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ABSTRACT

This study examined the impact of the second year of the federal class-size reduction (CSR) program in the Wake County Public School System (WCPSS), North Carolina. The 23 participating schools in the WCPSS had from 22% to 51% of their students receiving free or reduced-price lunches. In the second year, the CSR program was expanded from grades 1 and 2 to include grade 3. The achievement of students in schools where CSR was implemented at one grade level was compared with the achievement of students in participating schools where CSR was implemented at another level. Outcome measures were grade level standards of the county's literacy and mathematics assessments for grades 1 and 2 and the state's end-of-grade tests at grade 3. The average reduction accomplished through the CSR was only 3.9 students per class, and classes of 18 students or fewer were only possible in 5 of the 23 project schools. At grades 1 and 2 data did indicate that the increase in the percentage of students meeting the grade-level standards was greater for students in the reduced-size classes than in regular-size classes. This was true for reading and mathematics. At grade 3, there were no significant differences in reading and mathematics achievement between students in reduced-size classes and those in regular-size classes after controlling for free or reduced-price lunch status and differences in pretest scores. Recommendations are made for improving the CSR program using the model in which an additional teacher is used to make up a new class, reducing the size of all classes about equally. One attachment shows the class size reduction achieved at each school, and the other contains the teachers' survey about CSR. (SLD)

A Report to the
North Carolina Department of Public Instruction

CLASS-SIZE REDUCTION PROGRAM EVALUATION, 2000-2001

E&R Report No. 02.05

DEPARTMENT OF EVALUATION AND RESEARCH

WAKE COUNTY PUBLIC SCHOOL SYSTEM

CLASS-SIZE REDUCTION PROGRAM EVALUATION, 2000-2001

Summary

In the United States, there is substantial evidence that during the early grade levels small classes can significantly improve academic achievement. This report examines the impact of the second year of the federal **Class-Size Reduction (CSR)** program in the Wake County Public School System (WCPSS) on student achievement.

The 23 participating schools in WCPSS had from 22 to 51 percent of their students receiving free or reduced-price lunches. The number of low-achieving students at each school ranged from 46 to 117, representing 26 to 44 percent of the students in the schools. Under revised local and federal guidelines, participating schools implemented CSR in grades K-3, rather than grades K-2 as in the previous school year. For 2000-01, most schools chose to serve grade 3 and to use the model research has suggested is most likely to be effective with the CSR teacher.

Since these 23 schools are more alike in terms of demographics and previous student performance than other WCPSS schools, the achievement of students in schools where CSR was implemented at one grade level was compared with the achievement of students in other schools where CSR was implemented at another grade level. For example, achievement of third-grade students in schools that implemented CSR in grade 3 were compared with achievement of third-grade students in participating schools implementing CSR at grades 1 or 2 instead. Outcome measures were the grade-level standards of the WCPSS K-2 Literacy and Mathematics Assessments at grades 1-2 and the NC End-of-Grade (EOG) reading and mathematics tests at grade 3. Overall results follow.

It is important to keep in mind the amount of class size reduction achieved when reviewing the achievement assessment results. State teacher allotments were based on 23 (grades 1 and 2) or 25 (grade 3) students per teacher, with more students generally in these classes. While smaller classes were achieved with CSR, adding one teacher to a grade level did not generally result in classes of the size recommended by the enabling legislation (18). Class sizes of 18 or less were possible only in five of the 23 project schools, and some of those experienced increases in students during the school year. The average class size was 20.3, with an average reduction of 3.9 students.

CSRP Impact on Student Achievement at Grades 1 and 2

At grades 1 and 2, data from two years of K-2 Literacy and Mathematics Assessments data indicate that the increase in the percentage of students meeting the grade-level standards was greater for students in the reduced-size classes than in regular-size classes.

Reading Book Level (from K-2 Literacy Assessment)

- Overall, the increase in the percentage of students meeting the reading-book-level standard was greater for students in reduced-size classes than for students in regular-size classes.
- This pattern was the same for low-income students (based on F/RL status) and non-low-income students.

K-2 Mathematics Assessment

- Overall, the increase in the percentage of all students meeting the K-2 Mathematics Assessment standard was greater for students in reduced-size classes.
- *The pattern differed for low-income students and non-low-income students.* Non-low-income students in reduced-size classes showed greater increases than those in regular-size classes in meeting the standard, but low-income students did not.

CSR Impact on Student Achievement at Grade 3

At grade 3, the North Carolina End-of-Grade (EOG) pre-test and post-test data indicate that, controlling for differences in pre-test scores and free and reduced-lunch status of students, there were no significant differences in reading and mathematics achievement between students in reduced-size classes and those in regular-size classes.

EOG Reading

- Controlling for pre-test differences and income levels (F/R lunch status), there were no significant differences in the reading achievement of students in regular-size classes and those in reduced-size classes.
- This pattern remained the same when actual class sizes were controlled for in the analyses of reading achievement. In other words, there were no significant differences between the reading achievement of students in classrooms of fewer than 19 students and the achievement of students in larger classes (whether or not the actual class size was in a "CSR school" or a "comparison school"). Three schools had class sizes of 19 or less, while other schools had class sizes of 19-30 students.

