

Class Size and School Performance: An Analysis of Elementary and Middle Schools

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Abstract: The class size debate is still ongoing among researchers, even though smaller class sizes are widely supported by parents, teachers, and the public. To contribute to this discussion, data was taken from the North Carolina (NC) School Report Cards (SRC) datasets and used to address two questions: First, is there a relationship between an elementary school's performance score and average class size? Second, is there a relationship between a middle school's performance score and average class size? Using the results from a linear regression and ordered logit, we find that average class size significantly predicts both NC elementary and middle school performance. However, the estimates suggest that higher average class size is negatively related to elementary school performance, but positively related to middle school performance. These results suggest that the impact of class size on student and school performance may depend on the grade levels in question, for example, elementary or middle school. We conclude that policymakers should act carefully when manipulating class sizes, since the effect may depend on the grade levels.

Keywords: Class size, Elementary school, Middle school, School performance, North Carolina

Introduction

The class size debate is still ongoing (Jepsen, 2015; Paola, Ponzo and Scoppa, 2013; Hanushek, 2003; Shen and Konstantopoulos, 2019; Shin and Chung, 2009; Goldstein and Blatchford, 1998). Reductions in class size are widely supported by parents, teachers, and the public (Chingos, 2013). Woods (2015) notes that "teachers unions from Oakland, California to Auckland, New Zealand are advocating for smaller class sizes. A call for smaller class sizes was second only to higher salaries for the LA teachers union at recent protests." Woods (2015) continues by stressing that we need good data and strong analytic methods to find out the level and extent of the effect of class size on student achievement.

There are many factors associated with student learning at the K-12 levels. In their 1994 study, Wang, Haertel and Walberg find that 28 different variables are significantly related to student learning. According to Teodorovic (2011), several classroom-level factors have positive effects on student achievement. Teodorovic (2011) writes that "clear and structured classroom instruction, emphasis on complex (as opposed to basic) skills, whole-class instruction (rather than individual or group work), teacher feedback, orderly climate, moderately frequent reinforcement of student effort..." are all important for achievement (p. 215). Marzano (2003) underscores that there are several school, teacher, and student factors critical to student outcomes. School factors include a guaranteed and viable curriculum, challenging goals and effective feedback, parent and community involvement and safe and orderly environment (Marzano, 2003). Teacher related factors include effective instructional strategies and classroom management, while student related factors include prior achievement, motivation, and home environment (Marzano, 2003). Thus, there are a myriad of factors that affect achievement, making analyses of class size, specifically, especially challenging.

Class size can affect how students learn and even determine the amount of material covered during a class period. For example, a large class with a lot of noise may mean less time for the teacher to cover academic tasks slated for the day. The teacher may also be deterred from assigning group work, which is a best practice in education, because there are simply too many groups to manage. A small class, in contrast, may encourage more teacher pupil interactions, which has been shown to improve student outcomes (Blatchford, Bassett, and Brown,

2011; Leyva, Weiland, Barata, Yoshikawa, Snow, Treviño, and Rolla, 2015). As Paola, Ponzio and Scoppa (2013) emphasize, the effects of “educational inputs, such as class size, teaching quality, school resources, on student achievement have been deeply investigated in the economic literature. However, there is still an ongoing debate and no consensus has been reached about how these factors influence student performance” (p. 135).

Class Size in North Carolina Schools

In 2018, the NC Governor, Roy Cooper, requested greater funds to implement a state mandate for smaller class sizes (Governor Cooper, 2018). There is strong support for the small class measure, but as Mark Barrett (2018) reported, “some school officials in Western North Carolina and elsewhere say it may be difficult to find enough qualified teachers to meet the mandate and some school systems do not have enough classrooms.” Nevertheless, class sizes in the state have been decreasing.

Table 1 below shows that class size has been decreasing for Kindergarten through grades 3 from 2013- 2019. The average Kindergarten class had 21 students in 2013-2014 and decreasing to 18 students in 2018-2019. For Grade 3, the average class size decreased from 21 students in 2013-2014 to 17 students in 2018-2019.

