be reallocated to increase salary levels, thereby potentially retaining and attracting high quality teachers. According to Mitchell and Mitchell (2000), the huge investments spent in creating small class sizes are out of proportion to the reliability of the evidence supporting achievement production. Students may also benefit from classes with more classmates as there can be additional course offerings and programs, more diverse opinions expressed in individual classes, and more classes that are designed for students' ability levels (Borland, Howsen, & Trawick, 2005; Pong & Pappas, 2001).

Definition of Terms

The definitions used in the historical class size debate vary according to the researcher. The following definitions are ones that will be used in this research.

Class size: Class size is typically defined as the number of students for whom a teacher is primarily responsible during a school year. The teacher may teach in a self-contained classroom or provide instruction in one subject (Lewitt & Baker, 1997, p. 2). Achilles (2003) gives the following example of class size: “Average class-size is the sum of all students regularly in each teacher's class divided by the actual number of regular teachers in those specific classes. If the four second grade rooms have 14, 16, 18, 18 (n=64) the average grade two-class size is 16” (p. 4).

Regardless of the definition one uses, class size has been difficult to measure due to the dynamic nature of classrooms (adults and students move in and out of classrooms), a variety of classroom models (pull outs, resource rooms, aides, specialists), and a lack of precise measurements of what occurs in schools and classrooms (pupil-teacher ratios, pupil-professional ratios, class size based on the number of students assigned to a given teacher) (Reichardt, 2000). The lack of a common agreement as to what constitutes a small class or even an ideal class has made it difficult to compare research studies.

Operational definition of class size: For the purpose of this study class size was defined as the number of students for whom a teacher is primarily responsible during a school year. A small class was defined as a class having 11 or fewer students. A large class contained 20 or more pupils. Principals and guidance counselors reported the class sizes for freshman and sophomore English and math classes for the years 2007-2008.

The total number of students in the small schools' English and math classes was added together and divided by the number of classes to determine the average class size for small schools, 11. The total number of students in the large schools' English and math classes was added together and divided by the number of classes to determine the average class size for large schools, 20.

Pupil-teacher ratio (also known as teacher-student ratio): Achilles (2003) defined pupil-teacher ratio as the number of student in a school or district compared to the number of teaching professionals. All educators may be part of the computation, including counselors and administrators.

According to Hanushek (1999), the only data that are consistently available over time reflect pupil-teacher ratios. Determining class size requires one to decide which classes to count. For instance, are physical education and driver's education included? "Class size is generally best defined in the traditional elementary school grades, where a single teacher is responsible for a self-contained classroom, and the definition gets progressively more problematical as the instructional program becomes more complex" (Hanushek, p. 140). Although there is a slight discrepancy among the actual numbers, pupil-teacher ratio is significantly lower than average class size. The difference nationally between class size and pupil-teacher ratio is about 10 pupils (Achilles, 2003). Bracey (1999) wrote that the average pupil/teacher ratio is around 17:1, and the average class size is 23 for elementary schools and 25 for high schools. By Bracey's accounts, the difference between class size and pupil-teacher ratio is between six and eight students.

Class size reduction: Class size reduction is the processes to achieve class sizes smaller than the ones currently in place (Achilles, 2003).

NSRE: The New Standard Reference Exam (NSRE) refers to student academic assessments that were given to 4th, 8th and 10th grade Vermont students in English/language arts and mathematics. The exams were aligned with Vermont's Framework of Standards and Learning Opportunities and measured and reported on the percentages of students who met or exceeded a performance level (standard). (Vermont Department of Education, 2009). In English/language areas the exam measured student achievement in four areas: Reading: Basic Understanding; Reading: Analysis and Interpretation; Writing Effectiveness; and Writing Conventions. The mathematics reference exam measured and reported on the percentages of students who met or exceeded a performance level (standard) and raw scores in three areas: Concepts, Skills, and Problem Solving.

Limitations of the Study

Large and small in Vermont are relative terms. What is considered to be a large Vermont class would be considered small in many schools cited in the literature and in more populous regions of the United States. Using enrollment data collected by the Vermont DOE, Vermont high schools were ranked by the size of their student body. The largest and smallest districts were examined. Among these groups of large and small districts, five of the largest and five of the smallest districts with similar free and reduced price lunch data were compared to minimize the effects of socio-economic influences on student achievement (See Table 2, p. 6). In order to ascertain whether large Vermont

high schools had larger class sizes than did small high schools, in the spring of 2008, pilot interviews were conducted with principals from the 10 target schools. Calculation of average class sizes indicated this was the case; small schools' average math and English classes was 11, large schools averaged a class size of 20.

As with any test, NSRE data can vary according to student effort, the testing environment, and individual student circumstances on the day of testing. The testing procedures and the test itself were standardized with respect to the measurement of student achievement in both small and large schools.

Socioeconomic data were measured by free or reduced lunch count. These data were reported voluntarily by parents and students. Again, there was no reason to believe that there would be variation in reporting due to class or school size. This is due to the fact that the measure of free and reduced lunch was taken at grade 4 for all students and remained constant throughout the study of longitudinal effects.

Individually matched student data were available for the NSRE administered to students in grades 4, 8 and 10 in English language arts and math. Other data such as graduation rates, post-secondary school plans, and free and reduced lunch rates were only available for school level data, not individuals.

An important limitation of the study was the inability to have exact class size data for the students in each of the grades. Vermont does not collect this data. However, the state of Vermont collects teacher-student ratios, and while not the same as class size, the ratios between small and large classes in small and large schools showed substantial differences, similar in size to the class sizes reported in the principal interviews. Based

on the state data, interviews, and my professional experience as a Vermont educator, there was a high degree of confidence that class size in the smaller schools was substantially smaller than class size in the larger schools.

Vermont high schools received students from many elementary schools. It was not feasible to match each individual student with his specific class and its corresponding annual enrollment since the DOE did not disaggregate this data. Nevertheless, the NSRE test scores used included only students that were able to be tracked for the 2000, 2004, and 2006 data points. By matching these to large or small school districts, there was a high degree of confidence that it could be determined which of the students were in large or small classes.

When grouped by large and small schools, there was no difference in the proportion of missing outcome data. In order to test the hypothesis that student mobility may be linked to differences in performance across time, a subset of students was selected that represented only those students who were enrolled in the *same* school districts. This sub-population resulted in considerable attrition from the small schools' original matched pairs by grade 10. For example, the student population which began in small schools at grade 4 was reduced from 223 in the year 2000, to 69 (69%) by grade 10 in the year 2006. By grade 10, the population in large schools was reduced from 914 to 790 (14%). This is a difference in attrition of 55 percent. Attrition from the small schools would not be unusual in Vermont because the difference in percentage is subject to greater fluctuation in smaller group sizes. In addition, some of the students in small schools may have been subject to Vermont's school choice options. The most common

of which is that tuition be paid by towns of residence if they do not have schools at certain grade levels (Vermont DOE, Laws & Regulations, 2008). Vermont's Act 150 also required each high school to join with at least one other school to form a choice region (Vermont DOE, Laws & Regulations). When this sub-population of students who left the small school environment was analyzed according to the previous set of null hypotheses, no significant difference in either math or English/language arts was observed.

In this study large and small schools were defined by high schools only. If high schools accounted for four years of student experience, could it be known that the class size vector for kindergarten through 8th grade was the same? An assumption was made that class size was similar in grades 4 and 8 as it was in high school. This was based on teacher-student ratio figures collected by the DOE. Although not the same as class size figures, these clearly showed that class size in the feeder elementary schools for the selected large high schools was larger than class size in the small high schools (see Table 10, p. 55). Each targeted small high school was a kindergarten-12th grade institution and teacher-student ratio data was not available for these schools since data were not disaggregated by grade level. The teacher-student ratio also appeared to be a valid measure since it demonstrated a pattern of declining enrollment across all cohorts and schools.

Limitation of Qualitative Data

Interviews were conducted with the principals in 2008 and 2009. Patton (2002) noted that interview data can have limitations that include distorted responses due to

personal bias, anger, anxiety, politics, and the emotional state of the interviewee at the time of the interview. The data can also be subject to erroneous recall, reactivity of the interviewee, and self-serving responses (Patton 2002, p. 306).

The information gathered from interviews was limited to principals and guidance counselors. Perspectives of students, teachers and other school personnel could add greater depth to the understanding of this complex phenomenon.

Organization of the Study

This research study is described in the following four chapters. The literature review in Chapter 2 examines numerous conflicting studies concerning the effects of class size on student achievement. The chapter considers historical approaches to the class size debate, investigates seminal research studies, and summarizes the findings of the work of many researchers and authors. Chapter 3 describes the procedures and methods employed in the study. The results of the study are detailed in Chapter 4. Chapter 5 contains conclusions and implications of this research as well as its limitations.

In order for schools to remain anonymous, pseudonyms were given to represent the schools. School names beginning with a lower case letter are schools with small classes, school names beginning with a capital letter are schools with large classes. The small schools are carter, clinton, coolidge, washington, and reagan; large schools are Buchanan, Monroe, Nixon, Madison, and Bush. For consistency and conciseness, principals and students are referred to as masculine even though the subjects were of both genders.

CHAPTER 2: LITERATURE REVIEW

The purpose of this literature review is to investigate selected research, primarily in the U.S., on class size and student achievement. This review will highlight findings in the literature that address the following questions:

1. How has class size been approached historically?
2. Are small classes beneficial for students in early grades?
3. Are small classes beneficial for impoverished and/or minority students?
4. To what extent does teacher and student behavior impact class size effects?
5. What is a small class?
6. What role does economic theory play in the class size debate?

Historical Approaches to Class Size

The search for substantial achievement effects of reducing class size is one of the oldest and most frustrating for educational researchers.

Slavin, 1989

The origins of the debate over what constitutes optimum class size can be traced to Ancient Greece. The famous teacher Socrates never specified an optimum number, but he kept his classes exclusive and manageable by limiting them to rich young men. His Spartan contemporary, Herodotus, thought the right number was about 30, and that view survived until the last century (Tomlinson, 1998).

After World War II, the percentage of students enrolled in school skyrocketed. One of the most direct and effective methods used to manage the supply and minimize

the cost of teachers and classrooms was to manipulate class size. Larger classes needed fewer teachers and classrooms, hence the per-student cost was less (Tomlinson, 1998). The response of educators and school reformers to this practice was the same then as now. They believed that larger classes would increase the teachers' work burden and reduce the efficacy of instruction (Tomlinson).

However, did class size matter? Biddle and Berliner (2002) concluded that while more studies had been done regarding class size than any other educational topic, there was profound disagreement on the findings. Tomlinson (1998) wondered if there were things that teachers and students did differently in a small class that made the number of pupils so important, and if teaching became more difficult and learning less likely as class size rose.

Small Classes for Students in the Early Grades

Many researchers and studies explored the effects of small class on students in the primary grades. Mosteller (1995) proposed factors that made it likely that younger students benefited from smaller class size. When children first came to school, they were confronted with many changes and much confusion, entering this new setting from a variety of homes and circumstances. Many needed training in paying attention, carrying out tasks, and interacting with others in a working situation. In other words, when children start school, they have to learn to cooperate with others and generally become oriented to being students.

Biddle and Berliner (2002) offered tentative theories to explain why small classes had impressive effects in the early grades. This was when youngsters were first learning

the rules of school and forming ideas about whether they can cope with education. Since there was more one-to-one interaction in smaller classes, teachers learned more about individual students. This translates into helping students develop more useful habits and ideas about themselves. Additionally, teachers in small classes had higher morale and thus created a more supportive learning environment.

The three major experiments/initiatives, STAR, SAGE and California's CSR all involved students in early grades. The results of these studies are discussed in the next section.