EOG Mathematics

- Controlling for both pre-test differences and income levels (F/R lunch status), there were no significant differences in the mathematics achievement of students in regular-size classes and those in reduced-size classes.
- This pattern remained the same when actual class sizes were controlled for in the analyses of mathematics achievement. In other words, there were no significant differences between the mathematics achievement of students in classrooms of fewer than 19 students and the achievement of students in larger classes (whether or

not the actual class size was in a "CSR school" or a "comparison school"). Three schools had class sizes of 19 or less, while other schools had class sizes of 19-30 students.

Overall results are presented in the table below.

CSR versus Comparison Group Achievement Results

	Reading		Math	
Grade in Spring 2001	WCPSS K-2 Assessments	EOG	WCPSS K-2 Assessments	EOG
ALL STUDENTS				
1	CSRP +		CSRP +	
2	CSRP +		CSRP +	
3		CSRP -		CSRP -
LOW INCOME (F/RL) STUDENTS				
1	CSRP +		CSRP -	
2	CSRP +		CSRP -	
3		CSRP -		CSRP -
NON-LOW INCOME (F/RL) STUDENTS				
1	CSRP +		CSRP +	
2	CSRP +		CSRP +	
3		CSRP -		CSRP -

Note 1: At grades 1 and 2, CSRP + (positive) indicates that students in reduced-size classes had greater increases in percentage at or above the grade-level standard than students in regular-size classes. CSRP - (negative) indicates the opposite: that students in reduced-size classes had lower increases.
Note 2: At grade 3, CSR – (negative) indicates that class size reduction did not significantly contribute to achievement growth.

Recommendations

The following potential improvements are being applied in the current school year, 2001-2002:

- Adjusting allocations in order to give two teachers to the schools most in need, and asking those schools to use both teachers at the same grade level if necessary to achieve a class size of no more than 18 students.
- Continuing to encourage implementation of Model 1 (where the CSRP teacher is utilized to form a new class about equal in size to all other classes of the target grade, thus decreasing the size of all classes at that grade level in the school) and to discourage the use of a rotating teacher shared equally among all of the classes of the target grade (a model used when no space is available for a separate classroom but for which there is no supporting research in WCPSS).
- Encouraging C&I staff to continue training and "agreement checks" for grades K-2

teachers on the use of the Kindergarten Initial Assessment and K-2 Literacy and Mathematics Assessments in order to assure consistency in ratings among teachers.

The following are recommendations for the 2002-2003 school year:

- Encouraging future implementation of CSR for the earliest grade levels, particularly at grades 1 and 2 where WCPSS evaluation results indicate that class size reduction has a more positive impact on overall reading and mathematics achievement. The results of this evaluation suggest that the impact of reduced-size classes at grade 3 was not beneficial.
- Encouraging schools to consider ways to improve benefits for low-income students, especially in math. The Mathematics Assessment results at grades 1 and 2 indicate that low-income students did not benefit as much as non-low-income students from being in reduced-size classes. Additionally, low-income students had lower average pre-test scores than non-low-income students in these early grades, verifying greater instructional needs. National research suggests that low-income students show greater achievement gains when in smaller classes of 15 students or less.
- Developing a method of examining pre- and post- developmental status in literacy and mathematics by students at the kindergarten level. This evaluation was not conducted for kindergarten students because insufficient data were available on pre- and post-tests.
- Monitoring project schools for interactions with any other grants and for any changes in teacher/student allocation formulas lowering class size substantially.
- Examining differences in CSR impact in schools where a cohort of students is followed through the next grade with CSR implementation. For example, four of the participating schools in 2000-2001 chose to have the CSR teacher position move to the next grade level with the cohort of students involved in the project in the previous grant year.

Background

The U.S. Congress first authorized the **Class-Size Reduction (CSR)** Program in 1999 under section 310 of Public Law 106-113. The purpose of the CSR program was to put 100,000 new and fully qualified teachers into public schools, within seven years, in order to reduce class size to a national average of no more than 18 in grades one through three. The CSR program is based on a body of experimental research, including Tennessee's Project STAR, demonstrating that substantial reductions in class size have a significant effect on improving student achievement. (See E&R report # 01.30 for a review of the CSR literature.)

For fiscal year 2000, the U.S. Congress allocated $1.3 billion for the CSR program, enough for an increase above the initial 30,000 teaching positions nationwide. North Carolina received approximately $24.7 million for the initial school year and an increase of $2 million for the second year. School district allocations were based on two factors: the number of children in poverty (80 percent) and total enrollment (20 percent). The allocation for WCPSS was approximately $1.2 million for the 2000-2001 school year.

Evaluation Questions

Four general evaluation questions are addressed in this report:

1) What services were provided in 2000-2001, the second year of federally funded efforts to reduce class sizes in grades K-3?
2) Was the program implemented as planned and, if not, why?
3) What were the effects of the program?
4) How could the program be improved?

