

School Size and its Relationship to Achievement and Behavior

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Acknowledgments

The Evaluation Section convened a small working group on School Size within the Division of Accountability Services to assist in thinking through (1) state-level data available on achievement and behavior that could be related to school size and (2) analysis procedures most suited to study these relationships. Appreciation is extended to all members of this working group: Bradley McMillen, Gongshu Zhang, Carolyn Cobb, Gary Williamson, Kris Kaase, Judy Williams, and Helmut Feifs. Bradley McMillen conducted the literature review, conducted the analysis of dropout rate data by school size, and is the primary author of the report. Gongshu Zhang carried out all of the analyses on school size and achievement. Kris Kaase conducted the analysis on school violence data and school size. Judy Williams and Helmut Feifs carried out early exploratory analyses. All members contributed to the conceptual discussion, what to look for, how analyses should be conducted, and editing the final report.

Executive Summary

In the 1999 legislative session, House Bill 168 (Session Law 1999-237; Section 8.33) directed the State Board of Education (SBE) to study the relationship between school size and the behavior and academic performance of students in North Carolina. The Evaluation Section, Division of Accountability Services, formed a small study team composed of Accountability Services staff to review and summarize the available research on school size and to determine what state-level data were available to address the issue.

The first component of this study involved a review of the existing research on school size, particularly those studies that have examined school size in relation to achievement and behavior. With respect to achievement, studies at the elementary level have consistently found that smaller schools are associated with higher academic achievement. At the high school level, the findings are more mixed. Some high school studies have found higher achievement among students attending smaller schools, while others have found no achievement advantage for small schools. Others have found that students from medium-sized high schools outperform students from either smaller or larger schools. There is also some evidence indicating that smaller schools are particularly beneficial for students from economically disadvantaged backgrounds. Overall, it would appear that smaller schools are associated with higher achievement in elementary schools, but this conclusion cannot be stated as confidently for high schools.

Previous studies of student behavior indicate that smaller schools are associated with more positive outcomes for students. Larger schools are reported to have higher dropout and expulsion rates than smaller schools. Larger schools also have been shown to have more problems with most major behavioral issues including truancy, disorderliness, physical conflicts among students, robbery, vandalism, alcohol use, drug use, sale of drugs on school grounds, tobacco use, trespassing, verbal abuse of teachers, teacher absenteeism, and gangs. There is also a substantial body of research which indicates that students in smaller schools are more likely to be involved in extracurricular activities.

In order to examine the impact of school size in North Carolina, a study was conducted using End-of-Grade (EOG) and End-of-Course (EOC) Test data as well as two limited sources of state-wide behavioral information: the school violence report data compiled by the Department of Public Instruction each year and dropout data.

Analyses of EOG and EOC data examined absolute performance as well as achievement gains as a function of school size. Results indicated that smaller elementary and middle schools tended to demonstrate higher achievement than their larger counterparts, even after controlling for various student background characteristics. These differences were small, however, typically amounting to a 1 to 2 scale score point difference. At the high school level, no achievement differences were found between schools of varying sizes.

Analyses of school violence data and dropout rate in relation to school size did not yield any significant associations, with one exception. Rates of violence in middle schools appeared to increase slightly in larger schools after controlling for the poverty level of students in the school. As was true for the achievement analyses, however, this relationship was weak.

Based on the review of the literature on school size and the results of the analyses of available data from North Carolina, there appear to be some behavioral and academic advantages associated with smaller schools. The evidence is not compelling in all cases, however, and some of the relationships reported are small in magnitude. Even so, there is little empirical support for making schools larger. Studies have failed to adequately demonstrate the presumed economic and curricular benefits associated with larger schools.

The lack of evidence to support larger schools, coupled with the potential advantages of smaller schools in terms of student outcomes, should give caution to school consolidation efforts and should also prompt larger schools to examine possible alternative organizational strategies. The consolidation of smaller schools into larger units may result in cost savings. However, the extent to which savings are achieved will vary due to specific situational factors. Even when savings are realized through consolidation, there may be concurrent costs with respect to achievement and behavioral outcomes. With respect to schools that are already large, strategies such as vertical house plans or within-school magnet programs may allow larger schools to enjoy some of the benefits documented for smaller schools. In the future, more research is needed on how school size affects the day-to-day activities of students and teachers and on how schools can achieve positive student outcomes while also maintaining a high level of economic efficiency.

I. Introduction and Legislative Charge

The issue of school size has become of great interest to educators and policy makers alike. As the demand for safer schools and the need to help all students reach high achievement standards have increased, the roles of many schooling variables – including school size – have come under scrutiny for their potential contributions to positive student outcomes. Intuitively, school size would appear to have considerable impact on both student achievement and discipline in the school. Smaller size seems to invite more personal attention, less anonymity for students, better attention to individual needs, and a more caring environment.

In the 1999 legislative session, House Bill 168 (Section 8.33, Session Law 1999-237) directed the State Board of Education (SBE) to study the relationship between school size and the behavior and academic performance of students in North Carolina. The Evaluation Section in the Division of Accountability Services formed a small study team composed of Accountability Services staff to determine what state-level data were available and how such data might be analyzed. While results of statewide End-of-Grade (EOG) and End-of-Course (EOC) Tests are readily available to assess student achievement, limited data exist for measures of behavior. Two limited sources were identified: (1) the school violence report data compiled by the Department of Public Instruction each year and (2) dropout data.

This report includes a brief review of the literature on school size and its relationship to achievement as well as other school variables, including participation in extracurricular activities, dropout rates, and other behavioral factors. A analysis of school size in North Carolina and its relationship to variables available at the state level are also reported and include achievement results on state tests (1998-99), dropout data (1997-98), and school violence data (1997-98). A description of the size configuration of schools in North Carolina for the current school year (1999-2000) is also reported to provide a profile of the size of North Carolina schools and how they compare to the size of schools nationwide.

II. Size of Schools in North Carolina

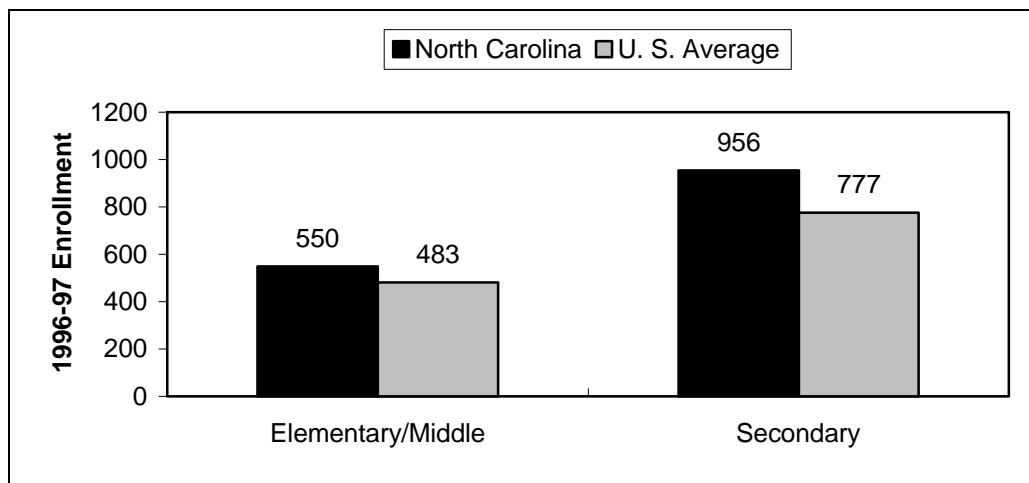
Concerns about school size in the educational research literature tend to center on high schools. The most common concern expressed is that high schools are too large, and that they are getting larger. Although there is little national data available on school enrollment trends, the assumption of increasing high school enrollments appears to have some validity. A report from the U. S. Bureau of the Census (1977) indicated that between 1930 and 1970, the number of high schools across the country held constant while the number of high school students tripled.

In an effort to better understand the distribution of school size in North Carolina, the first component of this study involved creating a profile of current school sizes at the elementary and secondary level. Data were analyzed in order to make comparisons between North Carolina and the nation as a whole, as well as to provide descriptive information about the size of elementary, middle and high schools in North Carolina.