Small Classes for Impoverished and/or Minority Students

There were two commonly cited class size experiments in the literature, STAR and SAGE, and one class size reduction initiative that took place in California. All three studies focused their attention on the early grades and examined the effects of class size on poor and minority students.

STAR

The most frequently cited class size study in the literature is the STAR (Student/Teacher Achievement Ratio) experiment. The Tennessee STAR (experiment began as a pilot in 1984, was mandated in 1985, and was completed in 1990). Pupils entering kindergarten in participating schools were randomly assigned to a small class (13-17), a full size class (22-25), or a full size class with a full time teacher aide. Teachers were also assigned at random to the classrooms. Pupils were to be kept in the same condition for up to four years, with a new teacher assigned at random each year (Finn, 2002). Participating schools had to have at least three kindergarten classes (57

kindergarten students) and accommodate one control and one treatment. The study was carried out in three kinds of groups: classes one-third smaller than regular-sized classes; regular-sized classes without a teacher's aide; and regular-sized classes with a teacher's aide. By comparing average pupil performance in the different kinds of classes, researchers were able to assess the relative benefits of small class size and the presence of a teacher's aide. The experiment involved many schools and classes from urban, suburban, and rural areas so that the progress of children from different backgrounds could be evaluated.

Findings from the STAR experiment have been disputed by researchers. Some authors claimed that this study clearly demonstrated a positive relationship between small class size and improved student achievement. According to Nye et al. (2004), the STAR experiment provided rather strong evidence that class-size reduction led to immediate increases in academic achievement in both reading and mathematics, with some evidence of larger effects for minority students. This study also demonstrated that students who experienced more years of small classes in kindergarten through grade 3 had higher levels of achievement six years later than students who had fewer years of small classes (Nye et al.).

Nye and colleagues (2004) acknowledge that the reason why small classes led to higher achievement and differentially higher achievement for minority students was not clear. They hypothesized that small classes may permit teachers to more effectively individualize instruction. Small classes may also tend to have fewer disruptions making all-class instruction more effective.

Biddle and Berliner (2002) write that based on the results of the Stanford Achievement Test battery, “Long-term exposure to small classes (in the early grades) had substantially higher levels of achievement; and the extra gains... were greater the longer students were exposed to those classes” (p. 12). They also noted that, “Although all types of students experienced extra gains from long-term exposure to small classes (in early grades), those gains were greater for students who are traditionally disadvantaged in education” (p. 13).

Other authors claimed that the STAR study did not prove that small class size had dramatic effects on the academic achievement of minority and poor students. Hanushek (2002) argued that the effects in the Tennessee STAR project occurred primarily in kindergarten and 1st grade and that there was no evidence that additional years of class size reduction contributed incrementally to the effect of small classes in the early years. He acknowledged that the effects were greater for minority and disadvantaged students but maintained that the effects appear small relative to costs of programs and alternative policy approaches (Hanushek cited in Bohrnstedt & Stecher, 2002).

SAGE

A second large, experimental study, SAGE (Student Achievement Guarantee in Education), targeted low-income students and was envisioned as a way to narrow the achievement gap for children living in poverty. SAGE was a five-year project that began in 1996 in Wisconsin. It did not employ random assignment and involved a range of interventions that included a family/school component, curriculum reform, and professional development in addition to reducing class size from 25 to 15 students per

class. Thirty volunteer schools in which at least 30 percent of the students lived below the poverty line participated in the initial study.

Results showed that students in SAGE classrooms outperformed the comparison group in reading, language arts and math through 3rd grade, with the most pronounced effects found for African-American students.

Some researchers urged caution in using this project to draw conclusions about the effects of class size on student achievement. SAGE did not involve a clean experimental design but rather, a massive intervention study in which class size reduction was used along with other intervention strategies (Graue et al., 2005; Molnar et al., 1999).

California CSR (Class Size Reduction)

A third major class size reduction project took place in California in the late 1990s. This was not an experiment or designed as a research study. All schools were offered small classrooms, and the fact that 1.8 million students were affected made it the subject of much discussion in the literature.

Bohrnstedt and Stecher (2002) found a positive association in 1998 between 3rd grade class size and SAT-9 scores after controlling for differences in student and school characteristics. However, the size of this CSR effect was small, particularly when compared to the size of achievement differences related to socio-economic status or race/ethnicity.

The Impact of Student and Teacher Behavior

Some contributors proposed that what students and teachers do in large and small classes made the most significant impact on student outcomes. Misbehaving students, student attention span, peer pressure, student engagement and teacher attention to students and content were all influenced by class size according to several authors.

Lazear (2001) offered a disruption model to explain the importance of class size. He claimed that optimal class size was larger for better-behaved students and this helped explain why it was difficult to find class size effects in the data. He proposed that age and attention span factored into the class size-student outcomes equation.

Lazear (2001) makes the assumption that one child's disruption destroyed the ability of all students to learn at that moment. When a student was misbehaving, the teacher must attend to him and thus the learning of the student and his classmates was affected. In addition to disobedient students, a student who asked a question to which all other students knew the answer disrupted the learning process. In order to demonstrate his theory, Lazear offered a model that uses p as the probability that a student does not interfere with classroom learning. "It is expected that p would be relatively high because even having $p=.98$ in a class of 25 students results in disruption 40 percent of the time ($1-.98^{25}=.40$)" (Lazear, p. 780). The better the behavior of student, Lazear argued, the fewer the number of teachers, n , needed. The relationship of n to p demonstrated why there were more students in a college lecture than in a kindergarten class. "If p were .97, learning would occur 40 percent of the time in a class of 30 but only 2.5 percent of the time in a class of 120" (Lazear, p. 783).

Resnick (2003) suggested that smaller classes benefited student achievement claiming that teachers in small classes paid greater attention to each pupil. Students in these classes experienced continuing pressure to participate in learning activities and became better, more involved students; attention to learning went up and disruptive and off-task behavior went down. Pedder (2006) believed that class size might impact classroom processes and pupils' learning. He stated that smaller class size allowed teachers to cover more curriculum and students to be more cognitively engaged. These two features led to improved student achievement. Pedder asserted:

In larger classes, more time is needed for non-academic activities related to administrative and organizational procedures and to the management and control of discipline... Reductions in the quantity of learning opportunities constrain teachers from achieving the necessary pace, depth and breadth of curriculum coverage as class size increases. (p. 224)

Some researchers and scholars wrote that it was not class size itself that determined student outcomes, but rather smaller classes may provide opportunities for other educational interventions. Glass, Cahen, Smith, and Filby (1982) posited that it was not simply the number of students in a class that impacts learning. "Class size has no magical effect on student achievement. Instead, it influences what goes on in the classroom, what the teacher does, his or her manner with the students, and what the students themselves do or are allowed to do" (p. 67).

Glass et al. (1982) also cited studies that discussed the notion of time-on-task and student attention and postulated that in smaller classes, teachers were more likely to have

more interactions with individual students resulting in more time-on-task and better attention. This may lead to increased student achievement.

Discussion of the small achievement effects of reduction in class size usually point to one critical factor: teachers' behaviors did not vary very much regardless of the size of classes (Slavin, 1998). More accurately, teachers did change their behavior in small classes, but the changes were relatively subtle and unlikely to make important differences in student achievement.

Like Slavin (1998), Hannushek (1999) wrote that changes in teacher behavior were necessary, not simply doing more of the same thing. "Just providing more resources -whether in the form of reduced class sizes or in other forms- is unlikely to lead to higher student achievement as long as future actions of schools are consistent with their past choices and behavior" (cited in Normore & Ilon, 2006, p. 435). Johnson (2000) examined the 1998 NAEP database of reading to measure the influence of class size on academic achievement. This analysis looked at academic achievement by analyzing six factors: class size, race and ethnicity, parents' educational attainment, number of reading materials in the home, free or reduced-price lunch participation, and gender. He concluded that:

On average, being in a small class does not increase the likelihood that a student will attain a higher score on the NAEP reading test, and children in the smallest classes (those with 20 or fewer students per teacher) do not score higher than students in the largest classes (those with 31 or more students per teacher). (pp. 6-7)

He stated that class size as a variable pales in comparison with the effects of many factors not included in the NAEP data, such as teacher quality and teaching methods. As a result of the literature review, teacher behavior (termed teacher-student relationships and teacher quality later in this study) were explored qualitatively in this study.

Defining a Small Class

The literature lacked a consensus definition of a small class. What constituted a “small class” depended upon who was establishing the parameters. For example, Project STAR, the largest experimental study of the effects of class size on achievement, defined a small class that has between 13 and 17 students and a large class ranged from 22-26. Under California’s Class Size Reduction program, most California school districts kept their reduced size classes as close to 20 students as possible. (Bohrnstedt & Stecher, 2002). In Blatchford’s United Kingdom study, 23 pupils constituted a small class (2003). In Indiana’s Prime Time study, the average class size for the smaller class was set at 18, but actual “small class” sizes ranged from 18-31. Classes of 24 were considered small if there was a teacher aide to assist the teacher (Hattie, 2005).

Resnick (2003) stressed that class sizes must be reduced substantially to achieve the benefits. “There is no experimental research suggesting that any benefits are realized by subtracting only a few children from a larger class - for example, transitioning from 28 to 25 students. Even a class of 20 students may be too large” (p. 2). Although not an experimental study, the work of Glass et al. (1982) added a great deal to the debate. Their often-cited meta-analysis suggested that small class size had a very positive effect on student achievement. However, many have criticized their methodology. Glass et al.

looked for class size studies using document retrieval and abstracting resources, previous reviews of the class size literature, and the bibliographies of studies found. They found 77 empirical research studies of the relationship between class size and learning spanning 70 years, performed in more than a dozen countries. From the 77 studies, Glass and colleagues recorded 725 comparisons of smaller and larger classes (studies from 1900-1979) almost evenly divided between junior high and below and secondary school. They concluded that the relationship of class size to student achievement is quite strong (Glass et al.).

Examining Glass and his colleagues' work, Hattie (2005) concluded that reducing class size from 40 or more to 20 students led to almost no increase in achievement. Not until class sizes being dropped to 15 students or lower were there larger effects on achievement. Hattie criticized the studies that Glass et al. utilized in the meta-analysis writing, "...the studies were of short duration, included many one-on-one tutoring studies, and were in some cases non-school related (e.g., tennis coaching)" (p. 3).

In light of the varying definitions and methodologies for defining school and class size, a procedure had to be established for this Vermont study on the effects of class size on student achievement. Identifying large and small schools, then calculating the class size in those schools, was the most logical way to define class size.

The Role of Economic Theory

There were other researchers who believed that class size did not play an important role in student achievement. Hoxby (2000) offered an economic theory to explain the reason why class size did not significantly influence student achievement.

Hoxby maintained that class size was a primary example of the education production fallacy; one could not assume there was a relationship between educational inputs like class size and outputs such as achievement. She argued that "...while class size reduction always affords *opportunities* for increased investment in each child's learning, it is not obvious that every school takes up such opportunities" (Hoxby, p. 240).

Bonseronning (2003) maintained that class size research made little use of economic theory. He asserted that since education production involved teachers, students and a number of other actors, the efforts of these actors and their complicated interactions were the determinants of student achievement. "For this reason, it seems unlikely that class size changes will have uniform effects on student achievement always and everywhere" (Bonseronning, p. 964).

Other researchers wrote that students may benefit from an increased class size. Pong and Pallas (2001) reported some studies found that students do better in large classes. They hypothesized that this could be because more experienced teachers are given larger classes or low achievers are placed in smaller classes. Borland et al. (2005) stated that in a larger class there was an implied increase in associated skills from which an associated student may benefit and peer effects on student achievement were expected to be positive. Furthermore, if students competed with one another, there would be an additional positive effect with increased class size.