Implementation

Implementation Plan

District staff determined that 28 teachers in 23 schools could be supported through the CSR funds, with three of the 28 teachers added after mid-year when unspent monies became available. The 23 schools invited to participate were those with the most need in terms of three indicators:

- Percent of students receiving free- or reduced-price lunches.
- *Number* of students whose academic achievement was below grade level.
- *Percent* of students whose academic achievement was below grade level.

Invited schools were the same as those for the previous school year. This was done based on the belief that stability in staffing for at least two years was important to making an impact. These 23 schools had between 21.6 and 51.1 percent of their students receiving free- or reduced-price lunches. They also had 46 to 117 low-achieving students each, representing 25.8 to 43.9 percent of the students in the school.

District staff offered participating schools a choice of three implementation models that reflected the national guidance document. Models 1 and 2 involved adding an additional classroom, and Model 3 involved having an additional teacher rotate to team with the regular teachers at a grade level. (Descriptions follow.) District staff recommended the selection of Model 1 unless adequate space was not available for an additional classroom.

Actual Implementation

All 23 of the invited schools chose to participate, and all returned the required form in fall 2000 showing that they were implementing one of the available models in an appropriate grade. Under revised local guidelines, participating schools implemented class-size reduction in grades K-3, no longer limited to grades 1 and 2 as in the previous school year. (See Attachment 1 for a listing of participating schools and the grade levels and models selected by each school.)

Services Provided

Students were served in different target grades and by several implementation models. As depicted in Table 1, the preferred model (Model 1) and the third grade (not an option in the local guidelines for the previous year) were selected most often. Only one school chose to form a combination-grade class, and that was within Model 2.

Table 1:
Frequency for Each Implementation Model and Grade Level

Implementation Model	Kinder-garten	Grades K-1 Combined	Grade 1	Grade 2	Grade 3	Total
1. Teacher of new class **about equal in size to** all other classes of the target grade	1	0	7	5	6	*19*
2. Teacher of new class **substantially smaller than** other classes of the target grade	1	1	1	1	0	*4*
3. Rotating teacher shared equally **among all** of the classes of the target grade.	0	0	0	1	1 + (3)*	*5*
Total	*2*	*1*	*8*	*7*	*10*	*28*

*Three teachers were hired after mid-year. too late to establish separate classrooms.

Twenty-five teachers hired under the CSR program enabled reduced-size classes to be offered to 2,721 students as of the 20th day of the school year, about 109 students per teacher hired. Another three teachers were hired after mid-year, affecting another 318 students, about 106 students per teacher hired. The numbers of students served within each implementation model and grade level are shown in Table 2.

Table 2:
Number of Students Served for Each Implementation Model and Grade Level

Implementation Model	Grade K	K-1 Combined	Grade 1	Grade 2	Grade 3	Total
1) Teacher of new class **about equal in size to** all other classes of the target grade	100	0	726	565	578	*1,969*
2) Teacher of new class **substantially smaller than** other classes of the target grade	123	190	109	106	0	*528*
3) Rotating teacher shared equally **among all** of the classes of the target grade.	0	0	0	0	542	*542*
Total	*223*	*190*	*835*	*671*	*1,120*	*3,039*

As depicted in Table 3, the amount of class-size reduction achieved varied by implementation model, with the most reduction achieved under Model 1 (about five students per class) and the least under Model 3 (about two students per class).

Table 3:
Class-Size Reduction Achieved for Each Implementation Model

Model	Students Served	Average Before	Average After	Average Reduced
Model 1	1,969	24.86	**19.92**	4.94
Model 2	528	26.13	**21.70**	4.43
Model 3	542*	25.70	**23.52**	2.18

*Only one-fourth of the students in Model 3 were in reduced-size classes for the full school year because three (of four) teachers in Model 3 were hired after mid-year when funds became available.

Again, as in the initial year, adding one teacher to a grade level did not result in the achievement of classes of the size recommended by the enabling legislation (18 or fewer). In order to reduce the average class size to 18 in grades K-3 in WCPSS, often two teaching positions would have to be added per grade level using Model 1. Another factor that sometimes limits class-size reduction is the enrollment of new students after the school year begins.

While most of the 23 participating schools had space to create one additional class, they would

not have had the space to create an additional class at every grade level, K-3, at least not without re-designing existing spaces or adding mobile classrooms.

Effects of the Program

CSR Teacher Feedback on Program Effectiveness

Ninety-eight CSR teachers in the 23 schools (at the grade level where CSR was implemented) completed a survey in spring 2001. (See Attachment 2 for the complete questionnaire and results.) The 57 items on the CSR Teacher Survey fall into roughly six major clusters, cited in class-size reduction research, addressing issues related to instruction, individualization, student engagement, achievement, parental involvement, and the global benefits of reduced-size classes. As the body of literature on class-size reduction attests, there is some degree of overlap between these clusters. For example, individualization and student engagement are closely related, as are instruction and individualization.

On the whole, teachers were very positive about the potential benefits of CSR, with at least "some" agreement with every item. At least 75% percent of respondents agreed "much" or "very much" with the survey items in Table 4.