Table 1. History of Student to Teacher Ratio in North Carolina, 2013 - 2019

Year	Kindergarten			1 st Grade			2 nd Grade			3 rd Grade		
	Alott	Avg	Max	Alott	Avg	Max	Alott	Avg	Max	Alott	Avg	Max
13-14	19	21	24	18	21	24	18	21	24	18	21	24
14-15	18	21	24	17	21	24	17	21	24	17	21	24
15-16	18	21	24	17	21	24	17	21	24	17	21	24
16-17	18	21	24	16	21	24	17	21	24	17	21	24
17-18	18	20	23	16	20	23	17	20	23	17	20	23
18-19	18	18	21	16	16	19	17	17	20	17	17	20

Source: NC Senate committee approves revised version of HB13; Class-size changes pushed to 2018. <https://abc11.com/1912645/>

Table 1 above shows that student-teacher ratios have decreased in Kindergarten, from 19 to 18 students per teacher, and in Grade 3, from 18 to 17 students per teacher between the 2013 and 2019 school years. Accompanying these class size reductions, however, has been a tremendous rise in additional costs (see Table 2). Therefore, considering the strong public support for smaller class sizes, the additional costs need to implement reduction programs, and mixed empirical findings on the matter, more research is critical to continue the debate.

Table 2. Estimated Cost of Small Class Size Mandate in Selected Counties/School Systems

County /School System	Number of Needed Teachers	Amount needed to implement mandate/ other issues
Asheville City Schools	15 or 16 elementary school teachers	Additional classrooms
Chapel Hill-Carrboro City Schools		\$3 million for teacher supplements for new hires
Charlotte-Mecklenburg Schools	353 new positions	\$23 million
Durham County Schools		\$100 million
New Hanover County Schools	48 new positions	\$3.2 million and additional classrooms
Surry County Schools	17 new teachers	\$1.7 million
Wake County Public Schools	460 new teachers	400 new classrooms; \$320 million in capital, operating expenses

Source: Compiled using information from Nordstrom, K (2017). Class Size Chaos: Districts are scrambling to meet new requirements by initiating layoffs and eliminating enhancement teachers. North Carolina Justice Center. <https://www.ncjustice.org/wp-content/uploads/2018/11/Ed-Policy-Perspectives-CLASS-SIZE-Kris.pdf>

Purpose of the Study

Given the interest by parents, educators and policy makers and with the results from other studies being mixed at best, the purpose of this study are to answer the following research questions:

1. Is there a relationship between a school's performance score and average class size for NC elementary schools?
2. Is there a relationship between a school's performance score and average class size for NC middle schools?

Our data come from the North Carolina (NC) School Report Cards (SRC) datasets. Using the results from a linear regression and ordered logit, we find that average class size significantly predicts both NC elementary and middle school performance. However, the estimates suggest that higher average class size is negatively related to elementary school performance, but positively related to middle school performance.

Literature Review

Class Size

Numerous studies have examined the effects of small classes on student achievement. However, the findings "on the educational effects of class size differences [have] not been clear" (Filges, Sonne-Schmidt and Nielsen, 2018, p. 5). Indeed, the results have been "mixed at best" (Borland, Howsen, and Trawick, 2005, p. 73; Chingos, 2013). According to Chingos (2013), "the evidence on the efficacy of class size is clearly mixed, with one high-quality study finding quite large effects, another finding no effects, and a handful finding effects in between" (p.430). In their meta-analysis of class size research, Filges, Sonne-Schmidt and Nielsen (2018) find that "there is some evidence to suggest that there is an effect of reducing class size on reading achievement, although the effect is very small. There is no significant effect on mathematics achievement, though the average is negative meaning a possible adverse impact on some students cannot be ruled out." (p. 6). Finn, Pannozzo and Achilles (2003) conduct a similar meta- analysis and conclude that the "results favored small classes in at least 38 of the 42 measures employed. While some individual changes were small, no measure in any study was statistically significant in favor of larger classes" (p. 334).

In a 2003 paper, Buckingham stresses that "several large scale studies and many smaller ones find a relationship between learning and class size. But a closer examination reveals crucial methodological problems and generalizations that make the findings far less than definitive, even meaningless" (p. 72). In contrast, Glass and Smith (1979), in their meta-analysis of research on class size and academic achievement, came to the conclusion that there is a clear and strong "relationship between class size and achievement...The relationship seems slightly stronger at the secondary grades than the elementary grades; but it does not differ appreciably across different school subjects, levels of pupil IQ, or several other obvious demographic features of classrooms" (p.15). In a large scale study of the California Class Size reduction program, Jepsen and Rivkin (2009) find that reduction in class size raised schools' average mathematics and reading achievement by roughly 0.10 and 0.06 standard deviations, respectively. However, the accompanying rise in the shares of new and not-fully certified teachers offset some of the benefits of class size reductions (Jepsen and Rivkin, 2009, p.224). Complicating the class size debate further, Chingos (2012) concludes that mandated class size reductions in the state of Florida had little, if any, effect on student achievement. In their study of class size during elementary school, Nye, Hedges and Konstantopoulos (2002) draw the following conclusions:

- a. Small classes in early grades lead to higher academic achievement.
- b. The advantages of smaller classes are larger for lower achieving students for reading, but larger for higher achieving students in mathematics.
- c. While there is strong evidence that small classes can benefit all students, evidence for the differential benefit for lower achieving students is both weak and contradictory (p.215).