North Carolina and the Nation

Based on 1996-97 school year comparisons, enrollment levels in North Carolina public schools tend to be higher than the U. S. average for comparable types of public schools. This is true for elementary/middle as well as secondary schools (Figure 1).

Figure 1: Average Enrollment in North Carolina and U. S. Public Schools, 1996-1997



NOTE: Elementary/middle schools are defined as a school in which the lowest grade is no higher than 6 and the highest grade is 8 or lower. Secondary schools are defined as schools in which the lowest grade is no lower than 7. Vocational schools, alternative schools, special education schools, and other schools not reported by grade level are excluded.

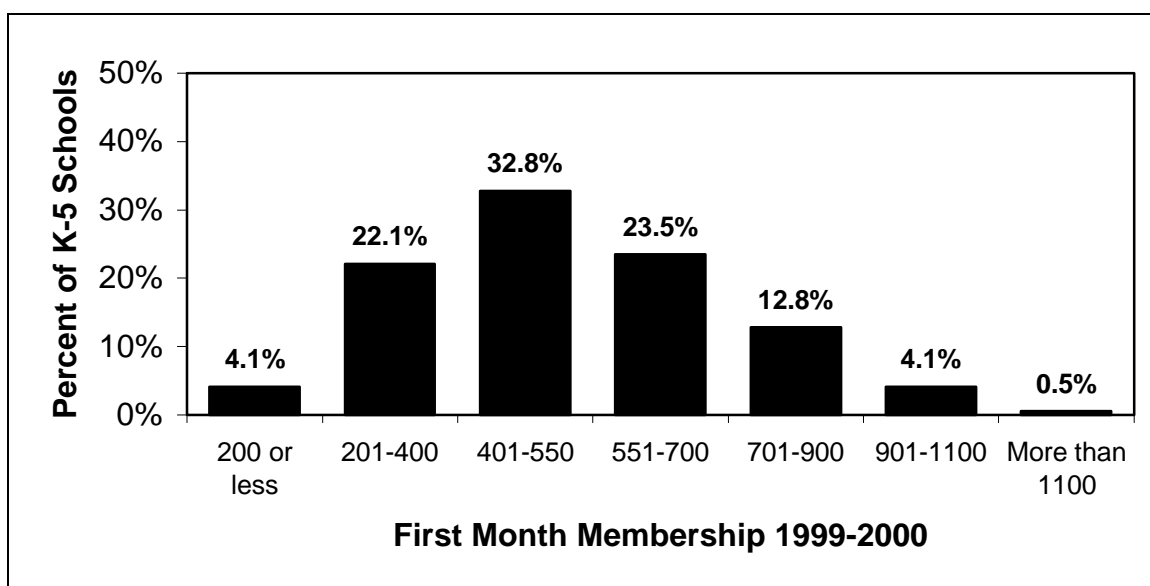
SOURCE: U.S. Dept. of Education, National Center for Education Statistics, Common Core of Data.

Elementary, Middle and High Schools within North Carolina

In order to examine further the size of North Carolina schools using current data, first month membership data from the 1999-2000 school year were analyzed. These analyses focused specifically on three groups of schools: K-5 schools, 6-8 schools and 9-12 schools¹. The decision to report data for these three types of schools was made for two reasons. First, these are the traditional grade level configurations that are commonly associated with elementary, middle and high schools, respectively. Nearly 75 percent of the public schools in North Carolina operate on one of these three grade level configurations. Second, it allowed for a clear examination of the size of North Carolina schools that would not be influenced by the number of grade levels represented in the school. For example, even though K-5 and K-6 schools might both be considered elementary schools, K-6 schools would be expected to have more students enrolled on average because they serve an additional grade level. Therefore, the results in this report that are generated from North Carolina data are based solely on K-5, 6-8 and 9-12 schools.

K-5 Schools. First month membership in K-5 schools in North Carolina ranges from 57 students to 1,150 students for the 1999-2000 school year. The average membership is 520, with 41 percent of K-5 schools having more than 550 students in membership (Figure 2).

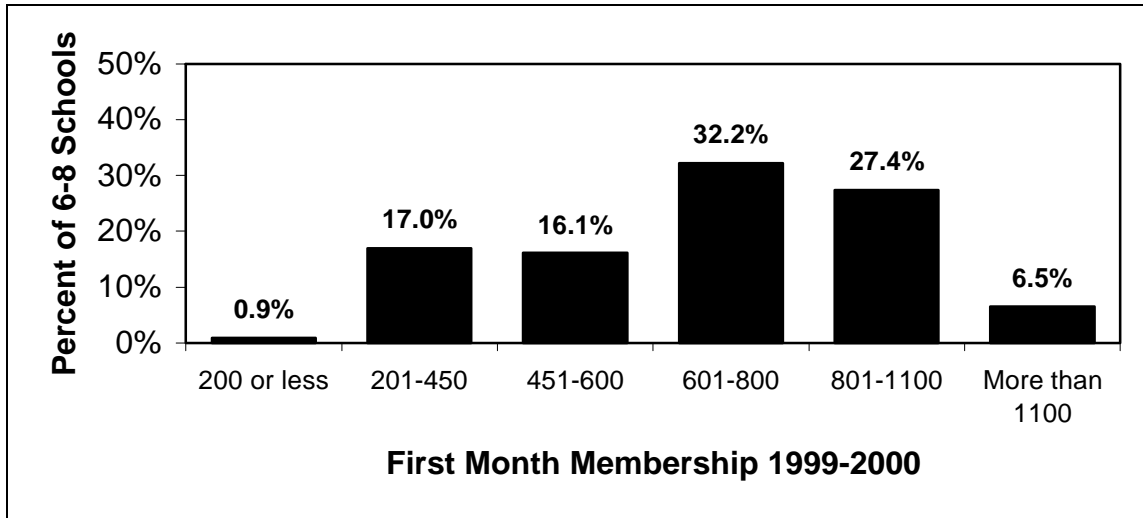
Figure 2: North Carolina K-5 Public Schools by Membership, 1999-2000



¹ These analyses do not include alternative schools, detention centers, hospital schools, or special education schools.

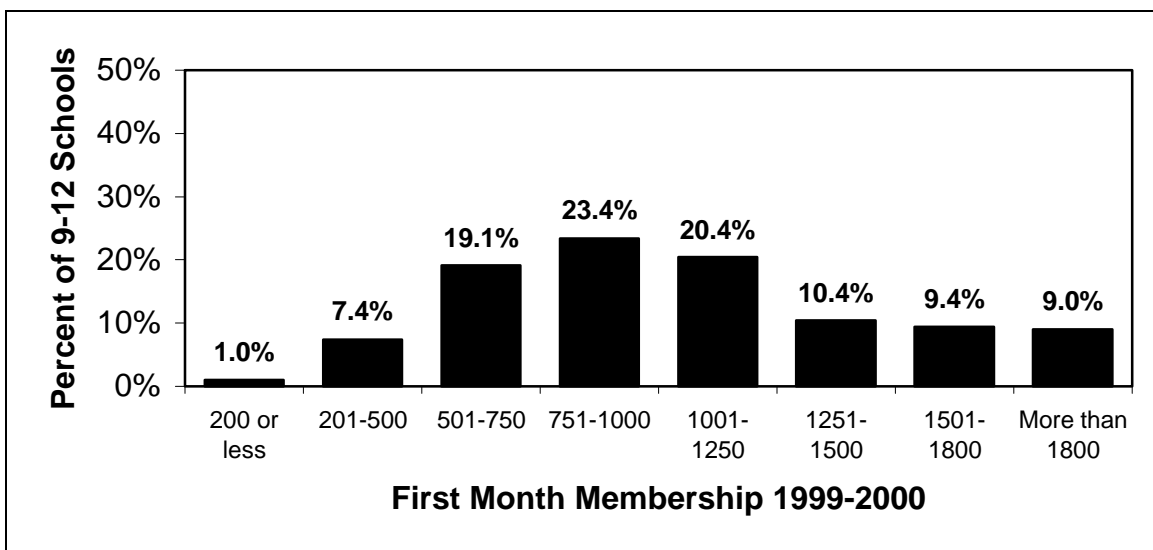
6-8 Schools. First month membership in 6-8 schools in North Carolina ranges from 38 students to 1,565 students for the 1999-2000 school year. The average membership is 693, with 34 percent of 6-8 schools having more than 800 students in membership (Figure 3).