Table 4:
Survey Items with Highest Teacher Agreement

Item #	Cluster	Compared to regular class sizes, to what extent do you believe that...	% Agreeing "Much" or "Very Much"	% Agreeing "None" or "Little"
25	Individualization	You know your students' personalities better?	**85%**	3%
24	Individualization	You know each of your students' abilities better?	**85%**	4%
16	Individualization	You provide more individualized instruction to students?	**83%**	4%
9	Instruction	You use more flexible small-group instruction in your class?	**82%**	3%
30	Individualization	You intervene more with individual students in order to enhance academic progress?	**82%**	2%
28	Individualization	You are better able to keep track of how each student understands the lessons?	**78%**	2%
42	Instruction	You give more feedback that is tailored to each individual student?	**78%**	3%
12	Instruction	Instructional time is a higher percentage of the day in your class?	**77%**	5%
36	Student Engagement	Your students have a closer relationship with you?	**76%**	5%
15	Individualization	Your classroom atmosphere is more intimate than regular classes?	**76%**	6%

Note: Ninety-eight teachers responded to the questionnaire for a response rate of 92 percent. These included the allotted CSR teachers plus the other teachers on their grade-level teams whose class sizes were reduced because of the addition of a CSR teacher.

Teacher respondents' perceptions about the benefits of CSR parallel other findings in the class-size reduction literature. In particular, respondents tended to agree most with questions related to whether CSR enables individualization within the classroom. Teachers seemed to be most positive about the greater degree of intimacy and personal contact in their smaller classes, claiming to know their students' personalities and abilities better in their smaller classes. Teachers also strongly agreed that their students have a closer relationship with them, which class-size reduction literature identifies as a factor in stimulating student engagement.

The instructional items agreed upon most by respondents are related to the theme of individualization; CSR teachers appeared to value the ways in which smaller classes provide a more flexible and personal context for instruction. The respondents also perceived that they have the ability to spend proportionally more time on instruction in their CSR classes than in their larger classes, a perception that may be related to the fact that 63% of respondents agreed "much" or "very much" that they spend less time on discipline in their CSR classes.

While most items in the survey elicited moderate to high levels of agreement, at least 30% of respondents agreed "none" or "little" with the items listed in Table 5.

Table 5:
Survey Items with Lowest Teacher Agreement

Item #	Cluster	**Compared to regular class sizes, to what extent do you believe that...**	% "Much" or "Very Much" Agreement	% "None" or "Little" Agreement
34	Instruction	You use less small-group instruction for different groups in the class?	25%	**40%**
23	Parental Involvement	Your students' parents are more involved?	36%	**38%**
8	Achievement	Your students will score higher on K-5 classroom profiles or EOGs?	35%	**34%**
1	Global	Your class is not small enough to see the benefits of class-size reduction?	27%	**33%**
5	Individualization	Student behavior that is acceptable in your class would be viewed as too disruptive in a regular-size class?	27%	**32%**
51	Student Engagement	Your students have better attendance?	43%	**32%**

Note: Ninety-eight teachers responded to the questionnaire for a response rate of 92 percent. These included the allotted CSR teachers plus the other teachers on their grade-level teams whose class sizes were reduced because of the addition of a CSR teacher.

Interesting to note is the fact that a fairly high percentage of teachers (38%) perceived little or no increase in parental involvement, and 32% of teachers noticed little or no improvement in students' attendance (but the majority did). Additionally, 34% of respondents predicted that their students' K-2 Literacy and Mathematics Assessments or EOG scores would show little or

no improvement. These results may be related to the fact that *27% of teachers surveyed believed that their class was not small enough to see the benefits of class-size reduction.*

Most teachers *did* agree on the benefits of reduced class size, but at least some believed that their classes might not be small enough for those benefits to materialize. As one teacher wrote on the survey form, "I have 25 [students], but it's better than 31." Others commented similarly. One teacher wrote that even though she began the year with 19 students, "over the course of the year, I have received an additional 5 students...which brings any numbers back to the original amount of students. I do not feel that a class with this number of students will benefit from any of the factors listed in your survey." Thus, those teachers who disagreed about some of the benefits of CSR may not reject the theoretical basis of class-size reduction but may, instead, be teaching in contexts relatively smaller than before but with less reduction in class size than recommended by the experimental research or the enabling legislation.

Overall, the teachers generally concurred with the benefits of reduced-size classes, indicating that, as a result of CSR, their own interest in teaching is much higher (71%), and that low-income students (61%) and low-achieving students (64%) are learning more in their smaller classes.

Impact on Student Achievement

Method and Measures

As noted earlier, the 23 Wake County elementary schools receiving CSR funding chose to target different grade levels. Since these schools are more alike in terms of demographics and previous student performance than other Wake County schools, it would be inappropriate to construct comparison groups from the district as a whole. Therefore, for purposes of this study, E&R staff members chose to compare the achievement of students in schools where CSR was implemented at one grade level with the achievement of students in other schools where CSR was implemented at another grade level. For example, among the project schools, achievement of third-grade students in schools that implemented CSR, Model 1, in Grade 3 are compared with achievement of third-grade students in participating schools implementing CSR at grades 1 or 2 instead. In this way, grade-level comparisons of achievement in reading and mathematics are made between students in reduced-size classes and students in regular-size classes within the 23 project schools.