Baker, Farrie and Sciarra (2016) argue that there is ample research showing that elementary school "children in smaller classes achieve better outcomes, both academic and otherwise, and that class size reduction can be an effective strategy for closing racially or socioeconomically based achievement gap" (p.5). They also emphasize that reductions in class size may positively influence teacher recruitment and retention. Odden (1990) concludes that smaller classes enable opportunities for teachers to engage in research-backed instructional strategies that have been shown to promote higher student performance, like group work and class discussions (p.219). In a review of the relevant research from Australia and New Zealand, Zyngier (2014) concludes that the gains from small classes in early grades are larger when class size is reduced to fewer than 20 students. (p.16).

In a 2012 study, Shin finds that Black students benefit more than others ethnic groups from reduced class sizes regarding first-, second-, and third-grade academic achievement. Indeed, in an analysis of data from the National Education Longitudinal Study, Akerhielm (1995) finds that for 8th graders, students in smaller classes

performed better than students in larger classes. Loveless and Hess (2007) find that smaller class sizes offer teachers more time to address the individual needs of each student, and the smaller settings provide better structure, safety and discipline (p. 2). Finn, Gerber and Boyd-Zaharias (2005) found that students attending small classes over three years increased their likelihood of graduating from high school, especially among economically disadvantaged students.

In an experiment on class size and student outcomes, Mosteller (1995) finds that “minority groups gained more than others in the first two years of the experiment; and although the last two years showed benefits comparable with those of the majority, there was a falling off of benefits” (p.125). Folemer-Anneverlink, Doolard, Mascareno and Bosker (2010) conclude that more “student-teacher interactions occurred in smaller classes than in larger classes. This is true both for interactions related to instruction and classroom management in kindergarten and Grade 1” (p.36). Greater student teacher interactions may facilitate higher quality instructions, especially at the lower grades. Indeed, a 2015 Hanover Research Report notes that several studies find that “enrollment in smaller classes can lead to higher standardized test scores, an increased likelihood of taking college entrance exams, increased earnings, and higher college attendance rates, especially among certain subpopulations” (p.4). In his 1990 paper, Robinson (1990) concludes the following:

- a. The most promising effects of small classes on pupil learning occur in grades K-3 (p.82).
- b. There is some evidence that smaller classes can have greater positive effects on the achievement of disadvantaged and minority students (p.83).
- c. There is more positive student attitudes and behaviors in smaller classes (p.86).

A National Council of Teachers of English Policy Statement (2014) advocates for smaller class size as a means of improving student learning. Nevertheless, they stress that “for many high school students smaller classes do not make a significant difference in academic performance. However, for minority and at-risk students as well as those who struggle with English literacy, smaller classes enhance academic performance.” In the statement, educators are advised to note that benefits from reduced class sizes are not uniform across all grades and populations.

Method

Participants

Data are from the North Carolina (NC) School Report Cards (SRC) datasets (NCDPI, 2019). In NC, SRCs are available for each public school. Schools receive report cards with their performance score, in addition to other reporting material, like details on student and teacher characteristics. SRCs are sources of information for government administrators and researchers. The data used for these reports are available at the public school system’s website.

The NC General Assembly dictates that student outcome information be used to calculate and ascribe grades to public schools in the state. Two components are used to calculate grades: 1) school achievement scores, which form 80 percent of the grade and 2) school academic growth amongst students, which comprise the final 20 percent. Performance scores fall along a 100-point scale, which then determines letter grades. These letter grades follow a standard 15-point grading scale: A: 85-100 B: 70-84 C: 55-69 D: 40-54 F: Less than 40 (NCDPI, 2019).