Conversely, Normore and Ilon (2006) offered an economic argument that professed small classes could save money. "...in the long run, potential benefits may offset the costs. Smaller classes in primary grades start students on a path that reduces

the need for special education, grade retentions, or disciplinary measures and increases the likelihood of high school graduation” (p. 434). Nevertheless, their research did not convince Normore and Ilon that class size reduction (CSR) was worth the cost.

One important conclusion drawn from the literature was that there were many factors other than class size affecting student achievement. While class size influenced what occurred in the classroom, the research on class size and student achievement made note of many other variables, limits, and factors that affected student achievement. Other interventions and strategies may mitigate the influence of class size and may have greater impact than class size. One of these variables is the physical environment of a school and classroom (Lewit & Baker, 1997). A second factor is the range of class sizes and the resources spent by schools on students (Lewit and Baker). A third influence is the age, education, and experience of teachers (Ehrenberg, 2001).

Other Benefits of Small Classes

The research also yielded evidence supporting factors other than student achievement that cause some policymakers, educators, and parents to advocate for smaller classes. These include factors relating to student behavior, engagement, and teacher morale. For example, Achilles (2003) contended that the purposes of schooling were to help students achieve in four general areas to which he referred as the ABCDs: Academics, Behavior and discipline in and outside school; Citizenship and participation in and outside school; and Development into competent, productive adults (p. 1). Hattie (2005) emphasized the importance of investigating underlying motivations for teachers and parents and the need to examine teaching practices. He found that disruptive

students are a reason why some promote small classes. Improving classroom management skills, providing alternative settings or additional support for disruptive students, or changing the curriculum might have more of an effect on student achievement than universally reducing class size.

Miller-Whitehead (2003) suggested that small classes helped improve teacher morale and reduced discipline problems. She stated that small classes reduced the need for remediation through early identification and prevention of problems. Further, Miller-Whitehead (2003) claimed long-term benefits of small classes such as improved graduation rates, lowered dropout rates, decreased teen pregnancy rates, a higher proportion of graduates with advanced or honors diplomas and students who took the ACT and SAT college entrance exams or who planned to attend college.

Normore and Ilon (2006) noted that smaller class sizes had a positive impact in several areas: more time to cover curriculum, higher levels of student-student and student-teacher engagement, and safer schools with fewer discipline problems.

Summary of the Literature

There have been numerous conflicting studies concerning the effects of class size on student achievement and a lack of consensus on the definition of large and small classes. This chapter reviewed articles that support the notion that class size greatly influences academic achievement and those that do not espouse this view. It attempted to answer a number of questions. How has class size been approached historically? While the approaches to class size have varied throughout history, the literature shows that class size today in U.S. public schools is at an historic low. Are small classes beneficial for

students in early grades? Many studies support this notion although the effect sizes are modest. Are small classes beneficial for minority students? A number of studies support this while acknowledging that small classes do not eliminate the achievement gap between minority and non-minority students. Are there things that teachers and students do in class that makes the number of pupils important? Although there is a great deal of research supporting the idea that teacher behavior influences student achievement, the literature shows that teacher behavior ordinarily does not change on account of the number of students. The number and type of student may be very important as disruption models have shown. What constitutes a small class? The literature offers many definitions of a small class, but the most common range appears to be a class with fewer than eighteen pupils. What role does economics play in the class size debate? The answer to this seems to depend on one's philosophy of education and one's opinion of the importance of class size. Some have argued that small classes can save money by reducing the need for future expensive intervention; others believe that resources would be better spent on inputs other than reducing class size, and some claim that class size reductions can fulfill a variety of objectives, not all of which are related to achievement.

As the literature review has demonstrated, there are many different answers to these questions depending on the researcher and author. Further research is needed to provide clear answers to the effects of class size on student achievement in the context of present day Vermont public schools.

The literature also raises important policy considerations. Policy initiatives and large sums of money have been dedicated to reducing class size in a large number of

states. Some rural states find themselves with small classes due to declining student population. If smaller classes benefit students' academic achievement in some areas (e.g., reading and math), then resources can be devoted to promoting small classes for this subject but not necessarily in all areas. On the other hand, if small classes do not have a significant effect on academic achievement, policy makers can create class and school structures that reflect this. In summary, while some researchers supported the notion that small class sizes benefit student achievement, others did not and many raised questions about the substantially higher costs. This dissertation links to the existing research and extends it to contemporary Vermont to address the expressed need for longitudinal research on the effects of class size on student achievement.

CHAPTER 3: METHODOLOGY

This section presents the methodology to be used in a longitudinal study of the effects of class size on student achievement. The research studied a cohort that began as 3,107 4th graders in the year 2000, and decreased to 1,137 10th graders in 2006. The study included the entire 2008, 12th grade classes of the 10 selected schools to analyze graduation rates and post-secondary plans. The study combined descriptive statistics with informant interviews. Notably, qualitative methods were used to delve into apparent relationships derived from quantitative statistics in order to understand what the numbers measured or missed and to gain an understanding into other possible causes for differences in student outcomes.

Mixed Methods

This research study utilized a mixed methods approach. Mixed methods research is the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study. When researchers bring together both quantitative and qualitative research, the strengths of both approaches are combined, leading to a better understanding of research problems than either approach alone (Cresswell, 2008; Patton, 2002).

Quantitative research has many benefits. It allows one to test and validate theories about how phenomena occur, test hypotheses that are constructed before the data are collected, and generalize research findings when the data are based on random samples of sufficient size. Quantitative research enables one to obtain data that allow quantitative predictions to be made, construct a situation that eliminates the confounding

influence of many variables, and credibly assess cause-and-effect relationships. Further, quantitative research methods provide precise, quantitative, numerical data; the research results are relatively independent of the researcher; and they are useful for studying large numbers of people (Johnson & Onwuegbuzie, 2004).

In a mixed methods approach, qualitative research compliments quantitative research. It is advantageous for studying a limited number of cases in depth, describing complex phenomena, and providing understanding and description of people's personal experiences of phenomena. One can also use examples to vividly demonstrate a phenomenon to readers (Johnson & Onwuegbuzie, 2004).

Research Questions

The following research questions are the basis for this study:

1. How are the outcomes for Vermont students who are educated in small classes different from those educated in larger classes in respect to:
 - a. immediate post graduation plans of students?
 - b. graduation rate?
2. Are there statistically significant differences between large and small class sizes with respect to:
 - a. student achievement as measured by New Standards Reference Exam math test scores?
 - b. student achievement as measured by New Standards Reference Exam English/language arts test scores?

- c. opportunities that students have to learn reading and mathematics as measured by a series of questions (Opportunities to Learn) concerning student experiences and the size of classes they actually experienced during high school?

The first research question generates the following three null hypotheses to be tested statistically:

1. There is no significant difference between groups of Vermont students who are educated in small and large classes with respect to student achievement as measured by NSRE mathematics test scores at grades 4, 8 and 10.

2. There is no significant difference between groups of Vermont students who are educated in small and large classes with respect to student achievement as measured by NSRE English/language arts test scores at grades 4, 8 and 10.

3. There is no significant difference between Vermont students who are educated in small and large classes with respect to selected opportunities students have that may be related to learning reading and mathematics as measured by a series of questions concerning student experiences and the size of classes they actually experienced during school.

- a. Students in this school have opportunities for additional help beyond the initial classroom instruction.
- b. Students know that this school's test results are discussed in the community.

- c. I know that if I want to talk with a counselor I can easily do this in this school.
- d. When something is broken in this school it is quickly repaired.
- e. Students who learn faster than other students are provided with new learning opportunities.
- f. This school is clean and pleasant.
- g. Students believe that academics are very important in this school.
- h. I have good, updated books and materials in this school.
- i. I am able to use a computer when I need one in this school.

The pilot interviews conducted in 2008 (Appendix B) led to extended interviews in 2009 to explore the influence of class size on student academic achievement as well as other considerations raised by principals and guidance counselors. The interviews acted as a guide to ensure that multiple causes were explored. In-depth conversations were held with the principals of each of the 10 schools, and in four of the schools the guidance counselors provided information relating to class size and post-graduation plans. All except one of the principals of the large schools had been in their current positions for at least four years. The exception was in his first year in this school but had previously worked as a principal and superintendent. In the small schools the principals had been in their present positions for seven, three, and two years, and two were in their first year as principal anywhere. All of the principals had been educators for many years.

The intent of the qualitative data was several fold. It was critical to verify that students in larger schools attended larger math and English classes than did students in

smaller schools. Second, it was important to learn what the principals thought were the most important factors impacting student achievement.

The third topic of interest involved the practices and programs schools in Vermont were implementing to help improve student achievement. In 2008, the Vermont State Board of Education published, “Vermont Secondary Schools for the 21st Century: Ensuring Each Student Can Succeed in College, Career, and Citizenship.” In this paper the State Board “attempted to update” many of the 12 principles of *High Schools on the Move* released in 2002. The State Board listed examples of observed practices undertaken by some schools that were working to transform the 12 principles into improved school practices. These included: 9th-grade academies, professional learning communities, student advisories, team teaching, use of houses and small learning communities, more rigorous curriculum expectations, and many other initiatives. The Board asserted, “We have found no school that had yet accomplished systematic transformation” (Vermont State Board of Education, 2008, p. 1). This state initiative designed to prepare students to be successful in college, careers, and citizenship complemented my study.

Also of interest was the organization of small schools and whether or not they delivered education differently than large schools since students in small schools are more likely to be educated in small classes. Finally, it was necessary to explore issues that were raised in the literature from the perspectives of current education practitioners. The results of the interviews are discussed and analyzed in the following pages.

The qualitative data gathering followed an interview schedule as indicated in Appendix A. Questions in the interviews were designed to elicit responses in the following areas:

1. What is the typical class size for freshman and sophomore English and math classes in large and small schools?
2. What factors do principals think most affect student achievement?
3. Since class size appears to be shrinking due to declining enrollment and not policy decisions, were schools implementing practices to boost student achievement and if so, what were they doing?
4. Since class size and school size are linked in Vermont (small schools tend to have smaller classes and larger schools tend to have larger classes), what other differences exist between large secondary schools and small secondary schools that may impact student achievement?

The Target Population

The population identified for this research is a cohort of the 12th grade students in the class of 2008 in five of Vermont's smallest and five of the largest high schools. These students were studied through state assessment records collected at grade 4 (2000), grade 8 (2004), and grade 10 (2006). This cohort began as 260 4th graders in the smallest five schools and 1100 4th graders in the largest five schools in the year 2000, and became 223 and 914 10th graders respectively in 2006. The decline in the amount of 10th graders from the number of 4th grades can be attributed to several factors. The most likely reason for the decrease in number was attrition; a number of students may have moved over the

course of six years. In addition, a number of towns in Vermont with elementary and middle schools do not have high schools or do not designate which high school pupils must enroll; students choose the high school to attend. Other students may have dropped out of school and other students may have enrolled in private schools or were homeschooled.

Selection of Students

Vermont does not collect class size data for individual classes (it does collect student-teacher ratios for schools). Since it was possible to access NSRE data on individual students, students could be tracked in the grades the test was administered: 4, 8 and 10. To find which students were in smaller classes, an investigation was undertaken to find which schools had the smallest classes and likewise for the larger classes. Using enrollment data collected by the Vermont DOE, high schools were ranked by the size of their student body. The largest and smallest schools were selected as the base population. Those groups of large high schools were compared to small high schools with similar free and reduced price lunch data to minimize the effects of socio-economic influences on student achievement. In the spring of 2008, pilot interviews were conducted with principals from the 10 target schools. Calculation of average class sizes indicated an average class size of 11 for the small schools and 20 for the large.