In North Carolina, academic progress and achievement in grades K-2 is assessed using local observational profiles - for math and literacy - that are utilized by teachers throughout the year. At the end of the school year, teachers then record the summary ratings from each student's completed profile folders on data-capture scan sheets collected centrally. The WCPSS K-2 Mathematics and Literacy Assessments, based on a specific goals and objectives for the *NC Standard Course of Study*, have been used system-wide since 1997. Teachers indicate a student's progress on the objectives, with each rating based on teacher observations of a student's demonstrated level of performance and should reflect multiple demonstrations of an objective by

the student. However, the K-2 assessment ratings are more subjective in nature than standardized test results and, thus, have lower statistical reliability than the NC End-of-Grade test scores.

Statewide standardized tests are not administered until the third grade, where students complete NC End-of-Grade (EOG) mathematics and reading pre-tests at the beginning of the school year and post-tests near the end of the school year. (Note: The EOG third-grade pre-tests are shorter in length than the post-tests and, therefore, the reliability of pre-test results is lower. However, a lengthier pre-test would be developmentally inappropriate for students entering grade 3.)

To assess the effects of class size reduction, E&R staff used least squares regression analyses to reduce any bias due to pre-existing differences among the students in the two groups. The first analysis was used to account for (control) differences in student background in two areas - prior achievement (pre-test score) and income level (whether receiving free or reduced-price lunches) – when comparing the achievement of students in the reduced-size classes and the regular-size classes.

Next, because it was possible that "real" class sizes might be no different in the two groups whose achievement was being compared, a second regression analysis was used to gauge the effects of CSR on achievement. This second analysis was based on students' actual class sizes rather than the two categories of (1) reduced-size classes (created by the allotment of a CSR teacher position) and (2) regular-size class (no CSR teacher position allotted).

An evaluation was not conducted for kindergarten students because insufficient data were available on pre- and post-tests. Also, no equivalent comparison group was available for the single combined-grade class in one CSR school, and results are not presented for those classes/grades where three CSR teacher positions were added after mid-year. Since only a single class of Models 2 and 3 was implemented at each grade level for the entire school year, no comparisons were made between models.

Reading Book Levels from Literacy Profiles, Grades 1-2:

The WCPSS K-2 Literacy Assessment provides ratings that show development in academic achievement from grades K-2. One measure in particular, the reading book level (ranging from *None* to *Level 31-32*), is based on a standard protocol, and the other literacy measures are highly correlated with it. Different books, emphasizing and enhancing specific reading objectives, are available for each of the book levels. K-2 Reading Assessment findings include the following:

Grades 1 and 2

- About 70-80 percent of the students in both reduced- and regular-size classes met the grade-level standards for reading at grades 1 and 2 in spring 2001, an improvement over spring 2000.
- Low-income students had lower pre- and post-test scores than non-low-income students.
- The increase in the percentage of all students meeting the reading-book-level standard was greater for students in smaller (CSR) classes than for students in regular-size classes.

- The pattern was the same for low-income students (based on F/R lunch status) and non-low-income students: increases were greater for students in smaller classes than in regular-size classes.

Overall results for Model 1 at each grade level are summarized in Table 6.

Table 6:
Reading Book Level Results, Model 1, by Grade Level
for All Students, F/R Lunch Students, and Non-F/R Lunch Students

Grade	Reduced Class Size			Regular Class Size		
	Pre-Test: % at or above Standard	Post-Test % at or above Standard	Increase in % at or above Standard	Pre-Test: % at or above Standard	Post-Test % at or above Standard	Increase in % at or above Standard
All Students						
K to 1	44.4	74.5	30.1	44.0	70.8	26.8
1 to 2	77.0	83.2	6.2	72.3	76.0	3.7
Free- and Reduced-Price Lunch Students						
K to 1	34.5	63.6	29.1	22.9	51.0	28.1
1 to 2	69.5	81.4	11.9	61.9	66.0	4.1
Non Free- and Reduced-Price Lunch Students						
K to 1	45.3	75.6	30.3	45.7	72.2	26.5
1 to 2	78.0	83.4	5.4	73.6	77.3	3.7

Note 1: For 2000-01, the standard was a reading book level of 13-14 for first grade and 23-24 for second grade -- with a re-telling score of 3 or 4 (on a four-point scale). Reading book level is an indicator of fluency and comprehension.
Note 2: Sample size ranged from 491 to 1,312 students.

WCPSS Mathematics Assessments, Grades 1-2

Using the WCPSS K-2 Mathematics Assessments, teachers throughout the year rate student performance on a I-IV scale on the four math strands in the *NC Standard Course of Study*. At year's end, students with ratings of III or IV on three of the four math strands are deemed to have achieved the standard for a particular grade level. Mathematics findings include the following:

- About two-thirds to three-fourths of the all students in both reduced- and regular-size classes met the grade-level standards for mathematics at grades 1 and 2 in spring 2001, an improvement over spring 2000 results.
- Low-income students had lower math pre- and post-test scores than non-low-income students at both grades.
- Overall, students in smaller classes showed slightly greater improvement than those in regular-size classes in reaching grade-level math standards at grades 1 and 2.
- Different patterns emerged for low-income and non-low-income students:

- The percentage of low-income students meeting the mathematics standards increased less for those in reduced-size classes than in regular-size classes.
- The percentage of non-low-income students meeting the mathematics standards increased more for those in smaller classes than in regular-size classes.