We have two separate analysis samples. One sample contains data for NC elementary schools, and the other sample contains data for NC middle schools. The analysis samples contain two years of data, namely for 2018 and 2017. The elementary school dataset includes 2,452 observations for 1,226 elementary schools. Therefore, the set contains two records for each school. Since there are 1,329 elementary schools in NC, our dataset contains over 92 percent of all public elementary schools in the state. The 103 excluded schools were dropped from the final sample because they had missing information for key variables. The middle school dataset has 850 observations for 425 middle schools. Hence, the dataset has two records for each school. There are 465 public middle schools in the state, so the dataset comprises over 91 percent of all public middle schools in NC. Forty schools were excluded because they had missing information for key variables. We only use observations for 2018 and 2017 because a major part of the performance score formula, namely the accountability measures, changed for these years relative to the other years. Hence, performance score comparisons to the years prior to 2017 are problematic.

Measures and Variables

School Performance – Public schools in NC receive a score based on their performance, which varies from 100 to 0. A score corresponds to a letter (A to F) and is composed of two factors. The first (80%) is determined by a school's achievement scores, which come from accountability measures. These accountability metrics include grade level assessments, end-of-grade-tests that evaluate mathematics and reading, and English language assessments for English Learners. The second factor integrates the academic growth of a school's students. Academic growth is measured as the development children experience relative to the mean devolvement experienced by children across NC (for a subject and grade level). Hence, this evaluates the progress students have made since the previous academic year, as a result of the academic instruction they received.

Average Class Size – The average class size at a school, across all subjects and grade levels.

Other Covariates

Years of Teaching Experience – This variable is measured as a set of three mutually exclusive and exhaustive variables.

- *0 to 3 Years of Teaching Experience* - The share of teachers at a school with 0 to 3 years of experience.
- *4 to 10 Years of Teaching Experience* - This share of teachers at a school with 4 to 10 years of experience.
- *Over 10 Years of Teaching Experience* - This share of teachers at a school with over 10 years of experience.

Teachers with Advanced Degrees - The share of teachers with education or licensing levels above bachelor degrees.

Teachers with Full Licenses - The share of teachers who are fully licensed, meaning they meet all examination and certification requirements.

Teacher Turnover - The share of teachers that worked for a school the previous year, but are no longer employed there.

Student Attendance - The average daily share of students that attend school, across grade levels.

Economically Disadvantaged Students - The share of children at a school that are considered economically disadvantaged.

Year 2018 – Dummy variable equal to 1 if the year is 2018 and 0 if the year is 2017.

Results

The analysis and results are as follows - First, the frequencies of performance grades received by NC middle and elementary schools are presented in tables. Second, descriptive statistics and data visuals, followed by our study's hypotheses, are provided. Third, we test our hypotheses with the results from a linear regression and ordered logit.

Middle and Elementary School Performance in North Carolina

Table 3 shows the frequency of middle school performance grades in 2018 and 2017. In 2018, roughly 3 percent of schools earned As, and in 2017, that percentage was roughly 3.5. The percentage of schools that earned Bs in 2018 dropped compared to the previous year. Sixteen percent earned Bs in 2018, while around 20 percent received Bs in 2017. A marginally higher percentage earned Cs in 2018, close to 48 percent, compared to the 43 percent it was in 2017. About 26 percent of middle schools earned Ds in 2018, which is down from 2017. In 2018, 7 percent of schools earned Fs. In 2017, however, the percentage was around 5.7.

Table 3. Frequency of Middle School Performance Grades

Letter Grade	2018		2017	
	Percent	Frequency	Percent	Frequency
A	3.06	13	3.53	15
B	16.00	68	19.76	84
C	47.76	203	43.53	185
D	26.12	111	27.53	117
F	7.06	30	5.65	24

Table 4 displays the frequency of grades received by elementary schools in 2018 and 2017. In 2018, over 3 percent of schools earned As, and in 2017, that percentage was around 4. The percentage of schools that earned Bs in 2018 is approximately the same as it was in 2017, around 28 percent. The same goes for the share of schools that earned Cs. In 2018 and 2017, around 45 percent of schools earned Cs. About 19.6 percent of middle schools earned Ds in 2018, which is up from 2017 (18.4%). In 2018, around 3.2 percent of schools earned Fs. In 2017, however, the percentage was 4.

Table 4. Frequency of Elementary School Performance Grades

Letter Grade	2018		2017	
	Percent	Frequency	Percent	Frequency
A	3.18	39	4.08	50
B	28.71	352	28.38	348
C	45.35	556	45.11	553
D	19.58	240	18.43	226
F	3.18	39	4.00	49

Table 5 displays descriptive statistics for the dependent variable for both middle and elementary schools, in 2018 and 2017. Middle schools performed roughly the same in both years, having average performance scores of approximately 59. Elementary schools performed roughly the same in both years, too, having average performance scores of approximately 63.