Figure 3: North Carolina 6-8 Public Schools by Membership, 1999-2000



9-12 Schools. First month membership in 9-12 schools in North Carolina ranges from 56 students to 2,559 students for the 1999-2000 school year. The average membership is 1,067, with approximately 29 percent of 9-12 schools having more than 1,250 students (Figure 4).

Figure 4: North Carolina 9-12 Public Schools by Membership, 1999-2000



Summary

The sizes of schools in North Carolina appear to cover an extremely wide range at all grade levels. In addition, the smallest schools in each grade range tend to be charter schools. However, the presence of charter schools does not have an appreciable effect on these school size distributions due to the fact that very few of them serve the exact grade levels that are used for these analyses. With respect to national comparisons, schools in North Carolina tend to be larger than schools across the nation as a whole at both the elementary/middle and secondary levels.

III. Review of Research on School Size

Historical Perspective

The origin of the current debate over school size is usually traced to the publication of a book titled *Big School, Small School* (Barker & Gump, 1964). In this book, the authors reported on a study of five Kansas high schools ranging in size from 83 to 2,287 students. Based on their analysis, they concluded that smaller schools offered students a better opportunity to get involved in activities (e.g., sports, band, clubs, etc.) because activities in smaller schools tended to be “undermanned”. The authors found that in larger schools, even though there were usually more activities available, there were so many more people competing for the available spots in those activities that not everyone had an opportunity to become involved. For example, if a school of 2,000 students was to put on a school play, only a small percentage of the students in that school would be able to be involved in the production in any way. In a school of 75, however, the majority of students would probably *have* to be involved in order to accomplish such a task. Barker and Gump demonstrated this undermanning phenomenon in small high schools, leading them to conclude that smaller schools made it easier for students to get involved in activities and helped to prevent students from becoming marginalized and overlooked by the bureaucratic and impersonal environment often found in larger schools.

A few years after the publication of the Barker and Gump study, opponents of the “smaller is better” philosophy gained some momentum from a study that extolled the virtues of larger schools (Conant, 1967). In this study, data were analyzed from over 2,000 high schools across the U. S with enrollments between 750 and 1,999. The results indicated that smaller schools were not as able to offer as diverse a curriculum as larger schools, leading the author to conclude that high schools with enrollments smaller than 750 students could not deliver an efficient, comprehensive educational program. In addition to the Conant study, the impetus to make schools bigger also emanates from the assumption that schools with larger enrollments will have lower per-pupil costs. The viability of this assumption has been challenged, however, due to complex methodological problems inherent in this type of research and a lack of consistent findings across studies (McGuire, 1993; Walberg & Walberg, 1994).

Several years later, the premises of Barker and Gump were bolstered by Goodlad (1984) in a *A Place Called School*, which is a compendium of a series of studies he and his colleagues

conducted over several years looking at the characteristics of successful schools. Among his suggestions for improving schools, he advocated for the reorganization of large schools into smaller units. Based on the available data, Goodlad found the existing data do not adequately support large schools. Specifically, he stated that elementary schools should not be larger than 300 students, and junior and senior high schools should have 500-600 students at most.

The Barker and Gump study and the subsequent writings of Conant and Goodlad have framed the debate about school size for the past three decades. Although much of the literature on school size has focused on high schools, some studies have also been conducted at the elementary level. Several of these studies are reviewed below, focusing mainly on those that have looked at how achievement and student behavior might be affected by school size. This review includes only published studies of high quality; it deliberately omits those which have not been reported in adequate detail and which have not been subjected to the peer review process.

School Size and Achievement

Elementary Schools. The majority of the research on school size and achievement at the elementary level points toward an inverse relationship – smaller elementary schools tend to have higher achievement. For example, a study in New York found that reading and math test scores were higher in elementary schools with smaller enrollments, even after controlling for socioeconomic factors (Kiesling, 1968). Wendling and Cohen (1981) also found that third graders from smaller schools demonstrated higher achievement in reading and math than their counterparts in larger schools. In that study, the average enrollment in the lower-achieving schools was 776, while the average enrollment of the higher-achieving schools was 447. Fowler (1995) reviewed a number of studies of the size-achievement relationship in elementary schools, all of which reached the same conclusion as the Kiesling and the Wendling and Cohen studies. Several of the studies Fowler reviewed, however, were not widely published or were not published at all. Even so, there is little contrary evidence in the educational research literature to refute the conclusion that smaller elementary schools are associated with higher achievement.

Secondary Schools². Although the findings for elementary school would appear fairly consistent, the research on high school size and achievement is less conclusive. Using state

² No studies were found focusing specifically on achievement and school size in middle schools.

achievement test data from 293 public high schools in New Jersey, Fowler and Walberg (1991) found that school size was inversely related to test scores in mathematics and writing. They also found that smaller schools were associated with higher passing rates on the reading portion of the state's Minimum Basic Skills Test as well as on the mathematics and writing portions of the state's High School Proficiency Test. These effects were statistically significant even after controlling for students' family income level, but the actual size of the effects was not clearly reported. The schools in this study had enrollments ranging from 147 to 4,018, with an average enrollment of 1,070.

Other studies have also demonstrated similar results. Fetler (1989), in a study of all public high schools in California, found that schools with smaller enrollments tended to have higher achievement scores, although the relationship was not strong and the analysis did not take into account any student background factors. Walberg and Walberg (1994) used data from the 1990 National Assessment of Educational Progress (NAEP) mathematics assessment to examine relationships among size, expenditures and achievement. Their analyses demonstrated that states with larger schools tended to score lower on the NAEP mathematics assessment, even after controlling for per-pupil expenditures and percentage of non-white students in the state.

One of the more sophisticated studies on this topic found that students from medium-sized high schools actually demonstrated higher achievement than students in either smaller or larger schools (Lee & Smith, 1997). Using longitudinal data from a nationwide sample of over 9,000 students, the authors studied the relationship between size and achievement gains between 8th grade and 12th grade. The results indicated that after controlling for various student-level and school-level demographic characteristics, students in moderate-sized high schools tend to have higher gains in both reading and mathematics, with the effects for mathematics being somewhat stronger than those for reading. Specifically, they found that the highest gains in achievement were found in high schools with enrollments between 600 and 900 students. In addition, the finding of lower mathematics gains in larger schools was especially pronounced for non-white students and students from lower socioeconomic backgrounds. The Lee and Smith study is also the only study reviewed in this area which used achievement *gains* as the outcome measure.

This interaction between poverty and size was also echoed in a recent report published by the Rural School and Community Trust (2000). Data were analyzed from 13,600 public schools in 2,290 districts in Georgia, Montana, Ohio, and Texas. The results indicated an interaction

effect between size and poverty, with poverty having a much stronger negative influence on achievement in large schools. In other words, students in the less affluent communities in each state demonstrated higher achievement if they attended smaller schools. Although this report has received substantial media attention, the details of their analysis have not yet been reported in enough detail to judge the merits of the findings adequately.

Other studies, however, have failed to demonstrate higher levels of achievement for smaller high schools. Lindsay (1984), analyzing data from a nationally representative sample of almost 14,000 high school students found no meaningful relationship between school size and academic ability. Academic ability in this study was measured by a standardized composite score based on four tests (vocabulary, reading, inductive reasoning, and mathematics) that were used in the National Longitudinal Study conducted by the U. S. Department of Education. A study by Jewell (1989) reached similar conclusions. In examining the relationship between school size and college entrance exam scores across all 50 states and the District of Columbia, he found no significant relationship between high school size and either ACT scores or Scholastic Achievement Test (SAT) scores after controlling for poverty. In another earlier study, Baird (1969) analyzed data from over 21,000 high school students who took the American College Test (ACT) and found that students from smaller schools actually had lower ACT scores. Compared to the results for elementary schools, the evidence for the size-achievement relationship at the high school level appears to be more mixed.