Overall results for Model 1 at each grade level are summarized in Table 7.

Table 7:
K-2 Mathematics Assessments Results, Model 1, by Grade Level for All Students, F/R Lunch Students, and Non-F/R Lunch Students

Grade	Reduced Class Size			Regular Class Size		
	Pre-Test: % at or above Standard	Post-Test % at or above Standard	Increase in % at or above Standard	Pre-Test: % at or above Standard	Post-Test % at or above Standard	Increase in % at or above Standard
All Students						
K to 1	67.3	76.0	8.7	69.4	76.1	6.7
1 to 2	52.9	63.1	10.2	56.9	66.6	9.7
Free- and Reduced-Price Lunch Students						
K to 1	59.7	67.2	7.5	52.2	61.7	9.5
1 to 2	33.3	44.4	11.1	37.1	50.3	13.2
Non Free- and Reduced-Price Lunch Students						
K to 1	72.1	81.7	9.6	78.6	83.7	5.1
1 to 2	66.1	75.5	9.4	69.3	76.9	7.6

Note 1: Students with ratings of III or IV (within a 1-4 scale) on at least three of the four math strands were deemed to have achieved the standard.
Note 2: Sample size ranged from 733 to 1,503 students.

NC End-of-Grade Reading and Mathematics Assessments, Grade 3

Standardized NC End-of-Grade (EOG) assessment results are reported for third-grade students. The NC accountability program includes pre- and post- assessments of third-grade reading and mathematics, with the pre-tests administered at the beginning of the school year and the post-tests administered in late spring of the same school year. (Note: The EOG grade 3 pre-test has lower reliability than the post-test, largely because the pre-test is shorter, yet a lengthier pre-test would be developmentally inappropriate for students entering grade 3.) Raw scores of the EOG tests are converted to scale scores so that test results can be compared on a common scale across years. Analyses conducted by the NC Department of Public Instruction indicate that no ceiling effects are found on either the pre- or post-tests.

EOG pre- and post-test results were available for 1,758 third-grade students in the participating schools who had both reading and mathematics scores. The mean (average) scale scores - and the standard deviation of each – for students in reduced-size classes and in regular-size classes are

shown in Table 8. Descriptively, students who were in reduced-size classes had slightly lower, but similar, average scale scores on mathematics and reading pre-tests than those in regular-size classes. Average growth in scale points was similar for both groups of students.

Table 8:
Means and Standard Deviations of Third-Grade EOG Mathematics and Reading Results

Variables	Reduced Class Size			Regular Class Size		
	Mean/ Average Scale Score	Standard Deviation	Average Growth in Scale Points from Pre to Post	Mean/ Average Scale Score	Standard Deviation	Average Growth in Scale Points from Pre to Post
Grade 3 Math Pre-Test	236.9	8.2	14.7	237.6	8.0	14.4
Grade 3 Math Post-Test	251.6	7.9		252.0	7.6	
Grade 3 Reading Pre-Test	139.2	8.4	7.9	140.3	8.6	8.3
Grade 3 Reading Post-Test	147.1	9.0		148.6	8.8	

Note 1: N=1,758 students.
Note 2: The standard deviation is a measure of the amount of variation in scores within which about two-thirds of the students fall. For example, a standard deviation of 8.2 indicates that about two-thirds of the students had scores that were 8.2 scale points above or below the average scale score.

To assess the effects of class size reduction, E&R staff used least squares regression analyses to control for any bias due to pre-existing differences among the students in the two groups. The aim was to control for differences in student background in the areas of prior achievement (EOG pre-test score) and family income, based on free or reduced-price (F/R) lunch status, when examining the main effects of class size reduction.

Next, because it was possible that "real" class sizes might be no different in the two groups (CSR classes and regular-size classes), a second series of regression analyses were conducted, this time using students' actual class sizes rather than students' membership in classes designated as CSR or non-CSR. Three schools had 3rd-grade class sizes below 19 while the other 15 schools had classes of 19-30 students.

EOG Reading, Grade 3

Findings include the following:

- Over and above the positive impact of EOG pre-test reading scores and the negative effects of low income (F/R lunch), class size reduction did not contribute positively to reading achievement between EOG third-grade reading pre-tests and post-tests.
- Similarly, controlling for the same variables, actual class size did not contribute positively to reading achievement at grade 3.

EOG Mathematics, Grade 3

Findings include the following:

- Over and above the positive impact of EOG pre-test mathematics scores and the negative effects of low income (F/R lunch), class size reduction did not contribute positively to mathematics achievement between EOG third-grade reading pre-tests and post-tests.
- Similarly, controlling for the same variables, actual class size did not contribute positively to mathematics achievement at grade 3.

Numerical results of the regression analyses are shown in Attachment 3.

Summary and Recommendations

The summary and recommendations are at the beginning of this evaluation report.