Table 5. Middle and Elementary School Performance Scores: Descriptive Statistics

Variables	Mean (SD)	
	2018	2017
Middle School Performance Score	59.46 (12.76)	59.85 (12.79)
Elementary School Performance Score	63.50 (12.10)	63.41 (12.54)

Class Sizes in North Carolina Middle and Elementary Schools

Table 6 shows the descriptive statistics for the average class size variable, for both middle and elementary schools in 2018 and 2017. In 2018, the average middle school class contained around 23 students, and the average elementary school class contained around 19.1 students. In 2017, the average middle school class contained around 23.4 students, and the average elementary school class contained around 19.7 students.

Table 6. Average Class Size and School Performance Score

Variable	Mean (SD)	
	2018	2017
Middle School Average Class Size	22.97 (3.73)	23.40 (3.44)
Elementary School Average Class Size	19.11 (2.26)	19.68 (2.22)

Class Size Hypotheses

Before we present statistics related to the analysis on class size and performance, we formally state the two hypotheses, corresponding to our two research questions.

Hypothesis 1:

H_{1,N}: There is not a relationship between average class size and school performance in NC public middle schools.

H_{1,A}: There is a relationship between average class size and school performance in NC public middle schools.

Hypothesis 2:

H_{2,N}: There is not a relationship between average class size and school performance in NC public elementary schools.

H_{2,A}: There is a relationship between average class size and school performance in NC public elementary schools.

Scatterplots and Correlations

Figure 1 presents a 2x2 panel of scatterplots, showing the average class sizes in middle and elementary school plotted against performance scores, in 2018 and 2017 respectively. The first row contains the results for middle schools, and the second row contains the results for elementary schools. The first column contains 2018 data, while the second contains data from 2017. All four plots show an increasing relationship between average class size and school performance. However, the relationship is much stronger for middle schools, compared to elementary schools.