School Size and Behavior

Dropout Rates. Several studies have demonstrated that students from smaller schools are more likely to persist in high school and are more likely to attain higher levels of education beyond high school. In his study of California high schools, Fetler (1989) found that higher dropout rates were associated with higher school enrollments, even after controlling for the poverty level of the school and the achievement level of the school. Pittman and Haughwout (1987) report similar findings from a study of a nationally representative sample of 744 high schools. In this study, larger school size was related to higher dropout rates. However, this relationship was mediated by school climate. In other words, schools with larger enrollments tended to have a less positive, supportive social climate, and this less positive social climate was in turn associated with higher dropout rates. Based on their results, the authors of this study

estimated that an increase of 400 students in the enrollment of any given high school would lead to approximately a one percent increase in the dropout rate, all other things being equal. Fowler and Walberg (1991) found that students were more likely to be expelled in high schools with higher enrollments, even after controlling for the socioeconomic status of the school district. Schoggen and Schoggen (1988), in a study of 27 schools in New York, also found that schools with larger senior classes had higher dropout rates.

Disorder, Attendance, Drug Use and Violence. Studies have also examined school size in relation to the behavioral environment of schools as well as attendance. Haller (1992) studied a nationwide sample of over 550 public high schools in an effort to determine how size related to various aspects of student behavior. The results of the study indicated that larger high schools were associated with greater problems with truancy and disorderliness in the school. These relationships were largely consistent regardless of whether ratings of truancy and disorderliness were provided by principals or students. In a study using a nationally representative sample of almost 15,000 students, Lindsay (1982) found that smaller schools were more likely to have higher attendance rates.

During the 1996-97 school year, the National Center for Education Statistics conducted a nationally representative survey of 1,234 elementary, middle and high schools across the country focusing on violence and discipline problems (Heaviside, Rowand, Williams, & Farris, 1998). In their analysis, they divided schools into three groups based on size: less than 300 students, 300-999 students, and 1,000 or more students. Their results indicated that a substantial number of violence and discipline indicators were associated with school size. For example, principals from schools with larger enrollments (i.e. 1,000 or more) were more likely than principals of medium-sized or smaller schools to report moderate or serious problems with the following discipline issues: tardiness, absenteeism, physical conflicts among students, robbery, vandalism, alcohol use, drug use, sale of drugs on school grounds, tobacco use, trespassing, verbal abuse of teachers, teacher absenteeism, and gangs. Also, both larger schools and smaller schools reported higher rates of violent and nonviolent crime than medium-sized schools. Despite the scope of this study, one important caveat is that size is confounded by many other variables, including instructional level (elementary, middle, high), and poverty. For example, most of the larger schools in the study were middle and high schools, leading to the possibility that the observed

differences between large and small schools might really be characterized as differences between high schools and elementary schools. In another study that focused specifically on high schools, however, Page (1991) also found that students in larger high schools were more likely to use tobacco and other drugs compared to students in smaller high schools.

Participation. Participation in school activities is one of the most closely studied aspects of school size, with almost every published study pointing toward smaller schools as facilitating greater participation in extracurricular and other school activities, emanating from Barker and Gump's (1964) influential work. In an early attempt to test out Barker and Gump's undermanning theory, Baird (1969) conducted two separate studies focusing on the relationship between high school size and extracurricular achievements. In the first study, Baird analyzed data from over 20,000 high school students, finding that students from smaller schools reported having had more accomplishments in art, music, drama and writing during high school. In the second study, conducted with over 5,000 college students, the results indicated that students who attended smaller high schools had more achievements in leadership, speech, and drama. In addition, women from smaller high schools reported more achievements in music and writing than did women from larger high schools.

Several additional studies have been conducted in subsequent years that have also confirmed the findings of the initial Barker and Gump study. Grabe (1981) conducted a survey of 1,562 students attending 20 Iowa high schools to gather information about participation in five types of extracurricular activities: academic activities, athletics, fine arts, clubs, and social activities. The schools were predominantly rural, with 5 schools classified as large (grades 10-12 enrollment greater than 580) and the remaining 15 classified as small (grades 10-12 enrollment less than 580). Students from the smaller schools were more likely to report participation in all five types of activities.

Morgan and Alwin (1980) collected survey data from several thousand high school students in the state of Washington, and found that smaller schools were associated with greater opportunities for participation in journalism, music, drama, and debate activities. They also found, however, that this school size-participation relationship was either nonexistent or even reversed for other activities such as athletics, student government, and hobby clubs. The authors concluded that a particular school activity will be related or unrelated to school size depending

on how central that activity is to the school and how expandable the activity is (i.e., how easy it is to create additional teams or groups to support additional participants).

Schoggen and Schoggen (1988) took a rather innovative approach to studying participation in high schools. They reviewed yearbooks from 27 New York high schools and documented activity participation for over 10,000 high school seniors based on the names listed for each athletic team and activity group in the yearbooks. Their results indicated that larger percentages of students participated in activities in smaller schools. They also found that students in smaller schools tended to participate in more different types of extracurricular activities than students in larger schools, even though the larger schools had many more types of extracurricular activities available for students. This particular finding parallels other research on curriculum offerings in high schools, which indicates that even though larger high schools may offer more types of courses than a smaller school, in most cases very few students will actually end up enrolling in those additional courses (Monk, 1987).

A study by Lindsay (1982) also examined the relationship between extracurricular participation and size using a nationally representative sample of students. In this study, students from small schools reported participating more often in athletics, drama, music, debate, journalism, and student government activities. In addition, these results were consistent for male and female students, students from higher and lower socioeconomic backgrounds, students of higher and lower academic ability, and students from rural and urban areas.

The numerous studies linking school size to participation are particularly important given the role that participation may potentially play in facilitating other outcomes. In an effort to summarize the research on participation, Holland and Andre (1987) reviewed the available literature on extracurricular activity participation, including studies that examined school size and participation. They concluded that smaller schools are associated with greater activity participation, and that greater participation is associated with a variety of positive outcomes including higher self-esteem, higher educational aspirations, less delinquency, and greater involvement in community activities as an adult. In addition, Finn's (1989) theoretical model of school dropout implicates participation as a critical factor in preventing students from dropping out of school. Therefore, the relationship between smaller school size and greater activity participation may in turn affect other student outcomes as well.

Summary

According to the studies reviewed above, school size appears to be related to a host of behavioral and academic outcomes for students, with smaller schools being associated with more positive outcomes in most cases. The research on high school size and achievement appears to be an exception, however, with multiple studies in this area reaching different conclusions. The push for larger schools in recent years, particularly at the high school level, appears to be rooted in the desire to take advantage of economies of scale and to offer more comprehensive curriculum programs. Both of these anticipated outcomes, however, have not been clearly realized (McGuire, 1989; Monk, 1987; Monk & Haller, 1992). This, coupled with the potential benefits of smaller schools with respect to academic and behavioral outcomes for students, would appear to tip the scales in favor of smaller schools.

These same conclusions were also reached in two recent reports produced by the School Planning Section of the North Carolina Department of Public Instruction (NCDPI) in 1998. In developing guidelines for the construction and layout of school facilities, NCDPI staff reviewed the literature on school size. They came to the conclusion that smaller schools were associated with a safer, more orderly environment, higher student achievement, and more positive behavioral outcomes for students such as greater participation in extracurricular activities and higher self-esteem (NCDPI, 1998a; 1998b). The second of these reports also acknowledged the competing interests of taking advantage of the virtues of smaller schools versus cost-effective resource utilization that is presumably achieved with larger schools in their recommendations for optimal school size based on these interests (Table 1).

Table 1: Optimal School Size Recommendations – Climate versus Efficiency

Grade Level	Ideal Enrollment for Positive Climate and Order	Ideal Enrollment for Economic Efficiency
Elementary	300-400	450-700
Middle	300-600	600-800
High	400-800	800-1,200

SOURCE: Safe Schools Facilities Planner: Improving School Climate and Order Through Facilities Design. North Carolina Department of Public Instruction, 1998.

IV. Analysis of North Carolina Data

In an effort to better understand how school size relates to achievement and behavior in North Carolina, a study was undertaken to examine these relationships using state data. Based on the review of the literature and on the data that are available at the state level, three primary research questions were formulated.

1. What is the relationship between school size and achievement?
2. What is the relationship between school size and school violence?
3. What is the relationship between school size and school dropout rate?