Attachment 1

Class-size Reduction Achieved at Each School, for Each Model and Grade Level.

School	Grade	Model	Size Before	Size After	Reduced	# Students
Brentwood	3	1	27.3	**20.5**	6.8	82
Brooks	1	1	21.3	**16.0**	5.3	64
Carver	1	1	23.0	**18.4**	4.6	91
Cary	1	1	22.5	**19.3**	3.2	135
Conn	3	1	26.0	**19.5**	6.5	78
Creech Road	2	1	28.3	**21.3**	7.0	87
Creech Road	3*	3**	23.5	—	—	94
Farmington	**K**	**2**	**24.6**	**21.3**	**3.3**	**123**
Fox Road	2	1	24.8	**20.7**	4.1	124
Fuquay-Varina	2	1	25.2	**21.0**	4.2	126
Hodge Road	1	2	27.3	**22.3/27.3**	5.0/0	109
Hodge Road	3*	3**	27.4	—	—	137
Knightdale	2	2***	26.5	**21.5/26.5**	5.0/0	106
Lincoln Heights	K	1	16.7	**14.3**	2.4	100
Lockhart	**1**	**1**	**23.4**	**19.5**	**3.9**	**117**
Rand Road	1	1	22.3	**17.8**	4.5	79
Rand Road	3*	3**	29.0	—	—	87
Rolesville	1	1	25.0	**20.0**	5.0	100
Smith	2	1	27.0	**21.6**	5.4	108
Smith	3	1	28.5	**22.8**	5.7	114
Swift Creek	3	1	23.0	**18.4**	4.6	92
Vance	**2**	**1**	**24.0**	**20.0**	**4.0**	**120**
Vandora Springs	K-1	2***	22.5	**21.0/22.5**	1.5/0	90
Wake Forest	1	1	28.0	**23.3**	4.7	140
Wendell	3	3**	24.8	**22.4**	2.4	99
Willow Springs	3	1	31.0	**23.3**	7.7	93
Zebulon	2	3**	25.0	**22.1**	2.9	125
Zebulon	3	1	25.0	**20.8**	4.2	119

* The CSR teacher was hired after mid-year.

** One-half of students in regular classrooms at this grade level received services of a CSRP rotating (team) teacher for a portion of each instructional day.

*** The CSR classroom was much smaller than the other classrooms at the same grade level.

Attachment 2

Questionnaire and Percentage by Category for Each Item

Class Size Reduction -- Teacher's Survey 2000-2001					
QUESTIONS	**ANSWERS**				
To what extent do you believe that:	**None**	**Little**	**Some**	**Much**	**Very Much**
Your class is not small enough to see the benefits of class size reduction?	15%	18%	41%	18%	9%
Your students will benefit next year from being in your reduced size class this year?	1%	5%	34%	31%	30%
Staff development would be beneficial for teachers with reduced class size?	8%	17%	33%	35%	9%
Teachers in classes of 15 start to think of their classes as 15 classes of one student instead of one class of 15 students?	19%	15%	32%	27%	7%
Student behavior that is acceptable in your class would be viewed as too disruptive in a regular size class?	14%	18%	41%	18%	9%
Compared to regular size classes, to what extent do you believe that:					
You use more variety in your instructional practices?	1%	4%	34%	31%	30%
Low-achieving students in your class feel more positive about class and about learning?	8%	17%	32%	35%	9%
Your students will score higher on K-5 classroom profiles or EOGs?	19%	15%	32%	27%	7%
You use more flexible small-group instruction in your class?	0%	3%	15%	42%	40%
There are fewer behavior problems in your class?	6%	11%	20%	41%	22%
Low-income children are learning more in your class?	2%	5%	29%	43%	21%
Instructional time is a higher percentage of the day in your class?	1%	4%	18%	51%	26%
You spend less time on discipline?	4%	13%	20%	34%	29%
Low-achieving students in your class ask more questions?	1%	11%	28%	44%	16%
Your classroom atmosphere is more intimate?	1%	5%	18%	40%	35%
You provide more individualized instruction to students?	0%	4%	13%	48%	36%
You spend less time on non-instructional activities?	6%	16%	39%	27%	11%
Your class has more useable space?	4%	11%	22%	24%	39%
Your students experience fewer distractions?	0%	13%	24%	45%	18%
There is less noise in your class?	6%	11%	33%	33%	17%
Room arrangement is more flexible in your class?	1%	10%	27%	29%	33%