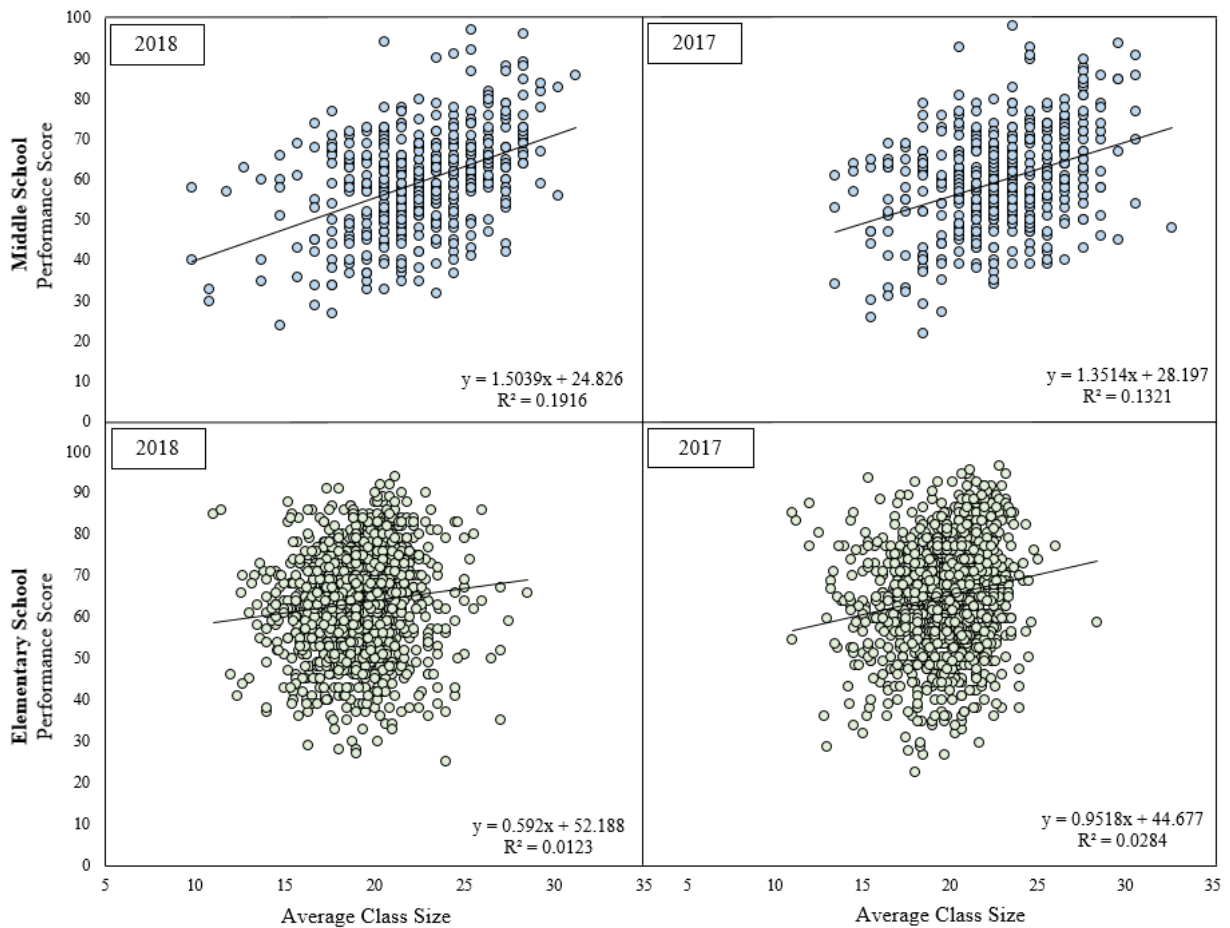


Figure 1. Average Class Size and School Performance Score

Figure 2 presents a 2x2 panel of histograms, showing the average class sizes in middle and elementary school conditional on earned performance grades, in 2018 and 2017 respectively. The first row contains the results for

middle schools, and the second row contains the results for elementary schools. The first column contains 2018 data, and the second contains 2017 data. For NC middle schools, surprisingly, better performing schools average larger class sizes, while lower performing schools average smaller class sizes. For NC elementary schools, a clear pattern does not exist. In 2018, average class sizes are approximately the same, regardless of a school's performance grade. In 2017, however, it appears that better performing schools average slightly higher class sizes compared to lower performing schools.