The first selection was to track students who had remained in the Vermont system from Grade 4 in 2000, to Grade 10 in 2006. This cohort would be the cohort to graduate in 2008, therefore using graduation rates for this cohort made the most sense.

The second selection was to track only those students who began their “cohort ride” in a district named as a small school or large school district. Large districts were ones that had larger elementary and high schools; small districts possessed smaller elementary and high schools. The rationale was that students attending smaller schools would be in smaller classes and students attending larger schools would be in larger classes.

The third and final selection was to track those students who had begun their 4th grade in 2000, in a small or large district, and stayed within that small or large district for the high school experience. These three selections had the advantage of controlling for mobility as a variable that might have confounded the hypothetical effects of small or large size school/districts on opportunities to learn and the resulting patterns of achievement.

Data Sources and Data Collection

A great deal of the quantitative data was obtainable from the Vermont DOE website (<http://education.vermont.gov>) and the Center for Rural Studies at the University of Vermont’s website (<http://crs.uvm.edu/schlrpt/cfusion/schlrpt08/vermont.cfm>). Test scores and answers to Learning Opportunities from the NSRE were analyzed at the DOE offices in Berlin, Vermont under the specific conditions designed to ensure confidentiality and anonymity of students. The student level data were de-identified and contained a unique identifier that is longitudinally valid.

Qualitative data were used primarily to answer research questions two through five. These were collected in the form of interviews with principals and guidance

counselors. A pilot interview was conducted in the spring of 2008 to confirm the class size hypothesis, small schools had small classes and large schools had large classes. These six pilot interviews also served to revise and expand upon the questions for a second interview with all 10 principals in March and April of 2009.

Quantitative Procedures

Quantitative data were used to track 1137 students in the 10th grade class of 2006, using data points in 2000, 2004, and 2006, and statistics on graduation rates and post-secondary plans for twelfth graders in the ten target schools in 2008. This study examined this relationship between class size and student achievement by combining student level data from a cohort of students who were first tested with the NSRE state tests in 2000, matched in 2004, and again matched in grade 10 in 2006. These data were anonymously combined with school level variables obtained from school and district records in order to investigate the relationships among class size, per-pupil spending, teacher quality, graduation rates, socioeconomic status of students, and other background variables available from the schools.

Qualitative Procedures

Qualitative methods using informant interviews examined the educational structures and dynamics in 10 Vermont high schools (Appendix B). In order to determine the feasibility of this study and to refine the interview, five principals and one guidance counselor were interviewed by telephone in May and June of 2008. They were informed of the purpose of the research, how this would benefit educators and policy makers, and were given preliminary questions. Principals were assured of confidentiality

and all agreed to participate to further support the research project. Since the state of Vermont does not collect class size data, the hypothesis was tested that small Vermont schools within small districts tended to have smaller classes than larger Vermont schools in larger Vermont districts. Interviews with the principals and guidance counselors confirmed this was the case. As a result of the pilot interviews, questions were revised and expanded upon for a second round of more in-depth interviews recorded in March and April of 2009. Several themes became evident from the pilot interviews and allowed for further probing during the second interview. The interviews also prompted queries into other school-based influences of student outcomes that are currently being explored in Vermont as part of “High Schools on the Move” and State Board of Education’s transformation initiative. The interviews provided a deeper and richer understanding of the quantitative data collected from test scores, surveys and demographic statistics. These conversations offered a window into current practices in Vermont’s high schools.

In addition, the interviews provided quantitative data regarding the students’ post-secondary plans and actual class sizes. Interviews were conducted with guidance counselors and principals.

CHAPTER 4: RESULTS

This chapter details the results of the research questions and is divided into two main sections, quantitative results and qualitative results.

Quantitative Results

The intention of this analysis is to discover the impact of class size on academic achievement in Vermont. It does so by answering the first, multi-part research question.

1. How are the outcomes for Vermont students who are educated in small classes different from those educated in larger classes in respect to:
 - a. immediate post graduation plans of students?
 - b. graduation rate?

2. Are there statistically significant differences between large and small class sizes with respect to:
 - a. student achievement as measured by New Standards Reference Exam math test scores?
 - b. student achievement as measured by New Standards Reference Exam English/language arts test scores?
 - c. opportunities that students have to learn reading and mathematics as measured by a series of questions (Opportunities to Learn) concerning student experiences and the size of classes they actually experienced during high school?

Research question 1a

The first part of this research question considered whether Vermont students who are educated in small classes experience different outcomes from those educated in larger classes with respect to immediate post-graduation plans. The results indicated that students in large schools are more likely to intend to enroll in two and four year colleges than are students in small schools. As Table 3 reveals: 79% of students who attended large high schools planned to enroll in two and four year post-secondary schools compared to 59% of students who attended small high schools. This is a substantial difference.

Table 3: Post-Secondary Plans

<u>Small High Schools</u>	<u>% planning to attend 2 or 4 year college</u>
washington	61%
carter	66%
clinton	65%
coolidge	45%
Mean of small high schools	59%
<u>Large High Schools</u>	
Nixon	79%
Bush	85%
Monroe	74%
Buchanan	78%
Mean of large high schools	79%
<u>Mean of small and large high schools</u>	<u>69%</u>

Note. Statistics available for 80% of the large schools and 80% of the small schools.

Research question 1b

The second part of this research question considered whether Vermont students who are educated in small classes experience different outcomes from those educated in larger classes in respect to graduation rate. The cohort graduation rate is the percentage of students enrolled at a school who graduate and earn high school diplomas within four years of entering 9th grade. Students earning high school credentials by passing General Educational Development (GED) tests are not considered graduates for the purpose of this definition. The cohort graduation rate is then a measure of on-time completion, with all students expected to finish within four years (Vermont DOE, 2008).

The results in Table 4 indicate that there was no substantial difference. The mean graduation rate for the small high schools was 80.2% and the mean for the large high schools was 81.7%.

Table 4: Cohort Graduation Rate, 2008

<u>Small High Schools</u>	<u>Cohort Graduation Rate</u>
washington	73.1%
reagan	83.3%
coolidge	75.0%
clinton	82.6%
carter	87.0%
Mean of small schools	80.2%
<u>Large High Schools</u>	<u>Cohort Graduation Rate</u>
Bush	85%
Monroe	75.7%
Buchanan	85.6%
Madison	81.4%
Nixon	81.0%
Mean of large schools	81.7%
<u>Mean of combined large and small schools</u>	<u>81.0%</u>

Source: Vermont DOE, 2008.

Research Question 2a

The second research question considered student achievement as measured by standardized mathematics test scores. The Null Hypothesis (H_0) stated: there is no significant difference between groups of Vermont students who are educated in small and large classes with respect to student achievement as measured by NSRE mathematics test scores at grades 4, 8 and 10. The sample consisted of 223 students in small classes and 914 students in large classes.

Table 5: Descriptives, Math NSRE

		Descriptives			
		N	Mean	Std. Deviation	Std. Error
4 th grade math, 2000	Small	223	649.95	41.663	2.790
	Large	914	653.22	43.112	1.426
	Total	1137	652.58	42.834	1.270
8 th grade math, 2004	Small	223	710.01	41.151	2.756
	Large	914	708.97	43.127	1.427
	Total	1137	709.18	42.731	1.267
10 th grade math, 2006*	Small	223	736.34	49.780	3.333
	Large	914	726.64	47.292	1.564
	Total	1137	728.54	47.923	1.421
*f=7.38		df (degree of freedom) 1, 1135		p=.007	

Table 6: 10th Grade NSRE Math Scores

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
10 th grade, 2006	Between Groups	16853.915	1	16853.915	7.380	.007

A one-way analysis of variance (ANOVA) was calculated on math NSRE scores in grades 4, 8 and 10. The results expressed no significant difference between the large and small classes for English/language arts achievement in either grade 4 ($p=.307$) or grade 8 ($p=.745$). However, as Table 5 displays, there was a significant difference in 10th grade NSRE math scores between large and small schools $F(1, 1135)=7.4, p=.007$

Research Question 2b

This section of research question two considered student achievement as measured by standardized English/language arts test scores. The Null Hypothesis (H_0) stated: there is no significant difference between groups of Vermont students who are educated in small and large classes with respect to student achievement as measured by NSRE English/language arts test scores at grades 4, 8 and 10. The sample consisted of 223 students in small classes and 914 students in large classes.

Table 7: Descriptives, English/Language Arts NSREs

		N	Mean	Std. Deviation	Std. Error
4 th grade English/ language arts 2000	Small	223	656.04	40.649	2.722
	Large	914	655.23	41.066	1.358
	Total	1137	655.39	40.968	1.215
8 th grade English/ Language arts, 2004	Small	223	712.78	38.259	2.562
	Large	914	713.87	38.141	1.262
	Total	1137	713.66	38.150	1.131
10 th grade English/ Language arts, 2006	Small	223	731.99	37.341	2.501
	Large	914	728.03	40.026	1.324
	Total	1137	728.80	39.529	1.172

A one-way analysis of variance (ANOVA) was calculated on English/language arts NSRE scores in grades 4, 8 and 10. The results expressed no significant difference

between the large and small classes for English/language arts achievement in either grade 4, grade 8, or grade 10.

Research Question 2c

The final part of research question two considered opportunities students have to learn reading and mathematics. These results refer to questions asked of the students in 8th grade. The Null Hypothesis (H_0) stated: there is no significant difference between Vermont students who are educated in small and large classes with respect to selected opportunities students have that may be related to learning reading and mathematics as measured by a series of questions concerning student experiences and the size of classes they actually experienced during school.

Three of the nine Opportunity to Learn questions analyzed showed a significant difference between students educated in small classes and large classes. Sixty-one percent of students in large classes reported that their school's test results are discussed in the community compared to 40 percent of students in small classes ($p=.004$). Seventy-three percent of students in small classes answered that their school was clean and pleasant compared to 60 percent of students in large classes ($p=.001$). Eighty-six percent of students in small classes stated they were able to use a computer when they needed one in school compared to 80 percent of students in large classes ($p=.049$).

Table 8: Opportunities to Learn

	Small Classes	No	Yes	Total	Large Classes	No	Yes	Total	Pearson Chi- Square Value	N of Valid Cases	df	Assymp. Sig. (2- sided)
My school is clean and pleasant	% of Students	27.1%	72.9%	100.0%	% of Students	40.4%	59.6%	100.0%	11.832	992	1	0.001
	% of Total	5.4%	14.6%	20.1%	% of Total	32.3%	47.7%	79.9%				
I can use a computer when I need one	% of Students	13.7%	86.3%	100.0%	% of Students	19.6%	80.4%	100.0%	3.892	1046	1	0.049
	% of Total	2.8%	17.4%	20.2%	% of Total	15.7%	64.1%	79.8%				
School's test results are discussed in community	% of Students	60.4%	39.6%	100.0%	% of Students	38.8%	61.2%	100.0%	8.447	545	1	0.004
	% of Total	5.3%	3.5%	8.8%	% of Total	35.4%	55.8%	91.2%				

Qualitative Results

This section summarizes the results of research questions 3-6.

3. What is the typical class size for freshman and sophomore English and math classes in large and small schools?

It was critical to ascertain that small schools typically had small classes in English and math and large schools ordinarily had large classes. One of the data points for the sample was the cohort in 10th grade. During this year students took the NSRE in math and English. Principals and guidance counselors reported the class sizes of freshman and sophomore English and math classes. The class sizes in the larger schools were markedly larger than those in the smaller schools. Most notably, the average size of advanced classes of the large schools was 22. The advanced class was named either “AP” or “Honors.” The advanced class sizes of the five large schools ranged from 15-27. The middle level class, usually called “College Prep,” averaged 20 pupils and the lower level, most often referred to as “Remedial,” averaged 18 students. When taken together, the average class size for the larger schools was 20.