QUESTIONS	ANSWERS				
Compared to regular size classes, to what extent do you believe that: (cont'd)	**None**	**Little**	**Some**	Much	Very Much
You communicate more to your students' parents?	2%	7%	24%	45%	21%
Your students' parents are more involved?	9%	29%	26%	19%	17%
You know each of your students' abilities better?	0%	4%	11%	52%	33%
You know each of your students' personalities better?	0%	3%	12%	46%	39%
Your interest in teaching is higher?	3%	4%	22%	35%	36%
Low-achieving students in your class contribute more to class discussions?	0%	6%	36%	43%	15%
You are better able to keep track of how each student understands the lessons?	1%	1%	20%	54%	24%
You feel that you are a better teacher?	5%	3%	21%	42%	29%
You intervene more with individual students in order to enhance academic progress?	0%	2%	16%	51%	31%
You ask more probing kinds of questions of your students?	3%	7%	22%	41%	28%
You wait longer for a student to answer an individual questions?	2%	7%	32%	35%	25%
You provide more whole-group instruction?	4%	15%	51%	23%	7%
You use less small-group instruction for different groups in the class?	11%	29%	36%	13%	12%
Your students have closer relationships with each other?	3%	7%	27%	34%	30%
Your students have a closer relationship with you?	0%	5%	19%	38%	38%
Very low-achieving students are learning more in your class?	0%	6%	33%	39%	22%
Your students are learning how to be good students better?	1%	4%	30%	43%	23%
Students in your class reflect more on what you say to them in response to their questions or statements?	1%	9%	32%	42%	16%
You reflect more on how each students' statements reveal their understanding of class material?	0%	3%	28%	40%	30%
You use more one-to-one tutoring in your class?	0%	10%	38%	29%	23%
You give more feedback that is tailored to each individual student?	0%	3%	19%	50%	28%
Your students are more enthusiastic about learning?	0%	8%	26%	38%	28%
You notice and deal with inappropriate behavior faster and with less disruption?	1%	6%	26%	37%	30%
You prepare more class activities?	1%	6%	26%	39%	28%
You use more hands-on activities such as art, manipulatives in mathematics, or drama in reading?	1%	2%	26%	45%	27%

QUESTIONS	ANSWERS				
Compared to regular size classes, to what extent do you believe that: (cont'd)	**None**	**Little**	**Some**	**Much**	**Very Much**
Low-achieving students in your class feel more comfortable or accepted?	0%	3%	27%	47%	24%
You cover the basic curricula faster?	3%	13%	41%	27%	16%
You have introduced more content from the next grade level?	7%	21%	48%	17%	7%
Your students are freer to express themselves?	1%	3%	27%	49%	19%
Your students have better attendance?	10%	22%	25%	26%	17%
You have more time for reinforcing activities?	1%	8%	26%	41%	24%
Your students learn critical thinking skills better?	0%	15%	30%	41%	14%
Your students learn independence more?	0%	12%	26%	40%	22%
Your students learn social responsibility more?	0%	9%	32%	42%	16%
Your students help each other more?	1%	8%	20%	44%	27%
Your students share their achievements more?	2%	7%	27%	32%	32%

Attachment 3

Results of Regression Analyses at Grade 3

Results of Regression Analyses, Grade 3 EOG Reading

Variables/Predictors	Main Effects	Linear Interactions
Pre-Test Reading Scale Score	0.68 (0.02)	0.67 (0.02)
F/R Lunch Status	-3.33 (0.02)	-3.35 (0.32)
Class Size Reduction (CSR)	-0.77 (0.35)	-3.69 (5.22)
Pre-Test Scale Score x CSR		0.02 (0.03)
Actual Class Size	-0.06 (0.05)	

Note: Numbers are regression coefficients, with standard errors in parentheses.

Results of Regression Analyses, Grade 3 Mathematics

Variables/Predictors	Main Effects	Linear Interactions
Pre-Test Math Scale Score	0.71 (0.01)	0.71 (0.02)
F/R Lunch Status	-1.66 (0.25)	-1.78 (0.25)
Class Size Reduction (CSR)	-0.53 (0.27)	-3.97 (7.12)
Pre-Test Scale Score x CSR		0.02 (0.03)
Actual Class Size	-0.20 (0.04)	

Note: Numbers are regression coefficients, with standard errors in parentheses.

Attachment 3

Results of Regression Analyses at Grade 3

Results of Regression Analyses, Grade 3 EOG Reading

Variables/Predictors	Main Effects	Linear Interactions
Pre-Test Reading Scale Score	0.68 (0.02)	0.67 (0.02)
F/R Lunch Status	-3.33 (0.02)	-3.35 (0.32)
Class Size Reduction (CSR)	-0.77 (0.35)	-3.69 (5.22)
Pre-Test Scale Score x CSR		0.02 (0.03)
Actual Class Size	-0.06 (0.05)	

Note: Numbers are regression coefficients, with standard errors in parentheses.

Results of Regression Analyses, Grade 3 Mathematics

Variables/Predictors	Main Effects	Linear Interactions
Pre-Test Math Scale Score	0.71 (0.01)	0.71 (0.02)
F/R Lunch Status	-1.66 (0.25)	-1.78 (0.25)
Class Size Reduction (CSR)	-0.53 (0.27)	-3.97 (7.12)
Pre-Test Scale Score x CSR		0.02 (0.03)
Actual Class Size	-0.20 (0.04)	

Note: Numbers are regression coefficients, with standard errors in parentheses.

CLASS-SIZE REDUCTION PROGRAM EVALUATION, 2000-2001

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This report is being disseminated to school system staff and policy makers and to the public, and is posted on the district Website at http://www.wcpss.net/departments/evaluation-research/listofreports. If you have questions, please contact Carol Speas at the Evaluation and Research Department, WCPSS, at (919)-850-8946 or at cspeas@wcpss.net.

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