School Size and Achievement

To address the question of whether school size is related to achievement, DPI staff gathered data from several sources within the agency, including end-of-grade (EOG) and end-of-course (EOC) testing databases. Achievement and demographic data were analyzed from the 1997-98 and 1998-99 school years. Since the scale for EOG and EOC scores changes from grade level to grade level and from course to course, scale scores were converted to standard scores with a mean of 50 prior to conducting the analyses.

In order to correct for schools that have exceptionally low membership, alternative schools, special education schools and other ungraded schools were not included. Schools with atypical grade level configurations (e.g., K-2, 6-12, K-12, etc.) also were not included in the analysis due to the fact that their membership is affected by having different numbers of grade levels. The final samples therefore included 847 K-5 schools, 308 6-8 schools, and 292 9-12 schools. The data for each of these three groups were analyzed separately, with the school (not the student) serving as the unit of analysis. All differences mentioned in these results represent statistically significant differences.

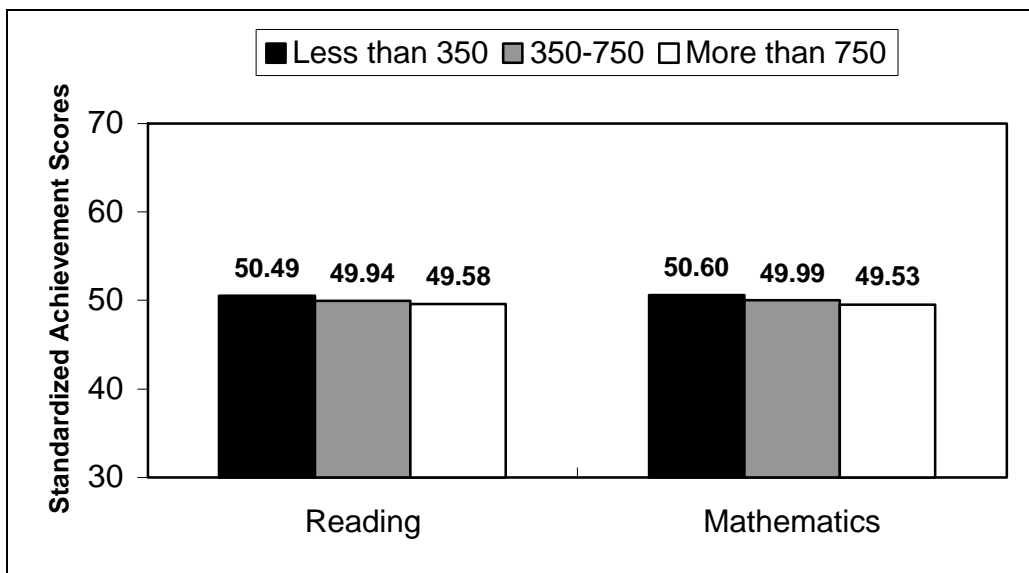
In all three analyses, control variables were included in order to get a more precise estimate of the relationship between membership and achievement. These variables included the percentage of students enrolled at the school who were non-white, the percentage of students who were eligible for free or reduced price lunch, and the percentage of students whose parents had no formal education beyond high school. These three variables were selected to serve as

controls in the achievement analyses because they are statistically associated with achievement and often serve as proxies for poverty. The inclusion of these controls resulted in a more precise examination of the association between membership per se and achievement.

K-5 Results. For the elementary school analysis, schools were divided into three groups based on membership: schools with less than 350 students, schools with 350-750 students, and schools with more than 750 students. These three groups of schools were compared with respect to their average 1998-99 standardized EOG test scores (Figure 5).

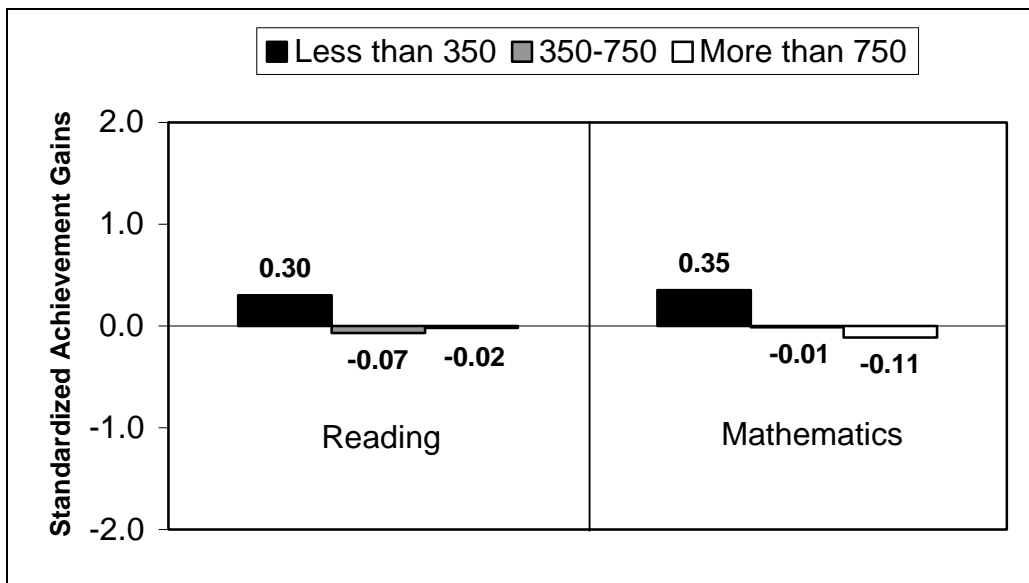
The results indicated that both Reading and Mathematics test scores for the smallest (i.e., less than 350 students) elementary schools were slightly higher than those for the other two groups of schools. With respect to Mathematics, the average test scores for medium-sized (i.e., 350-750 students) schools were also slightly higher than those for the largest-sized schools. These achievement differences were small, however, with the differentiation between the highest group and the lowest group equaling approximately one-tenth of a standard deviation. In the metric of EOG scale scores, this means that the difference in achievement between the smallest and largest schools would be approximately 1 to 2 scale score points.

Figure 5: Achievement by School Size, K-5 Schools, 1998-99



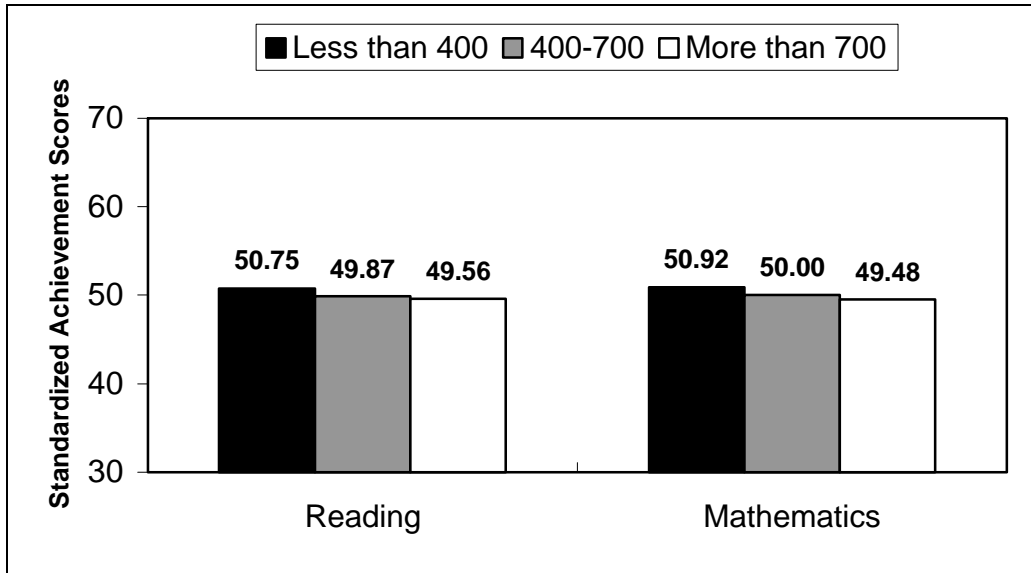
A second analysis was also conducted looking at school-level achievement gains between the 1997-98 and 1998-99 school year. This analysis indicated that the average Reading and Mathematics achievement gains for the smallest elementary schools were slightly higher than the gains for the other two groups of schools (Figure 6). Again, however, the actual size of these differences is small in the absolute sense.