The average English and math class size for the smaller schools was 11. Class sizes ranged from 5-19. The smaller schools offered one class per grade in English; advanced math students were placed in the next grade’s math class. The interviews confirmed my hypothesis: class size was considerably dissimilar in large and small high schools. Freshman and sophomore English and math classes in the larger high schools had almost twice as many students per class as did the smaller high schools.

In order to triangulate class size data reported from principals and guidance counselors I used the Vermont DOE database. Although Vermont does not calculate nor

collect class size data, teacher-student ratios could serve as a proxy measure for class size. As discussed previously, teacher-student ratio is not the same as class size. Nevertheless, the teacher-student ratios were smaller for small schools than they were for large schools which correspond to class size data reported by principals. These data also reflect declining teacher-student ratios during the research period, which makes sense in light of the statewide decreasing enrollment and decreasing class size as reported by principals.

Table 10 presents teacher-student ratio figures. This table includes elementary schools (labeled as feeder schools in the table) whose students are likely to later attend the targeted large high schools. The small schools are k-12 institutions and interviews with principals confirmed that most of the elementary school students attended the same school for high school. Additionally, small school principals reported that they do not receive many high school students from any one feeder elementary school. The small high schools do not receive a substantial percentage of students from any elementary or middle school other than their own. Further, the state does not separate the elementary classes from the high school classes for the purpose of reporting teacher-student ratios. For these reasons, there is no data on feeder elementary schools for the small high schools to report in the table.

Teacher-student ratios for feeder elementary schools and for large high schools was greater than that of small high schools. In terms of raw numbers, the ratio did not appear large. However, in examining the ratio in terms of percentages, it was evident that the teacher-student ratio in large schools was much higher than in small schools. In 2008, for example, the teacher-student ratio in large schools was 26 percent greater than

in small schools. In 2006, the teacher-student ratio was 21 percent greater in the large schools.

Table 9: Average Teacher-Student Ratio

	<u>Year</u>	<u>Enrollment</u>	<u>Classroom teachers</u>	<u>Teacher-student ratio</u> (to the nearest tenth)
<u>Large High Schools</u>				
Nixon	2008	992	86.5	11.2
	2006	1041	84.5	12.3
Feeder elem #1	2008	317	28	11.3
	2006	301	21	14.3
Feeder elem #2	2008	401	29	13.8
	2006	397	30.5	13.0
Madison	2008	1013	73.44	13.8
	2006	1043	69.57	15.0
Feeder elem #1	2008	252	17.5	14.4
	2006	279	17.9	15.6
Feeder elem #2	2008	324	24.5	13.2
	2006	346	21.5	16.1
Feeder elem #2	2008	581	36	16.1
	2006	620	36	17.2
Monroe	2008	1148	71.91	16.0
	2006	1167	72.7	16.1
Feeder #1	2008	313	17.4	18.0
	2006	262	14	18.7
Feeder #2	2008	400	22	18.2
	2006	307	19	16.2
Bush	2008	1196	87.3	13.7
	2006	1168	83.7	14.0
Feeder #1	2008	286	20	14.3
	2006	293	19	15.4
Feeder #2	2008	269	21.5	12.5
	2006	278	22.5	12.4
Feeder #3	2008	308	23.1	13.3
	2006	287	21.6	13.3
Feeder #4	2008	338	23	14.7
	2006	333	25	13.3
Buchanan	2008	1137	96.75	11.8
	2006	1199	95.73	12.5

Table 9 (cont.): Average Teacher-Student Ratio

	<u>Year</u>	<u>Enrollment</u>	<u>Classroom teachers</u>	<u>Teacher-student ratio</u> (to the nearest tenth)
Feeder #1	2008	736	40	18.4
	2006	774	53.5	14.5
Feeder #2	2008	697	39	17.9
	2006	662	48	13.8
<u>Small High Schools</u>				
clinton	2008	174	21.9	7.0
	2006	207	22.3	9.3
carter	2008	242	20	12.
	2006	258	19.6	13.2
coolidge	2008	167	18.5	9.0
	2006	186	21.5	8.7
reagan	2008	209	19	11
	2006	231	18.6	12.4
washington	2008	122	11.5	10.6
	2006	151	13.1	11.5
Mean large high schools	2008		13.3	
	2006		14	
Mean large feeders	2008		15.1	
	2006		14.9	
Mean small high schools	2008		9.9	
	2006		11	

Note. The feeder elementary schools had configurations of k-5, k-6 and k-8. This data does not include guidance counselors nor librarian/media specialists as part of its calculation.

Source: Vermont school report, 2009.

4. What factors do principals think most affect student achievement? Several questions were designed to elicit responses from principals concerning student achievement.

Principals cited many factors that affected student achievement and there appeared to be no major differences between the opinions of principals in large schools and those in small ones. Principals most frequently attributed teacher experience, teacher skill and the teacher-student relationship to increased student achievement.

Teacher Experience

The pilot interviews and research discuss the importance that teacher quality had on student achievement. It is difficult to measure teacher quality but teacher experience may serve as a proxy measure. An experienced teacher is likely to have gained a richer repertoire of strategies for helping students learn and for classroom management. This experienced educator may also have deeper content knowledge. Although it was not feasible to obtain the teaching credentials and content knowledge of the hundreds of teachers impacting the students targeted in this study, the state of Vermont collects data on teacher experience (See Appendix D for an explanation of the qualifications to be considered an experienced teacher, Level 2 license).

Table 10: Teacher Experience, 2007-2008 School Year

	<u># experienced</u>	<u>#not experienced</u>	<u>% experienced</u>
<u>Small High Schools</u>			
carter	21	2	91%
clinton	17	12	59%
coolidge	19	7	73%
reagan	19	5	79%
washington	17	3	85%
Mean for small schools			77%
<u>Large High Schools</u>			
Buchanan	65	36	64%
Bush	76	17	81%
Madison	58	31	65%
Monroe	73	18	80%
Nixon	56	20	74%
Mean for large schools			73%
<u>Mean for large and small schools</u>			<u>75%</u>

Source: Vermont Department of Education Credentialing Database, 2008.

Regardless of school size, principals overwhelmingly believed teacher experience was an important factor for student achievement. Those who felt that experience translated into positive outcomes believed experienced teachers knew how to structure learning and guide students, and pupils were more on task. For principals, more experienced teachers meant students were more likely to achieve at high levels.

Some principals preferred some experience though not necessarily too much.

“There’s something about the energy and creativity that newer teachers, those with two to

four years, have. It spurs on success.” Another offered, “There’s an impact but I can’t say a veteran will automatically guarantee higher achievement. Younger or newer teachers come with different tools, strategies and technology. Older new teachers are better.” Others thought it depended on the individual. “It’s teacher specific. Experience helps if it is a high quality teacher, it adds to their repertoire.” Another offered, “It’s invaluable if that experience is one of professional development and attitude and engagement.” One felt that quality veteran teachers have knowledge, know how to motivate, and know kids. He cautioned there were also “survivors,” teachers who have managed to stay in teaching despite their inability to motivate students.

Two principals answered similarly. He believed that with his “veteran staff,” there was less student success, the staff is more stuck. However, those teachers who have continued with their education improve. Another principal answered, “It varies. Experienced teachers who have kept learning are great. It depends less on years and more on the ability to be flexible. Others are hindered, stuck.”

The smaller targeted schools had a slightly greater percentage of experienced teachers than did the large schools (Table 11). Seventy-seven percent of teachers in the small schools had level II licenses signifying they had taught for at least three years; seventy-three percent of teachers in the larger schools had level II licenses and were thus considered experienced. Assuming that experienced teachers are more effective at helping students achieve, the small schools have a slight advantage. However, if, as two small school principals said, the veteran teachers are stuck and not as effective as newer teachers, the large schools have a small advantage.

The Teacher-Student Relationship

Principals used a number of terms to discuss teacher qualities that promoted high quality teacher-student relationship. Some described the characteristic as being innate, the teacher had to be a “kid person.” One principal said that first a teacher had to care about kids, talk with kids, and develop a relationship with kids. If a teacher does that, then he can learn content, management and instructional strategies. Another said that teachers who were successful at building and maintaining positive relationships looked at the whole child and not just subject matter. Believing every student can learn and having personal dedication to student success are two other traits mentioned. “If a student knows teachers care, that’s first.”

Teacher Skill, Practice and Knowledge

Principals used many words to describe teachers who successfully facilitated student learning. These teachers were, “Engaging, fun, passionate. They have content knowledge. Students can sniff this out.” They were authentic people who had knowledge and passion. Skillful teachers were scholarly and utilized a tool box of instructional strategies. One veteran principal said that it took at least five years to acquire these competencies.

One leader said that teachers should be able to help students achieve, knew content, used formative assessments, and had high expectations. Several spoke of a teacher’s ability to be flexible, adjust instruction, and “know interventions for when students don’t get it.” Classroom management, creativity, and using content as a means to an end were other attributes that principals believed skillful teachers possess.

Other Factors

Three school leaders named family or factors outside of schools as being critical for successful student achievement. These named factors were parent and family habits, involved parents, and students who feel part of a community outside of school. Professional development, collegiality and collaboratively assessing student work were sources named by three principals. Two principals named school culture or climate as key influences on student achievement. Other inputs besides teacher-related factors included outside school resources, school resources for struggling students, student assets, having a key adult in one's life, homework help, and school opportunities.

The principals made it abundantly clear that they did not rank class size as an important influence on student achievement. Only one principal mentioned class size as being an input most affecting student achievement of the approximately 30 responses from the 10 subjects.

5. Since class size appears to be shrinking due to declining enrollment and not policy decisions, were schools implementing practices to boost student achievement and if so, what were they doing?

School Organization

School size affects more than simply class size. In addition to the number of students in each class, other effects of school size emerged from the study. The impact of these factors on student achievement is not within the scope of this study; however their importance cannot be ignored. Indeed, they provide alternative hypotheses to the theory that class size is a critical factor in the educational achievement of Vermont students and therefore are discussed here.

Promoting Strong Teacher-Student Relationships

Since both principals and the literature deemed teacher-student relationships to be critical to student achievement, did schools intentionally design practices to foster these? Most of the larger schools developed programs or procedures to build close teacher-student relationships. Smaller schools, by and large, did not make a concerted effort to do this as some thought that the very nature of their school size promoted these relationships.

Advisory Programs

Some schools have advisory programs specifically designed to help students form a close relationship with at least one adult in school. Of the target schools, three large ones have an advisory and one is planning to put a program into place next year as a result of their NEASC evaluation. The programs include one that meets for 25 minutes daily and has two teachers with 25 kids, one that meets each day for 20 minutes and has one or two adults with 15 students, and one that meets weekly for 45 minutes where teachers and students remain as a group for four years.

None of the small schools operate an advisory program. One said the school had one but he felt the teachers were not ready. According to him they did not have the interpersonal relations nor skills. Another tried but the teachers resisted maintaining that they were not guidance counselors. A third reported that being a small school made an advisory program less essential.

Other Practices

A number of principals cited practices or examples of action that encouraged close relationships that appeared to be coincidental and not intentional. For instance, in

some schools teachers are athletic coaches and lead drama and other co-curricular activities.

Smaller schools did not appear to take specific steps to foster close teacher-student relationships. As one principal told me, “Because of class size, it happens naturally. Our biggest class is less than 20. There’s nothing special, educational support teams, study hall.”