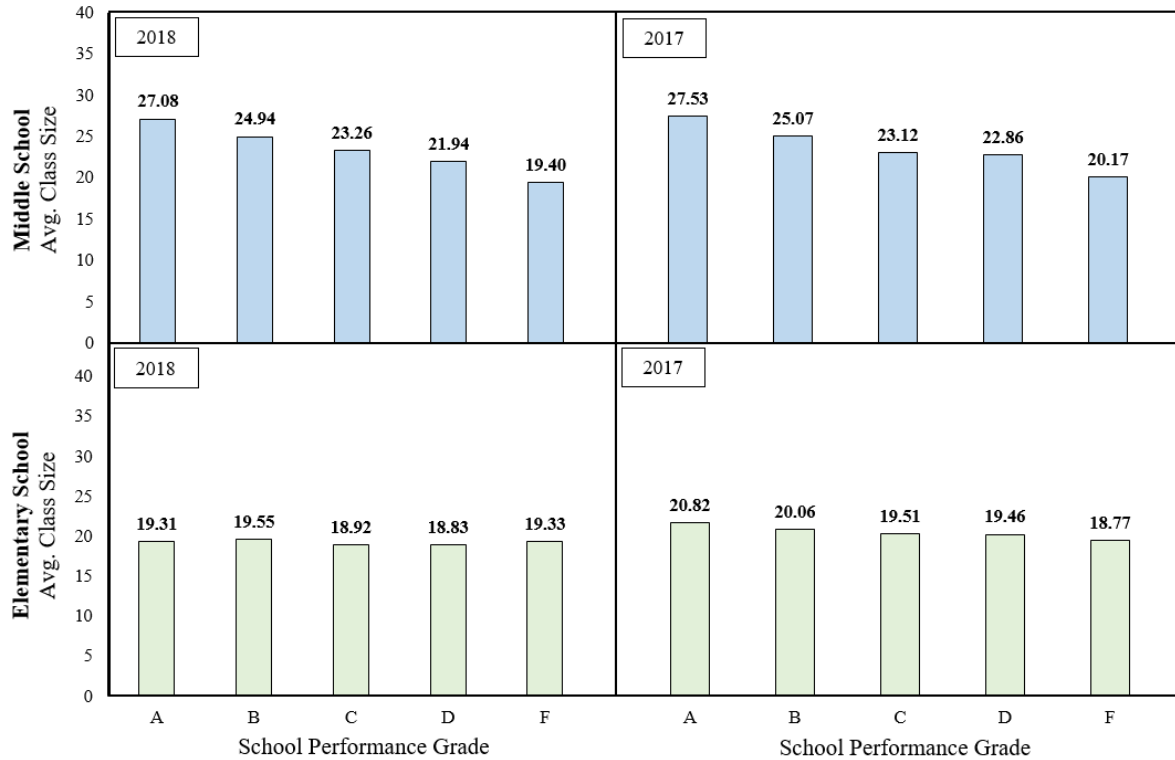


Figure 2. Average Class Size and School Performance Grade

Regression Analysis Plan and Results

To examine the relationship between school performance and class size, we estimate the following model separately for middle and elementary schools. Model (1):

$$SchoolScore_i = \beta_0 + \beta_1 ClassSize_i + \sum \beta X_i + \varepsilon_i$$

Where [SchoolScore_{*i*}] is the performance score of the *i*th school. [ClassSize_{*i*}] is the average class size at the *i*th school. X is an array of other control variables for the *i*th school. These variables include year, share of teachers with 4 to 10 years of experience, share of teachers with over 10 years of experience (the share of teachers with 0 to 3 years of experience is omitted to avoid perfect multi-collinearity), share of teachers with advanced degrees, share of teachers with full licenses, rate of teacher turnover, share of economically disadvantaged students, unique book titles per student, and average daily student attendance. β_0 is the intercept term, ε_i is the error term, and β_j is the slope coefficient of interest, which corresponds to the primary independent variable of interest for this study.

Model 1 is estimated under two econometric frameworks. First, it is estimated as a multiple linear regression and second, it is estimated as an ordered logit. For the first, the dependent variable of Model 1, SchoolScore, is treated as a continuous variable ranging from 100 to 0. For the second, SchoolScore is treated as an ordinal variable corresponding to the letter grade a school receives, A, B, C, D, and F (A = 5, B = 4, C = 3, D = 2, and F = 1). The results of the ordered logit are used to obtain the marginal effect of the change in a covariate on the probability that a school receives a particular letter grade.

Table 7 presents the key results from the multiple linear regression estimation of Model 1, for middle and elementary schools. We offer interpretations of the key variable of interest. The class size variable is

significantly related to school performance, for both middle and elementary schools in NC. For middle schools, however, the coefficient estimate is positive and significant at the 10% level. While for elementary schools, the coefficient estimate is negative and significant at the 1% level. When the average middle school class size increases by 1 student, school performance score increases by 0.162 points, holding all else constant. When the average elementary school class size increases by 1 student, school performance score decreases by 0.392 points, holding all else constant.

Table 7. Linear Regression Results for Key Variable

Key Independent Variable	Middle Schools					Elementary Schools				
	B	SE B	β	t	p	B	SE B	β	t	p
Average Class Size	0.1621	0.0826	0.0455	1.96	0.0501	-0.3919	0.0806	-0.0719	-4.86	<0.0001

Middle School Model Notes. N = 850. F-Value = 178.60. R-Squared = 0.6804. Adjusted R-Squared = 0.6766.
Elementary School Model Notes. N = 2,452. F-Value = 288.45. R-Squared = 0.5416. Adjusted R-Squared = 0.5398.

Table 8 displays selected results from the ordered logit estimation of Model 1, for both middle and elementary schools. The table presents the untransformed logit coefficients. We interpret the results for the key variable. For middle schools, average class size is increasing with earned performance grade. The logit coefficient estimate is statistically significant at the 10% level. For elementary schools, average class size is decreasing with earned performance grade. The logit coefficient estimate is statistically significant at the 1% level. Hence, the ordered logit results support those from the linear regression, for both NC middle and elementary schools.

Table 8. Ordered Logit Regression Results for Key Variable: Logit Coefficients

Key Independent Variable	Middle Schools				Elementary Schools			
	B	SE B	z	p	B	SE B	z	p
Average Class Size	0.0448	0.0236	1.89	0.058	-0.0822	0.0196	-4.20	<0.001

Middle School Model Notes. N = 850. LR Chi-Squared = 797.67 (p < 0.0001), Pseudo R-Squared = 0.3592.
Elementary School Model Notes. N = 2,452. LR Chi-Squared = 1,600.94 (p < 0.0001), Pseudo R-Squared = 0.2566.