Figure 6: Achievement Gains by School Size, K-5 Schools, 1998 to 1999



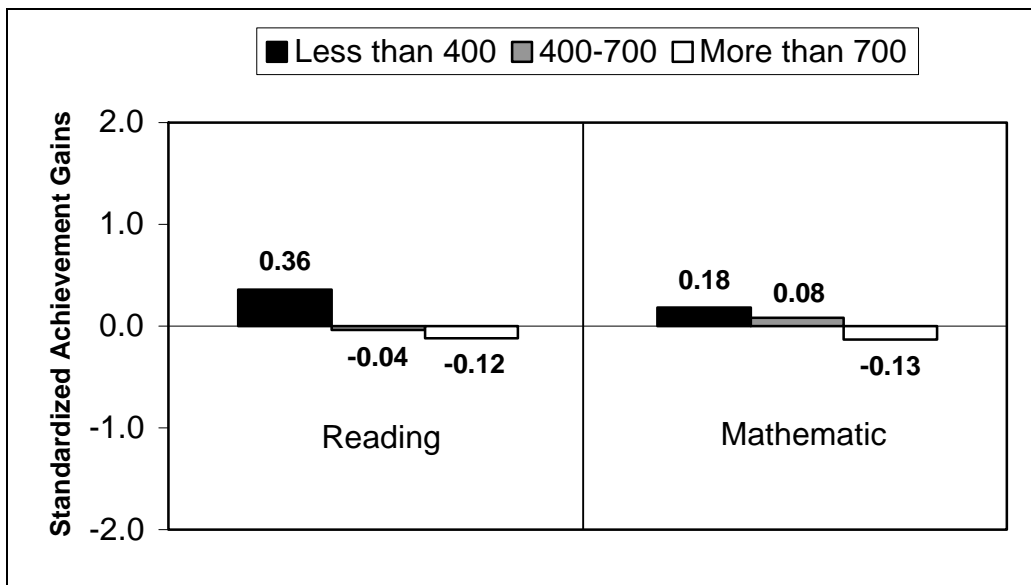
6-8 Results. For the middle school analysis, schools were again divided into three groups based on membership: schools with less than 400 students, schools with 400-700 students, and schools with more than 700 students. These three groups were compared with respect to their average 1998-99 standardized EOG test scores (Figure 7). As was true for the elementary school results, Reading and Mathematics test scores for the smallest (i.e., less than 400 students) middle schools were higher than those of the other two groups of schools. With respect to Mathematics, the average test scores of medium-sized (i.e., 400-700 students) middle schools were also slightly higher than those of the largest schools. As was true for the elementary school analysis, these differences amounted to approximately a 1 to 2 scale score point difference between the smallest and largest schools.

Figure 7: Achievement by School Size, 6-8 Schools, 1998-99



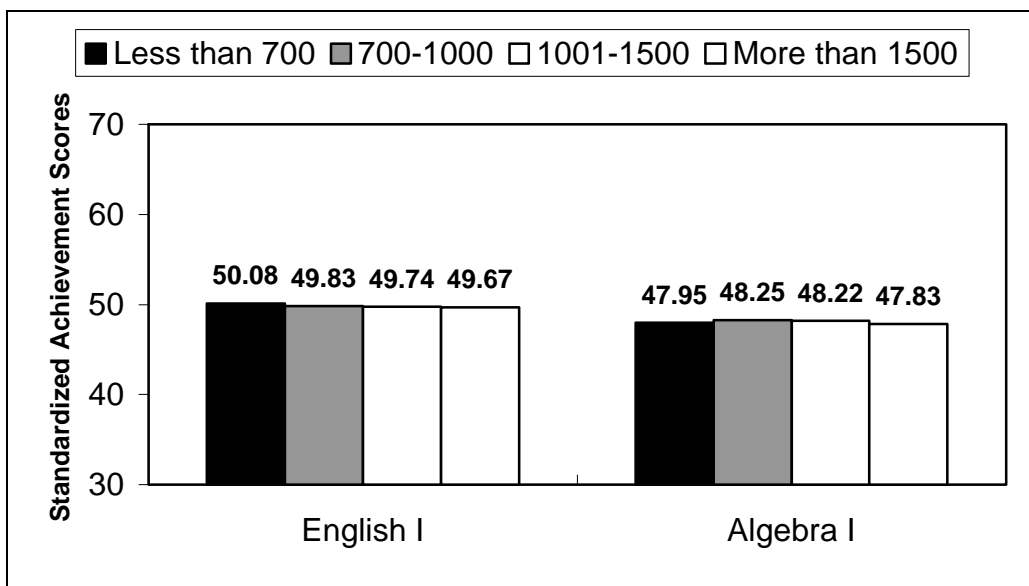
A second analysis was conducted looking at achievement gains in middle schools between the 1997-98 and 1998-99 school year. This analysis indicated that average achievement gains for the smallest middle schools were slightly higher than those of the other two groups of schools (Figure 8).

Figure 8: Achievement Gains by School Size, 6-8 Schools, 1998 to 1999



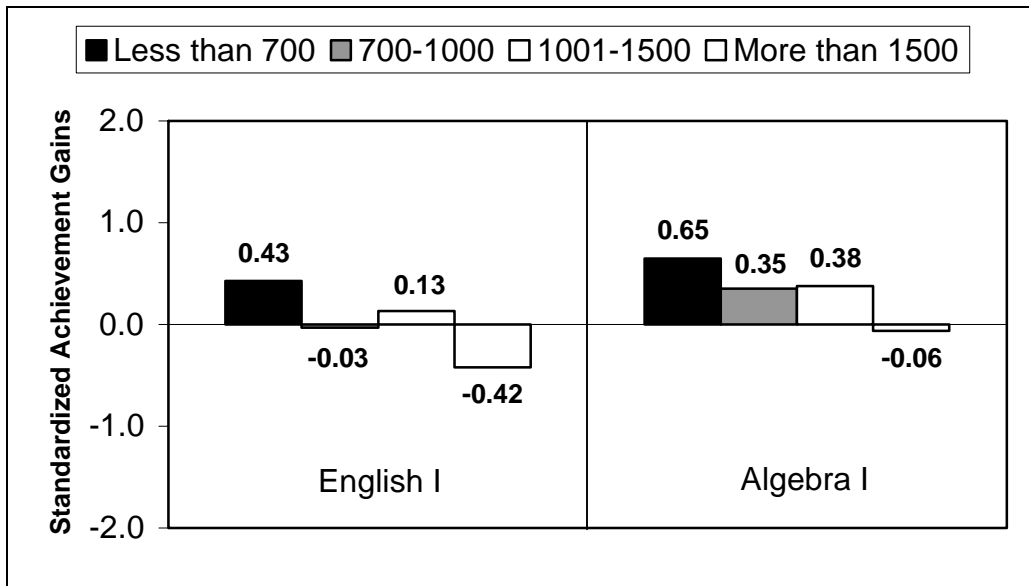
9-12 Results. For the high school analysis, the achievement data used consisted of EOC scores for five courses: Algebra I, English I, U. S. History, Biology I, and Economic, Legal, and Political Systems. The high schools were divided into four groups based on membership: schools with less than 700 students, schools with 700-1000 students, and schools with 1001 – 1500 students, and schools with more than 1500 students. These four groups were compared with respect to their average 1998-99 standardized EOC test scores in all five subject areas. These analyses indicated no differences in test scores in any of the five courses among the four groups of high schools. Achievement test scores during the 1998-99 school year on these five EOC tests was virtually the same regardless of school size. Figure 9 illustrates the specific results for Algebra I and English I.

Figure 9: Achievement and School Size, 9-12 Schools, 1998-99



A second analysis was conducted looking at achievement gains in high schools between the 1997-98 and 1998-99 school year. This analysis indicated that average achievement gains were not significantly different across the four groups of schools on all five EOC tests. Figure 10 illustrates the specific results for Algebra I and English I.