In another small school teachers chose to have lunch with kids as most of the high school ate lunch together in the cafeteria. He also said that because it is a kindergarten through 12th grade school, teachers saw students on special days, carnivals, and in the halls. Students also had the same teacher year after year. In addition, “Block scheduling helps. Fifty-sixty minutes of traditional teaching and 30 minutes for help on projects and homework one on one.” He said that small classes and more time also helped foster close relationships. Another small school principal believed that they intentionally foster these relationships. Every staff member was an unpaid class advisor that stayed with the class for all four years. He mentioned school-wide experiences outside of school such as parades and students saw staff outside of school as examples of how close teacher-student relationships were promoted. One principal of a small school said that it ebbs and flows depending on the teachers and their personal commitments. He cited k-12, all-school activities as examples. One of the purported benefits of smaller classes is the ability a teacher has to know a student. Indeed, this is a prime argument used to oppose large schools and classes. Whether the relationship between teacher and student is stronger and thus translates into better student achievement was not investigated in this study. However, the literature reported that teachers do not alter their behavior when

teaching a small class compared to a large class. This study found that larger schools are modifying their practices in order to strengthen teacher-student relationships.

Teacher Collaboration

The literature and the Vermont State Board of Education made note of teacher collegiality (for example, professional learning communities) and coaching as important contributors in increasing student achievement. Practices gaining popularity include utilizing protocols and committees to look at student work, developing common assessments, working in teams, and using teacher coaches. There was a dramatic difference between large and small schools in this area. Four of the five large schools had some sort of teacher teams. The most common arrangement was by department. Teachers regularly met to analyze results of formative assessments, develop common assessments, participate in Critical Friends groups, evaluate curriculum and determine professional development needs. None of the small schools answered affirmatively. Neither small nor large schools used teacher coaches. Some were familiar with the concept, but they either did not have them or used the traditional department head model.

6. Since class size and school size are linked in Vermont (small schools tend to have smaller classes and larger schools tend to have larger classes), what other differences exist between large secondary schools and small secondary schools that may impact student achievement?

The relationship between small schools and small class size, and large schools and large class size can also be described by the number of teachers with whom a student studied in English and math. All of the large schools reported that students had a different math and English teacher for each grade. That was usually the only instance

students had the teacher unless they happened to have that same teacher for an elective. All of the small schools reported that students had one teacher for all four years in math and another for four years of English unless they attended a career center or took an unusual elective. One small school had an English teacher and a math teacher for grades 7-9 and another for grades 10-12. A small school principal felt that there were both advantages and disadvantages to having the same English or math teacher for four years. “Teachers know individual kids and can move them along from where they are. Teachers don’t look at kids on a one year basis. They have four years. This could also be a drawback. They lose a sense of urgency.”

While the relationship between school size and class size is not necessarily a factor in the national debate on class size, it is an important matter in Vermont where class size and school size are intricately linked. A case in point is Leithwood and Jantzi’s (2009) review of 57 empirical studies of school size effects on student and organizational outcomes. In their conclusion they wrote that smaller schools were generally better for most purposes. They emphasized that, “*Smaller* is a relative term. In districts with secondary school sizes exceeding 2,500 students, for example, smaller can mean as many as 1,500 students, a size that would be considered very large in other districts.” In addition, “The breadth of the curriculum, often cited as a major advantage of large comprehensive secondary schools, seems achievable in schools as small as 500-600 students (Leithwood & Jantzi, p. 484). Large secondary schools in Vermont would be considered small in their review and in many parts of our country.

Other Educational Outcomes

Since students' post-secondary plans were studied as a measure of achievement (see Table 3, p. 46), principals were asked what their school did to help all students see college as an attainable goal. There were no substantial differences between small and large schools in this area. In most schools the guidance counselors took the lead. In some schools counselors spoke to students about the benefits of college and the importance of finding the right fit. Counselors helped students schedule classes and told them what they needed for high school and college. In a few schools all students took a semester of career exploration where they listened to presentations about businesses, the college admission process, and finding the right college. Some principals reported that teachers frequently referenced college in their classes.

Several interview subjects felt that it is neither a wise nor realistic goal for all students to go to college. Some kids just wanted to graduate high school while others were headed for work or a technical school. It was difficult to determine whether what schools did to make college accessible for all was truly a conscious and serious effort or whether the practices were the same as they have been for generations. The Vermont Student Assistance Corporation and Upward Bound were referenced by one school, but otherwise there did not seem to be conscious effort to address the goal of having all students view college as attainable. Nevertheless, as reported in the quantitative section, students in large schools pursued two or four year colleges at a significantly higher rate than students in smaller schools – 79 percent to 59 percent.

Other “High School on the Move” Goals

Principals were questioned on other practices that were encouraged by the State Board as part of its vision for education transformation in Vermont. Questions covered the topics of professional learning communities, extra support for 9th graders, personalized learning plans for students, and small learning communities. For the most part, none of the 10 Vermont high schools in this study embraced these practices. The principals were knowledgeable about some of the concepts and ignorant of others. For instance, many believed their schools had small learning communities but none portrayed that in terms of the school being divided into houses for all students or small learning communities for all. Instead they cited small communities for students with distinct characteristics such as ELL students, 9th grade teams, JROTC, the alternative school, and the students who attended the technology center.

No schools used personalized learning plans. Some believed they provided extra support for some 9th graders, but none of the schools had a freshman academy.

Course Offerings

One of the State Board of Education’s goal was for schools to have rigorous curriculum expectations. There was a sizeable disparity in the number and range of challenging (advanced) courses between large and small schools. Four of the five principals of large schools reported that they had a vast array of AP and honors classes in nearly all departments. Only two small schools had honors or AP classes and very few at that. One small school had an honors level English course, one had AP English and calculus, and another considered anatomy, physiology, and history electives to be challenging.

Summary of the Findings

It was abundantly evident that the principals interviewed in this study, similar to many researchers and authors in the literature, believed there were many inputs that affected student achievement. Class size was not among those frequently cited, although it was mentioned. Instead, teacher-student relationships and teacher quality were the most commonly named influences.

There were also noticeable programmatic differences between large and small schools. The small school principals knew best practices, programs and ideas but lacked the human and financial resources to implement them. There was an expressed sentiment that there were too few students and faculty to implement the changes. For example, if a school had one high school math teacher who taught four or five different math courses, it was much harder to collaboratively assess student work and develop common assessments than if one was part of a school with eight math teachers.

CHAPTER 5: DISCUSSION

This chapter discusses the results of this research study and is organized into five sections. Section one introduces the chapter. The second section considers the limitations of this study, essential for an accurate understanding and analysis of the findings. Section three presents a summary of the findings. The fourth section contends with the policy implications of the findings. The final section offers recommendations for further research.

Research Questions and Related Topics

The following research questions were the basis for this study: 1.

How are the outcomes for Vermont students who are educated in small classes different from those educated in larger classes in respect to:

- a. immediate post graduation plans of students?
 - b. graduation rate?
2. Are there statistically significant differences between large and small class sizes with respect to:
- a. student achievement as measured by New Standards Reference Exam math test scores?
 - b. student achievement as measured by New Standards Reference Exam English/language arts test scores?
 - c. opportunities that students have to learn reading and mathematics as measured by a series of questions (Opportunities to Learn) concerning student experiences and the size of classes they actually experienced during high school?

3. What is the typical class size for freshman and sophomore English and math classes in large and small schools?
4. What factors do principals think most affect student achievement?
5. Since class size appears to be shrinking due to declining enrollment and not policy decisions, were schools implementing practices to boost student achievement and if so, what were they doing?
6. Since class size and school size are linked in Vermont (small schools tend to have smaller classes and larger schools tend to have larger classes), what other differences exist between large secondary schools and small secondary schools that may impact student achievement?

Summary of Findings in this Study

The primary goal of this research study was to determine if small classes resulted in improved student achievement compared to those students in larger classes. Although Vermont does not have the large class sizes of the quasi-experimental studies and policy initiatives cited in the literature, it does have a wide range of average class sizes. The targeted high school math and English classes of this study ranged from an average of 11 students in the average small class to 20 in the average large class. If class size were a critical influence on students' academic achievement, one would expect to see significant differences between students who were educated in classes nearly twice as large as other classes. This study concludes that there was no such difference. In terms of academic achievement, with the exception of 10th grade math scores, students in larger classes performed the same or better than students in smaller classes. Students in larger classes

had slightly higher graduation rates, and a larger proportion planned to attend two or four year college.

The literature and Vermont principals agree that teacher quality and the teacher-student relationship are what most impacts student achievement. Concepts that have been mentioned in this study that might improve teacher quality include: ongoing, high quality professional development; regular and focused teacher collaboration; strong supervision of teachers; high quality teacher training programs; and hiring and compensating skilled teachers. All schools can deliberately foster strong relationships between teachers and students. Larger schools can create teams or houses, schedules that enable students having teachers for more than one class, utilizing advisories, and creating a school culture where relationships are fundamental.

Conclusions

Popular Support for Small Classes; the World is a Different Place

Few would argue the premise that schools, teaching, and students are vastly different than they were two and even one generation ago, and yet the basic structure of our schools remains the same. To some, smaller class size is the way to address the many changes schools face. Pedagogical practices in many classes are not what they once were. Today's classes routinely emphasize group work, hands-on activities, inquiry, and discovery-oriented lessons while having less seatwork and lecture. Classroom management techniques are significantly different. No longer is corporal punishment permissible in most schools in the U.S. Respect for authority, including teachers and other educational professionals, has changed. Teachers and schools are now routinely questioned and challenged by parents, community members, and even students.

Society has different expectations of schools. Teachers are expected to educate all students to a level of proficiency, and often in the same classroom regardless of differences in ability. In the past, classroom teachers did not have students with significant special needs and behavior problems. If they did, the expectations for their learning were not the same. Schools have become social welfare institutions in addition to educational institutions. They now have an important role in children's physical and emotional well-being in addition to their intellectual health.

The emphasis of many schools today is very much on the individual. There is a great deal of educational literature and pedagogical practice devoted to different learning styles, different kinds of intelligence, the importance of self-esteem and letting the individual study his passions and interests.

It is reasonable to conclude from this research study that class size does not significantly affect student academic achievement in Vermont. The differences in class size do not appear to be related to the provision of selected opportunities to learn, test scores or graduation rates. This being so, it behooves educators and policy makers to consider both the educational and economic effects of class size when making decisions concerning the future organization of Vermont schools. Policy makers and educators would be wise to address and institutionalize procedures that more positively impact student achievement than does class size.

With the above forces at work, it is no wonder that many educators and parents view small classes as vital. While small classes may help address the needs stated above, they are apparently not related to academic achievement in Vermont.

Limitations of the Research

As indicated in Chapter 1, several important limitations must be taken into account when discussing the findings of this study. In addition to those, there are limitations to the analysis of the qualitative data. Interview data can have limitations that include distorted responses due to personal bias, anger, anxiety, politics, and the emotional state of the interviewee at the time of the interview. The data can also be subject to erroneous recall, reactivity of the interviewee, and self-serving responses (Patton 2002, p. 306).

The information gathered from interviews was limited to principals and guidance counselors. Perspectives of students, teacher and other school personnel could add greater depth to the understanding of this complex phenomenon.

Measuring teacher quality or the teacher-student relationship was beyond the scope of this study. However, it would be important to know if there were significant differences between teacher quality and the nature of the relationships formed in the targeted small and large classes in this study. If this were true it could account for differences in student outcomes. Teacher experience could serve as a proxy measure for teacher quality. Data collected from the state of Vermont (see Table 11) showed that smaller schools had a greater percentage of experienced teachers than did larger schools as determined by their level of licensure.

Implications

Potential Effects

As student enrollment declines, schools are able to offer fewer programs and classes making them less attractive to students and families. This is important as some

forms of school choice exist in Vermont. High schools in Vermont enroll some students from outside their district boundaries; therefore the perspectives of potential students influence their enrollment. In addition, Vermont allows a certain number of students to attend a high school regardless of whether one resides within a district or not. Further, if attitudes towards a high school are negative, parents and students can choose private school, educate at home, or move. Unless Vermont experiences unexpected demographic changes, small schools will likely continue to see enrollment numbers decrease and corresponding cuts in programs and classes.