Table 9 displays key results from the ordered logit estimation of Model 1, for both middle and elementary schools. The table presents the estimated marginal effects (ME in the tables) associated with earning an A and earning an F (denoted with a subscript A or subscript F). We begin by interpreting the marginal effects associated with earning an A for the key variable. For middle schools, average class size is positively related to the probability that a school earns an A and the estimate is significant at the 10% level. When the average middle school class size increases by 1 student, the probability that a school earns an A increases by 0.00011, holding all other covariates constant at their means. For elementary schools, average class size is negatively related to the probability that a school earns an A and the estimate is significant at the 1% level. When the average elementary school class size increases by 1 student, the probability that a school earns an A decreases by 0.00062, holding all other covariates constant at their means.

We now interpret the marginal effects associated with earning an F for the key variable. For middle schools, average class size is negatively related to the probability that a school earns an F and the estimate is significant at the 10% level. When the average middle school class size increases by 1 student, the probability that a school earns an F decreases by 0.00037, holding all other covariates constant at their means. For elementary schools, average class size is positively related to the probability that a school earns an F and the estimate is significant at the 1% level. When the average elementary school class size increases by 1 student, the probability that a school earns an F increases by 0.00075, holding all other covariates constant at their means.

Table 9. Ordered Logit Regression Results for Key Variables: Marginal Effects

Key Independent Variable	ME_A	SE ME_A	z_A	p_A	ME_F	SE ME_F	z_F	P_F
Middle School								
Average Class Size	0.00011	0.00006	1.69	0.091	-0.00037	0.00021	-1.79	0.073
Elementary School								
Average Class Size	-0.00062	0.00017	-3.72	<0.001	0.00075	0.00020	3.78	<0.001

Middle School Model Notes. N = 850.
Elementary School Model Notes. N = 2,452.

To summarize the statistical results, the linear regression and ordered logit estimates complement one another.

- We reject $H_{1,N}$. Hence, we find evidence of a relationship between average class size and school performance in NC public middle schools. Average class sizes significantly predict school performance. Larger class sizes are positively related to middle school performance scores.
- We reject $H_{2,N}$. Hence, we find evidence of a relationship between average class size and school performance in NC public elementary schools. Average class sizes significantly predict school performance. Larger class sizes are negatively related to elementary school performance scores.

Discussion

This study based on the 2017 and 2018 data from the NC Schools Report Cards finds that in NC, average class size significantly predicts elementary school performance. As average class sizes increase, elementary school performance scores tend to fall. For middle schools, as average class sizes rise, school performance scores tend to increase. Our elementary school findings mesh well with the many other studies that find that students benefit from smaller classes, especially at the K-3 level (Baker, Farrie and Sciarra, 2016; Bascia, 2010; Zyngier, 2014). Indeed, according to Ehrenberg, Brewer, Gamoron, and Willms (2001), instruction in smaller classes could be more effective since “certain practices may work better in smaller classes. For example, students may pay better attention when there are fewer students in the room” (p.21). Robinson (1990) and Shin (2012) conclude that smaller classes may be very beneficial to minority and disadvantaged students. Mckeachie (1980) concluded that for the “Goals of higher level thinking, application, motivation, and attitudinal change are most likely to be achieved in small classes” (p.26).

Annie Duncan (2011), the Secretary of Education for the Obama Administration, declared that education is the civil rights issue of our generation. He indicated that “if you care about promoting opportunity and reducing inequality, the classroom is the place to start. Great teaching is about so much more than education; it is a daily fight for social justice.” Smaller classrooms in elementary school may be one way of improving achievement for lower performing students. Moreover, since many states have adopted policies aimed at reducing class sizes, especially at the K-3 level, our findings suggest that they could be beneficial in NC elementary schools and should continue.

Our finding regarding NC middle schools are a bit more controversial. We find that larger class sizes are positively related to middle school performance. This result does not mesh as well with the literature, like our elementary school findings do. Considering the surprising nature of these results, we feel it unwise to conclude that they offer evidence in favor of larger classes in NC middle school. More research is needed, along with more data, to ensure this finding is not simply a spurious correlation.

Conclusion

Class size reduction is one way to improve student achievement in NC, at least at the elementary school level. This study has shown that at the elementary school level, reduced class size significantly predicts school performance. The costs of implementing class size reduction are often high for many counties and school systems. States should continue the policy of reducing elementary class sizes. Researchers should also continue the investigation into whether class sizes have differential effects depending on the school level in which they occur.

Note

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