Figure 10: Achievement Gains and School Size, 9-12 Schools, 1998 to 1999



Among elementary and middle schools in North Carolina, smaller schools (less than 350 students and less than 400 students, respectively) showed slightly higher levels of achievement than larger schools after controlling for various student background characteristics. These results were consistent for both average achievement in 1998-99 as well as achievement gains between the 1997-98 and 1998-99 school years. These differences amounted to approximately 1 to 2 scale score points in most instances. Among high schools, there was no evidence of any statistically significant relationship between membership and achievement in any of the five subject areas examined.

In addition to the groupings of schools by membership that were used in the achievement analyses in this report, several other groupings were also used in preliminary analyses that divided schools into even smaller clusters (e.g., 8 groups instead of 3 or 4). The results of these other analyses are not reported here, because they lead to the same conclusion as those included in this report.

Since previous studies of school size (e.g., Lee & Smith, 1997; Rural School and Community Trust, 2000) have found that school size has a particularly strong association with achievement for students from disadvantaged backgrounds, further analyses of North Carolina testing data were conducted using the same methods described in the Rural School and Community Trust (2000) study to examine this hypothesis. Initially, this association was

confirmed. A statistically significant interaction was found, with the “larger size = lower achievement” connection being magnified in schools where a large percentage of children were eligible for free or reduced-price lunch. In subsequent analyses, however, this finding was nullified when parent education level was taken into consideration. Therefore, it is not clear whether the negative effects of large enrollments on economically disadvantaged students are due to school size per se, or to other factors associated with the educational background of the family. This particular result highlights one of the most difficult problems with research on school size. Size is inextricably intertwined with many other factors (e.g., urban/rural location, family demographics, student demographics, poverty) that are associated with academic and behavioral outcomes for students. This overlap, coupled with the fact that school size is typically not manipulated experimentally for research purposes, makes it difficult to identify which of these factors might possibly cause the often-observed relationships between size and outcomes.

School Size and Violence

To address the question of whether school size is related to school violence, DPI staff analyzed data from the 1997-98³ school year for all North Carolina public schools serving grades K-5, 6-8, and 9-12. The specific variables of interest were membership and the number of violent incidents at school per 100 students. Types of incidents included in this count were assaults, drug possessions, weapons possessions, robberies, and sexual offenses.

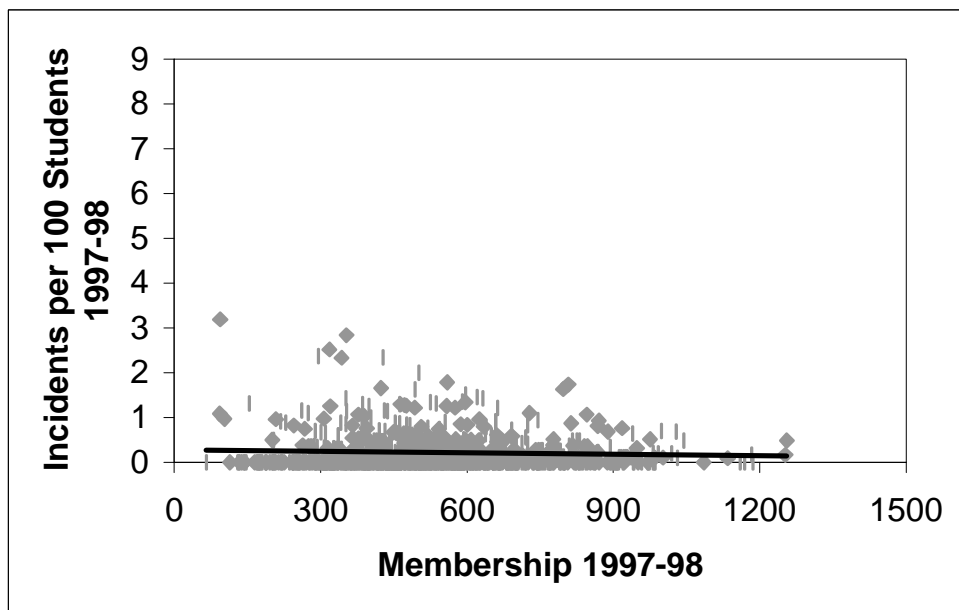
In order to correct for schools that have exceptionally low membership, alternative schools, special education schools and other ungraded schools were not included. Schools with atypical grade level configurations (e.g., K-2, 6-12, K-12, etc.) were also not included in the analysis due to the fact that their membership is affected by having different numbers of grade levels. The final samples, therefore, included 828 K-5 schools, 300 6-8 schools, and 284 9-12 schools. The data for each of these three groups were analyzed separately.

K-5 Results. A correlation analysis indicated that there was no relationship between membership and the number of violent incidents reported per 100 students ($r = -.06$). This lack of a relationship is illustrated by the plot and flat trendline in Figure 11, which indicate that as

³ School violence data for the 1998-99 school year were not available at the time this report was written.

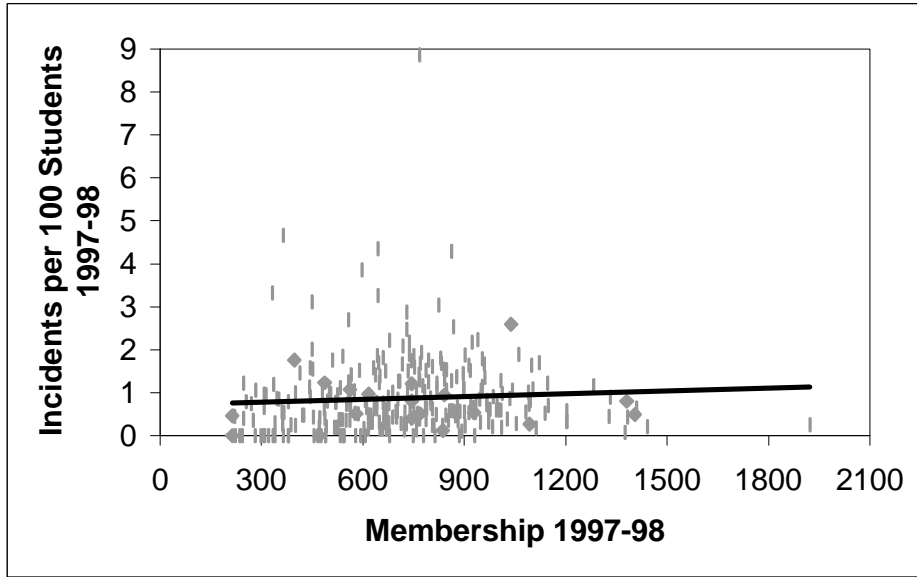
membership increases, the rate of violent incidents in the school remains approximately the same. Because the percentage of students in a school who are eligible for free or reduced price lunch is known to be related to the rate of violent incidents reported (Heaviside et al., 1998), a second analysis examined the relationship between membership and violence rate after controlling for the possible effects of the percentage of students eligible for free or reduced price lunch. The results were essentially the same as the first analysis; there was still no relationship between membership and violence rate.

Figure 11: Rate of Violent Incidents by School Size, K-5 Schools, 1997-98



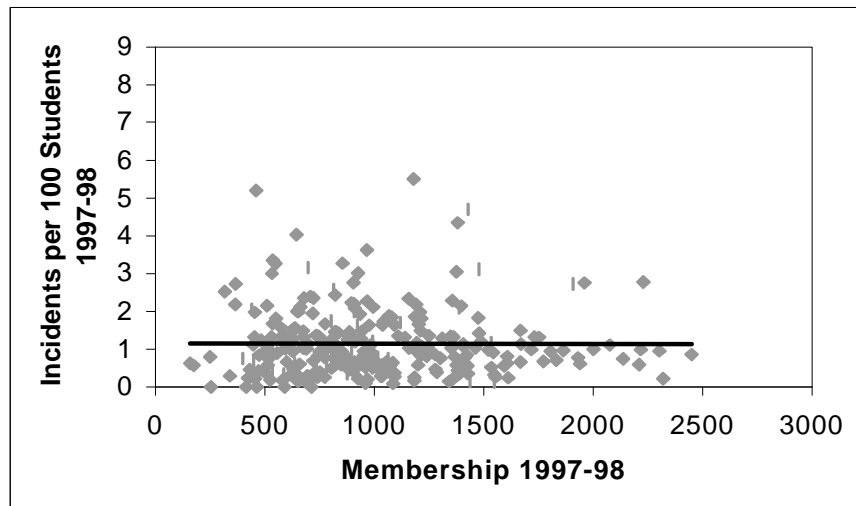
6-8 Results. A correlation analysis indicated that there was no relationship between membership and the number of violent incidents reported per 100 students ($r = .06$). This lack of a relationship is illustrated by the plot and the flat trendline in Figure 12. As in the K-5 results reported earlier, a second analysis was conducted controlling for the percentage of students in each school who were eligible for free or reduced price lunch. After controlling for this factor, there was a small statistically significant relationship ($r = .15$) between membership and the violence rate in middle schools. Therefore, after controlling for the poverty level of the students in the school, the results indicated that the violence rate tended to increase slightly in middle schools with higher memberships.