Consequences of Maintaining the Status Quo

Assuming current demographic trends continue, the population of school age children in Vermont will continue to decline. What will be the options for small schools and districts? Will Vermonters continue to look at other ways to save money such as cutting programs and services? Will the public continue to debate education funding mechanism instead of issues such as student achievement?

The Elephant in the Room: Funding

This study found that students in small and large classes in small and large schools produced similar achievement results. It therefore calls into question the greater cost it requires to fund smaller schools. The data in Table 12 demonstrate the variance in cost to educate students in large and small schools. The budgets per equalized pupil for fiscal year 2008 average \$12,340 for large schools and \$16,723 for the small schools, a difference of \$4,383. The costs ranged from a high of \$17,647 for a small school to \$10,983 for a large school, a difference of \$6,664.

For fiscal year 2008, the average spending per equalized pupil was \$9,932 for large schools and \$12,193 for small schools, a difference of \$2,261. The costs ranged from a high of \$13,205 for a small school to \$8,962 for a large school, a difference of \$4,243 (Vermont DOE, FY 2008 per pupil spending by school type).

Table 11: Per pupil spending FY 2008

	<u>FY2008 Budgets per Equalized pupil</u>	<u>FY2008 Spending per Equalized pupil</u>	<u>Rank</u>
<u>Large High Schools</u>			
Bush	\$14,737	\$8,962	238
Nixon	\$11,863	\$10,434	186
Adams	\$11,508	\$10,239	195
Madison	\$10,983	\$9,639	224
BFA	\$12,613	\$10,389	189
Mean large high schools	\$12,340	\$9,932	206
<u>Small High Schools</u>			
clinton	\$17,647	\$11,250	125
reagan	\$17,550	\$13,205	9
carter	\$17,500	\$12,942	18
coolidge	\$15,552	\$10,549	182
washington	\$15,366	\$12,973	16
Mean small high schools	\$16,723	\$12,193	70

Source: Vermont Department of Education, FY 2008 per pupil spending by school type.

Recommendations for Further Research

Attracting and Retaining Quality Teachers

A byproduct of the phenomenon of declining student enrollment in Vermont may be its effect on retaining and attracting quality teachers. This raises a number of questions. Will teachers choose to work in a school experiencing a reduction in its resources, course offerings, and student population? Will teachers remain in a school if there are available positions in a nearby school not subjected to these hardships? Will schools facing these financial challenges be able to offer the same salary and benefits as a school that is not? Are there ways in which schools can organize and practices they can follow which will support the recruitment and retention of high quality faculty? Since the quality of teachers that a student has may be the most influential factor that a school can effect, a greater understanding of how to attract and retain these professional in light of the challenges brought on by declining enrollment would be crucial.

Special Education: Inclusion/Mainstreaming

This study did not examine the inclusion of special education students and how this interacts with class size. Vermont is known for its commitment of including students with disabilities in mainstream classes. A survey concerning class size related to this study (Appendix C) found that Vermont principals and teachers believed that the practice of inclusion of special education students in regular education classes warrants smaller classes. Their rationale was that if regular education classes were to educate students substantially outside of the norm, then classes had to be smaller in order for teachers to meet everyone's learning needs.

An issue related to mainstreaming is the notion of ability grouping, a practice more common in the targeted larger Vermont schools than the smaller ones. If inclusion were to continue to be the standard practice, further investigation would provide valuable information as to the benefits and downsides of grouping students by academic ability.

Teacher Quality and Teacher-Student Relationships

As previously noted, evaluating teacher quality and teacher-student relationship was beyond the scope of this study. Yet both of these topics were cited in the literature and the research study as being highly influential to student educational outcomes. It is important to know if there are significant differences between teacher quality and the nature of the relationships formed in small and large classes and what can be done to strengthen both of these influences. Are there significant differences between large and small schools in regard to the opportunities for teacher collegiality and professional growth through professional development opportunities? Are there substantial differences in the nature of teacher-student relationships in small and large schools?

School Size

The aim of this study was to investigate the effects of class size on student achievement. However, in Vermont, it was not possible to separate class size from school size. As demonstrated in this study, small schools had small classes and large schools had larger classes. It is conceivable that schools in Vermont or other states could be organized differently. That is, large schools could have smaller classes and small schools could have larger classes. Further study of the relationship of class size and school size would substantially add to our understanding of the effects of both class and school size.

Limitations of Small Schools

Principals of small schools gave the impression of being confounded by their limitations. They reported that their small schools struggled to reach beyond their campuses and to innovate, largely due to limited staff and resources. Research into how these constraints may impact teachers and students is important to understand in order to overcome them. What are the effects on a student's academic achievement that has one teacher per subject for all four high school years? Are there different outcomes due to the fact that students in large schools have more course offerings, more variety of teaching practices, and a greater diversity of students within a class? Are there other effects of school size on student academic achievement?

REFERENCES

- Achilles, C. M. (2003). *Testimony and evidence to support small classes, k-3*. Edited and revised version of material presented to The New York State Senate Democratic Task Force on School and Equity, July 12, 2001.
- Achilles, C.M., & Finn, J. (2002, February). *Making sense of continuing and renewed class-size findings and interest*. Paper Presented at the Annual Meeting of Association of School Administrators, San Diego, CA.
- Achilles, C. M. (1999). *Let's put kids first, finally: Getting class size right*. Thousand Oaks, CA: Corwin Press.
- Angrist, J. D., & Lavy, V. (1999). Using Maimonides' rule to estimate the effect of class size on scholastic achievement. *The Quarterly Journal of Economics*, 114(2), 553-575.
- Biddle, B. J., & Berliner, D. C. (2002). *What research says about small classes and the pursuit of better schools*. Education Policy Reports, Arizona State University, Tempe.
- Bohrnstedt, G.W., & Stecher, B.M. (Eds.). (2002). *What we have learned about class size reduction*. California Department of Education: Sacramento.
- Bonesronning, H. (2003). Class size effects on student achievement in Norway: Patterns and explanations. *Southern Economic Journal*, 69(4), 952-965.
- Borland, M., Howsen, R. M., & Trawick, M. W. (2005). An investigation of the effect of class size on student academic achievement. *Education Economics*, 13(1), 783.

- Bracey, G. (1999). Reducing class size: The findings; the controversy. *Phi Delta Kappan*, 81(3) 246-247.
- Brewer, D., Krop, C., Gill, B., & Reichardt, R. (1999). Examining the costs of national class size reductions under different policy alternatives. *Educational Evaluation and Policy Analysis*, 21(2) 179-192.
- Cooper, H. M. (1989). Does reducing student-to-instructor ratios affect achievement? *Educational Psychologist*, 24(1), 79-98.
- Corbett, G., & Huebner, T. (2004). *Rethinking high school: Preparing students for success in college, career, and life*. San Francisco: WestEd.
- Cresswell, J. T., & Garrett, A. L. (2008). The “movement” of mixed methods research and the role of educators. *South African Journal of Education*, 28, 321-333.
- Egelson, P., Herman P., Hood, A., & Achilles, C. M. (2002). *How class size makes a difference*. Tallahassee, FL: SERVE.
- Ehrenberg, R. G., Brewer, D. J., Gamoran, A., & Willms, J. D. (2001). Class size and student achievement. *Psychological Science in the Public Interest*, 2(1), 1-30.
- Finn, J. D. (1998). *Class size and students at risk: What is known? What is next?* Washington, DC: Office of Educational Research and Improvement.
- Glass, G.V., Cahen, L. S., Smith, M. L., & Filby, N. N. (1982). *School class size: Research and policy*. London: Sage.
- Graue, E., Oen, D., Hatch, K., Rao, K., & Fadali, E. (2005, April). *Perspectives on class size reduction*. Paper presented at the symposium Early Childhood Policy in Practice: The Case of Class Size Reduction at the annual meeting of the American Educational Research Association, Montreal, Canada.

- Hanushek, E. A. (1999). The evidence on class size. In S. Mayer & P. Peterson (Eds.), *Earning and learning: How schools matter*. Washington, DC: Brookings Institution Press.
- Hattie, J. (2005, May). *The paradox of reducing class size and improving learning outcomes*. Keynote presentation at the International Conference on Class Size, University of Hong Kong.
- Hirschfeld, P. (2009, June 12). Too many schools, too few students, says ed chief. *The Times Argus*.
- Hoxby, C. M. (2000). The effects of class size on student achievement: New evidence from population variation. *The Quarterly Journal of Economics*, 115(4), 1239-1285.
- Johnson, K. (2000). *Do small classes influence academic achievement? What the National Assessment of Educational Progress shows*. Center for Data Analysis Report #0007.
- Johnson, R. B., & Onwuegbuzie, A. J. (2004) Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14–26.
- Kumka, C. (2009, April 1). Enrollment declines continue in Vermont schools. *The Times Argus*.
- Lazear, E. P. (2003). Educational production. *The Quarterly Journal of Economics*, 116(3), 777-803.
- Leithwood, K., & Jantzi, D. (2009). A review of empirical evidence about school size effects: A policy perspective. *Review of Educational Research*, 79.
- Lewit, E. B., & Baker, L. S. (1997). Class size. *Financing School*, 7(3), 1-10.
- Miller-Whitehead, M. (2003, November). *Compilation of class size findings: Grade level, school and district*. Paper presented at the Annual Meeting of the Mid-south Educational Research Association, Biloxi, MS.
- Mitchell, D., &

- Mitchell, R. (2000). *Class size: An amendment reflecting further research on state policies*. California Educational Research Cooperative, University of California Riverside.
- Molnar, A., Smith, P., Zajorik, J., Palmer, A., Halbach, A., & Ehrle, K. (1999). Evaluating the SAGE program: A pilot program in targeted pupil-teacher reduction in Wisconsin. *Educational Evaluation and Policy*, 21(2), 165-177.
- Mosteller, F. (1995). The Tennessee study of class size in the early grades. *The Future of Children*, 5(2), 113-127.
- Mosteller, F. (1999). How does class size relate to achievement in schools? In S. Mayer & P. Peterson (Eds.), *Earning and learning: How schools matter*. Washington, DC: Brookings Institution Press.
- National Center of Education Statistics, Digest of Education Statistics. (2008). *Enrollment trends*. Retrieved February 11, 2007 from <http://nces.ed.gov/fastfacts/display.asp?id=65>
- National Center of Education Statistics, Digest of Education Statistics. (2008). *Table 63, Public elementary and secondary pupil/teacher ratios, by enrollment size, type, and level of school: Fall 1987 through fall 2006*. Retrieved February 11, 2007 from http://nces.ed.gov/programs/digest/d08/tables/dt08_063.asp
- Normore, A., & Ilon, L. (2006). Cost-effective school inputs: Is class size reduction the best educational expenditure for Florida? *Educational Policy*, 20, 429-454.
- Nye, B., Hedges, L., & Konstantopolous, S. (2004). Do minorities experience lasting benefits from small classes? *Journal of Educational Research*, 98(2), 94-100.

- Patton, M. (2002). *Qualitative research & evaluation methods*. Thousand Oaks, CA: Sage Publications.
- Pong, S., & Pallas, A. (2001). Class size & 8th grade math achievement in the U.S. and abroad. *Educational Evaluation and Policy Analysis*, 23(3), 251-273.
- Reichardt, R. (2000). *The cost of class size reduction: Advice for policymakers*. Doctoral dissertation. Rand Graduate School, Santa Monica, CA.
- Resnick, L. (Ed.). (2003). Class size: Counting kids can count. *American Educational Research Association*, 1(2), 1-4.
- Saas, D. (2007, January). *School finance in Vermont: Balancing equal education and fair tax burden*. Discussion paper 07-1. New England Public Policy Center, Boston.
- Seiffert, E. (2007, February 4). When is small too small? *The Times Argus*.
- Slavin, R. (1989). Class size and student achievement: Small effects of small classes. *Educational Psychologist*, 24(1), 99-110.
- The Times Argus. (2007, February 4). *When is small too small?*
- Tomlinson, T. (1988). *Class size and public policy: Politics and panaceas*. Washington, DC: Office of Educational Research and Improvement.
- Vermont Department of Education (DOE) (2006). *School quality standards. State board of education manual of rules and practices*. Retrieved June 12, 2009 from <http://education.vermont.gov/new/pdfdoc/board/rules/2000.pdf>
- Vermont DOE. (2008). *Laws & regulations: School choice in Vermont: Act 150 & other laws*. Retrieved June 12, 2009 from <http://education.vermont.gov/new/html/laws/act150.html#other>

- Vermont DOE (2009). Educator licensing: Licensing regulations & endorsement areas. 5420 Level II Professional Educator's License. Retrieved October 31, 2009 from http://education.vermont.gov/new/html/licensing/regulations_endorsements.html
- Vermont DOE. (2008). *Vermont public school dropout and high school completion report for the 2007-2008 school year*. Retrieved June 12, 2009 from http://education.vermont.gov/new/html/data/dropout_completion.html
- Vermont DOE. (2008) *Vermont secondary schools for the 21st century: Ensuring each student can succeed in college, career and citizenship*. Retrieved June 12, 2009 from http://www.education.vermont.gov/new/pdfdoc/dept/transformation/secondary_schools_081908.pdf
- Vermont DOE. (2009). *FY 2008 per pupil spending by school type*. Retrieved June 12, 2009 from http://education.vermont.gov/new/pdfdoc/data/per_pupil/per_pupil_08.pdf
- Vermont DOE. (2009). *School data & reports: enrollment report* (updated 3/26/09). Retrieved June 12, 2009 from <http://education.vermont.gov/new/html/data/enrollment.html>
- Vermont DOE. (2009). *School data & reports: teacher/staff full-time equivalency (fte) and salary report* (updated 10/28/08). Retrieved June 12, 2009 from http://education.vermont.gov/new/html/data/teacher_FTE.html
- Vermont DOE. (2009). *Student performance: indicator definitions*. Retrieved December 1, 2009 from: <http://crs.uvm.edu/schlrpt/perform.htm>

Vermont DOE. (2009). *Vermont department of education school report*. Retrieved June 12, 2009 from <http://crs.uvm.edu/schlrpt/cfusion/schlrpt08/vermont.cfm>

Ward, J. G., & Laine, S.W. (2000). Implications of class-size reduction research for practice and policy. In S. Laine and J. Ward (Eds.), *Using what we know: A review of the research on implementing class-size reduction initiative for state and local policymakers*. Naperville, IL: NCREL.

Wenglinsky, H. (1997). *When money matters: How educational expenditures improve student performance and how they don't*. Princeton, NJ: Educational Testing Service.

Witte, J. F., & la Follette, R. M. (2000). Reducing class size in public schools: Cost benefit issues and implications. In S. Laine and J. Ward (Eds.), *Using what we know: A review of the research on implementing class-size reduction initiative for state and local policymakers*. Naperville, IL: NCREL.

Yan, W. (2004). The effect of kindergarten program types and class size on early academic performance. *Education Policy Analysis Archives*, 27, 1-22.

Appendix A: Interview Questions for Principals and Guidance Counselors, 2009

My name is Amos Kornfeld. I am a doctoral student doing dissertation research in the Educational Leadership and Policy Studies program at the University of Vermont. I am also principal of the Ottauquchee School in Quechee, Vermont.

The purpose of this research is to help educators and policy makers better understand the effects of class size on selected student outcomes.

I would like to ask you questions concerning your school and opinions regarding matters pertaining to class size and student achievement. The interview should last between thirty and forty-five minutes.

Participation in this interview is voluntary and you may choose to withdraw at any time or choose not to answer every question.

I intend to use this information to write my dissertation. No schools or individuals will be identified. The information will be included in my dissertation, shared with the university community and hopefully published and presented to the Vermont legislature. Only my advisor will have access to the interview data. I may be contacted by phone at work- 802.295.8654, or 802.649.2572 at home, or by email, kornfeldm@hartfordschools.net.

If you have any questions about your rights as a participant in a research project you should contact Nancy Stalnaker, the Director of Research Protections Office, at the University of Vermont at 802.656.5040.

Do I have permission to begin asking you questions?

I. Introductory Questions

1. What inputs do you think most affect student achievement?
2. What's your measure of the quality of math/English teaching in your school? Are students optimizing their learning?
3. To what do you attribute the achievement of your students in English and math?
4. What are the per pupil costs in the elementary, middle, and high schools?

II. Class size Questions

5. What are the class sizes for freshman and sophomore English and math?

6. How are students grouped? If by ability, do class sizes differ depending on the ability of students?
7. Does the amount of students you have determine the number of levels of classes you offer?
8. How many math and English teachers does a student typically have in 9th and 10th grade?
9. When you divide classes because of the number of student, are you placing students based on their academic ability?
10. What is the typical teacher-student load for English and math teachers? What is the range?

III. Teacher experience

11. Based on your experience, what do you think the effect of teacher experience is on student achievement?
12. What role does teacher experience play when a principal is recommending the hiring of a teacher?

IV. Teacher-student relationships

13. Does your school structure itself in a way to foster close teacher-student relationships? 14. Is there a teacher advisory program?
15. Do students typically have a teacher for more than one year?
16. How many students does an English or math teacher typically teach in a day?

V. Teacher qualities/hiring.

17. What qualities do effective teachers have?
18. How is decided as to who teaches lower and higher level English and math classes?
19. When hiring, how much emphasis do you place on college transcripts especially the courses taken and disciplines in which a candidate has minored and majored?

VI. High school reform oriented questions.

20. Does your school do anything to help all students see college as an attainable goal? If so, what?

21. What have you done to strengthen academic programs?
22. How have you worked to ensure coherent curriculum from middle grades through high school.
23. Do you provide extra support during 9th grade? If so, provide examples?
24. Do you do anything to bring out-of-school youth back to school?
25. Do you do have personalized learning plans? Small learning communities?
26. Do you consider your school to have an engaging curriculum? Challenging courses?
27. Describe the way your school is governed.
28. Do you have any of the following: teacher teams, coaches for teachers, protocols and committees to look at student work?
29. Do you have any of the following: Community partnerships (businesses, mentorships, relationships w/adults, and college partnerships/kids take college classes?)

Appendix B: Pilot Interviews, May, 2008

I am studying the effects of class size on student achievement. I'm using a longitudinal data base. I will be looking at this year's senior class and using English language arts and math NSRE scores from when they were in grades 4, 8, and 10 to get at the achievement piece. I am also interested in other data such as SES, learning opportunities, graduation rates and post-secondary plans. Schools will not be names and I will be glad to share my findings with you.

There is a lot of data that I can access from the state, but I am hoping that you can provide me with insides that one can not get from numbers. I'm particularly interested in English and math classes since that is where the most accessible test data is. So please frame your thinking in terms of students and teachers in those classes. Do you have any questions?

1. First, what do you think has the *greatest* affect on student achievement? (Follow up depending on answer)
2. What role do *teachers* play in student learning?
3. What *qualities* do effective teachers have?
4. In your opinion, what effect does class size have on student achievement for freshmen and sophomores in their English and math classes?
5. How might class size play a role in student achievement in math and English?
6. What teachers typically teach the lower level classes in math and English?
7. I have the English and math measures on your kids. They look good. Why?
8. How are math and English teachers assigned to the classes they teach?
9. These responses are confidential. What's your sense of the math and English teaching in your school? Are kids learning? Could they be learning more? How?
10. Do you consciously have smaller classes for lower achievers in English and/or math?
11. How about larger classes?
12. When you divide classes into multiple sections, does student ability play a role in your decision?

13. What percentage of kids would you say are taught by experienced math or English teachers?

14. How many math and English teachers does a student typically have in 9th and 10th grade?

15. Can you name your sending schools? What's your sense of them? Any idea of class size in English and math? Do you think the kids are prepared?

16. When you hire teachers, are any of the following very important:
Teacher experience, Teacher preparation programs and degrees, Teacher certification, Teacher coursework, or Teachers' own test scores

As I learn more, I may call you back. As I start looking at the data of their kids, I'll have more questions and data for you.

Appendix C: Another Perspective: 2007 Survey of Vermont Teachers and Principals

In 2007, I conducted a survey of classroom teachers and principals in five small Vermont schools, three were elementary schools and two were kindergarten through twelfth grader institutions. The surveys consisted of twenty questions, fourteen multiple-choice questions and six open-ended ones. Forty-one completed surveys of the fifty distributed were returned. 78% (32) of the respondents had been educators for at least six years, the majority for more than ten years. While this survey represents a relatively small sample size, it revealed interesting data concerning class size from an important constituent group.

-When they were students, 73% (30) of the educators typically attended elementary school classes with 21 or more students.

- 90% (37) answered that the classes they have taught have been generally smaller or the same size as the classes they attended as children.

- 85% (29) of educators who responded to the following question answered affirmatively:

Are there factors today that warrant smaller classes? Factors listed are: too many students on individual learning and behavior plans, less support from homes so students need more attention and academic support, families are under stress, teachers need to differentiate more effectively, greater demands on teachers to use time more flexibly, schools are expected to give a personal touch, public schools are teaching a greater percentage of the population, more diverse students than ever before, many homes do not teach basic social skills and respect or basic skills (abc's, reading, self-care) before kids enter school, more social issues that carry over into classroom, greater accountability for test scores, students have more health conditions, it is easier to teach reading and writing

with small classes, schools don't just teach academics-meal programs, health issues, social issues, daycare- options were not part of years past, knowing individual students strengths and weaknesses.

- 47% of the respondents who answered this question, (16 of 34), said there were factors today warranting larger classes. These include: our students' parents are in debt, the need to utilize resources to best extent possible, some classes have fewer than eight pupils, multi-age classrooms can allow for larger classes, property taxes are too high, schools are cutting programs to keep class sizes small, funding, assessment data are difficult to interpret with smaller numbers, grades, social-emotional needs, could have average and high skilled classrooms.

Appendix D: Teacher Experience

The state of Vermont licenses teacher at two levels: one and two. After three years a teacher may apply for a level two license. According to the VT Licensing Regulations: “A Level II Professional Educator’s License shall be issued, upon recommendation of a local or regional standards board, or the Office if the educator is not employed by an entity served by a local or regional standards board, to educators who have:

- a. practiced in Vermont in an endorsement area for three (3) years under a Level I License.
- b. provided evidence of three (3) relicensing credits, at least one (1) of which shall address the specific knowledge and performance standards of the endorsement being moved to Level II.
- c. submitted an approved Individual Professional Development Plan (IPDP) that was developed through analysis of professional practice and classroom data, and that articulates the educator's professional development goals for the ensuing licensure period. The IPDP goals shall address the knowledge and performance standards in effect at the time of renewal for each endorsement being moved to Level II, each of the *Five Standards for Vermont Educators*, and the action plan or improvement initiatives of the school where the educator is employed, as appropriate;
- d. provided verification from an administrator who has supervised the educator's work that the educator is performing at a professional level. The Office shall provide a signature form for administrators to use for this purpose;
- e. provided documentation of any valid licenses or credentials that are required by the endorsement(s) sought.”