Figure 12: Rate of Violent Incidents by School Size, 6-8 Schools, 1997-98



9-12 Results. A correlation analysis indicated that there was no relationship between membership and the number of violent incidents reported per 100 students ($r = -.01$), as illustrated by the plot and trendline in Figure 13. As in the K-5 and 6-8 results reported earlier, a second analysis was conducted controlling for the percentage of students in each school who were eligible for free or reduced price lunch. After controlling for this factor, there was still no relationship between membership and the rate of violent incidents.

Figure 13: Rate of Violent Incidents by School Size, 9-12 Schools, 1997-98



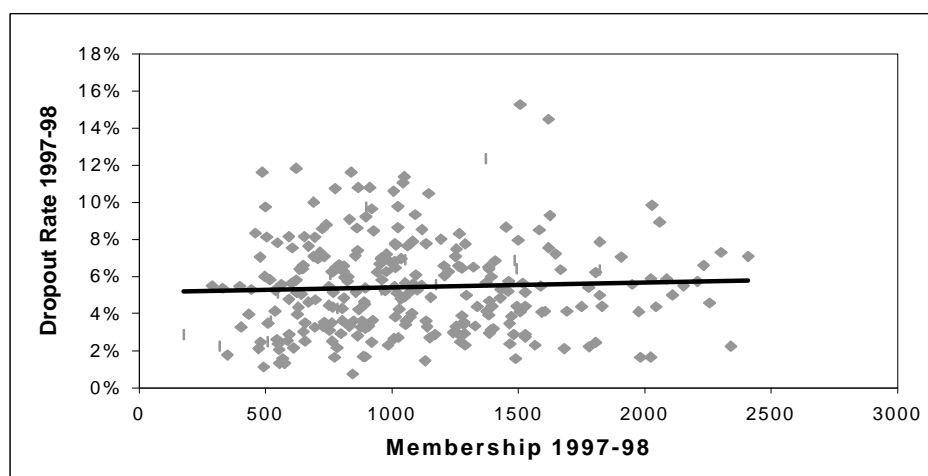
School Size and Dropout Rate

To address the question of whether school size is related to school dropout rate, DPI staff analyzed data from the 1997-98⁴ school year for North Carolina public high schools serving grades 9-12⁵. The variables of interest for this analysis were membership and dropout rate.

In order to correct for schools with exceptionally low membership and/or exceptionally high dropout rates, alternative schools, special education schools and other ungraded schools were not included. Schools with other grade level configurations that included any of grades 9-12 (e.g., 6-12, 10-12, K-12, 7-9 etc.) were also not included in the analysis due to the fact that their membership is likely to be affected by having different numbers of grade levels. The final sample included 273 schools out of the 434 who reported dropout data in 1997-98.

Results. A correlation analysis indicated that there was no relationship between membership and dropout rate ($r = .05$), illustrated by the plot and trendline in Figure 14. Because poverty is known to be related to the dropout rate (e.g., Kaufman, Kwon, Klein, & Chapman, 1999), a second analysis examined the relationship between membership and dropout rate after controlling for the possible effects of the percentage of students eligible for free or reduced price lunch. The results were essentially the same as the first analysis; there was still no relationship between membership and dropout rate.

Figure 14: Dropout Rate by School Size, 9-12 Schools, 1997-98



⁴ Dropout data for the 1998-99 school year were not available at the time this report was written.

⁵ School-level dropout data in North Carolina are collected only for schools that have grade levels in the range 9-12.

V. Key Findings

According to the available research on school size and its relationship to student achievement and behavior, the large majority of studies indicate that smaller is better. There are some inconsistencies with respect to high school size and achievement, but studies of school size in general have demonstrated that smaller schools are associated with better behavioral outcomes, higher rates of participation in extracurricular activities, and higher achievement. In addition, many of these studies have been conducted with large, nationally representative samples of students and schools, which would imply that those results should be fairly robust and applicable to a wide range of educational situations.

The analyses of state-level data from North Carolina appear to provide partial confirmation of these findings, but the associations between size and student outcomes that were found are not large. Analyses of achievement data did reveal statistically significantly higher achievement in smaller schools at the elementary and middle school levels, but the actual size of those differences appears to be quite small. With respect to school size and behavior, the only statistically significant finding in the analyses of North Carolina data was at the middle school level, where a higher rate of violent incidents was associated with larger schools after controlling for the poverty level of the school. As was true for the achievement findings, however, this relationship was not strong. Analyses of North Carolina dropout data demonstrated no relationship between school size and dropout rates. Unfortunately, state-level data are not available to address some of the size-behavior relationships identified in previous studies, such as those involving drug use and participation in extracurricular activities. The conclusions drawn from the analyses of North Carolina data, therefore, do not speak to the relationships between school size and these particular outcomes.

Further studies of how school size is related to the day-to-day activities of students and teachers would provide greater insight into the effects of school size in North Carolina. In any organization, structural factors such as size tend to have their effects on outcomes indirectly by altering the day-to-day processes and interactions that occur within the organization. Therefore, studies looking for a direct link between school size and student outcomes that fail to include these process factors in the analysis may reach inappropriate conclusions about the true role of school size in students' growth and development.

Conclusions

Taken together, the prior research on school size and the analyses of North Carolina data appear to show a slight advantage for smaller schools with respect to behavior and achievement. Despite the existence of some contrary findings in the literature, even a skeptical interpretation would likely conclude that larger schools are no better (and may in fact be worse) than smaller schools with respect to academic and behavioral outcomes. This advantage is probably not of sufficient size and clarity to advocate for widespread school construction in order to reduce school size, but it should prompt large schools to examine other ways of achieving these benefits. These findings should also lead local boards of education to at least consider whether efforts to consolidate smaller schools into larger ones might be achieving the desired efficiency at some cost to achievement and/or behavior.

Large schools might take advantage of organizational structures such as those discussed by Cawelti (1993) and Goodlad (1984) in order to create a small-school atmosphere within a large school. These may include vertical house plans (i.e. schools-within-schools) which essentially divide a large school into multiple smaller schools on the same campus, each of which operates with its own group of students and with relative autonomy. Cawelti also advocates the creation of special focused curriculum programs within high schools that could serve as within-school magnet programs to circumvent the enormity of a large school. Having “houses” within the school might allow smaller units of teachers and students to become more closely linked. These approaches assume that other factors (as opposed to size in and of itself) are responsible for the positive outcomes of small schools, such as the social climate, the personal relationships between students and teachers, and the extent to which students can become alienated and detached from the schooling experience. If these kinds of variables are found to be the true catalysts of positive outcomes in small schools, then some of the virtues of smallness might be transferable to large schools through these kinds of strategies.

With respect to consolidation efforts, the available research does not clearly support the common contention that larger schools are more efficient in terms of the delivery of quality educational programming. When considering only the financial ramifications, however, larger schools tend to be less expensive to operate, on a per-pupil basis, “other things being equal” (McGuire, 1993, p. 171). Unfortunately, these “other things” often vary across situations, and financial savings from consolidation will probably not apply equally across all expenditure areas.

For example, the consolidation of two schools may save personnel expenses by eliminating a principal's position, but it may simultaneously result in an increase in pupil transportation costs. Future studies are needed to determine exactly what size a school should be by taking into consideration both economic ramifications and student outcomes. Throughout the history of the school size debate, studies that have recommended optimal sizes have traditionally considered only one of these two perspectives. The fact that both of these considerations are of great importance requires research that examines how a school can take advantage of the positive student outcomes associated with smaller schools while still being a cost-effective educational delivery system.

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