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Abstract

Interest in single-sex classes continues to grow in the United States, but there has been little research at the elementary level in this country or elsewhere to help guide educators' decision-making about the overall value of single-sex classes in public schools and the specific value of single-sex classes in public schools for increasing boy's reading achievement. The major purpose of our study was to find out if single-sex classes in two public elementary schools in Arkansas, one in grade 5 and the other in grade 6, seemed to make a difference in boys' reading achievement in the 2008-2009 year, as judged by scores on annual state assessments. That is, did boys in an all-boys' class do better than, the same as, or worse than comparable boys in a mixed class? We were interested in whether boys' literacy scores significantly improved in a single-sex class because of the large and growing gap in reading (and writing) achievement between boys and girls by the high school years.

The single-sex classes in the two elementary schools for which we had state assessment data showed differing results. In one school, boys in the boys' class gained significantly more in Literacy than boys in the mixed class. In the other school, boys in the boys' class did not gain significantly more or less than boys in the mixed class in Literacy, but they did gain significantly less than the boys in the mixed class on the Reading test from a nationally normed test that the school also gives. As we also found, girls did not gain significantly more in Mathematics in a girls' class than in a mixed class in either school, but they did not gain significantly less. However, the trends in gain scores for boys and girls in Literacy and in Mathematics tended to favor the single-sex classes. There does not seem to be an academic downside in experimenting with single-sex classes so far as is suggested by test results in these two elementary schools.

I. Purpose of Study

Single-sex classes continue to be established (as well as discontinued) in the United States, but there has been little research at the elementary level in this country or elsewhere to help guide educators' decision-making about the overall value of single-sex classes in public schools and the specific value of single-sex classes in public schools for increasing boys' reading achievement (Institute for Education Sciences, 2005; 2009). The major purpose of our study was to help fill in that gap. In particular, we sought to find out if single-sex classes in two public elementary schools in Arkansas, one in grade 5 and the other in grade 6, seemed to make a difference in boys' reading achievement in the 2008-2009 year, as judged by scores on annual state assessments. That is, did boys in an all-boys' class do better than, the same as, or worse than comparable boys in a mixed class? We were interested in whether boys' literacy scores significantly improved in a single-sex class because of the large and growing gap in reading (and writing) achievement between boys and girls by the high school years. We also sought to explore teachers' and parents' views on any positive or negative differences in social behaviors they observed, as well as any differences in the instructional strategies the teachers chose to use, in order to learn more about the dynamics of single-sex classes and the changes that might take place in curriculum and instruction. This study is just the beginning of a project to follow elementary schools in Arkansas that establish and/or continue single-sex classes to find out if they significantly increase boys' reading skills.

In this study, we first review the research on single-sex schools. We then review various bodies of research on gender differences in reading interest and achievement to highlight the consistency and long history of these differences, beginning with indices of the gender gap in reading achievement at the national level and in Arkansas in order to document the dimensions of the problem. We then look at the research on differences between boys and girls in reading interest and in what they read. The findings of this research are included because they serve to suggest that boys may benefit from initiatives that promise to pay equal attention to their particular reading (and writing) interests at a time in American education when policy-makers, school administrators, and teachers are paying more attention to girls' particular interests and achievement than to boys'.

II. Research on Single-Sex Schools

We are fortunate to have available two reasonably up-to-date reports by the Institute for Education Sciences. One report published in 2005, titled "Single-Sex Versus Coeducation Schooling: A Systematic Review," reviewed quantitative studies at both the elementary and secondary levels from "English-speaking or Westernized countries somewhat comparable to American public-sector schools" using an "unbiased, transparent, and objective selection process adapted from the standards of the Campbell Collaboration or the What Works Clearinghouse." The review did not consider single-sex classes in a co-educational school. Forty studies met the inclusion criteria, the overwhelming majority of which were on high school students; only a small minority was on elementary school students. Moreover, most of the studies considered girls' schools, not boys' schools. The results were as follows: "most studies reported positive effects for single-sex schools on all-subject achievement tests." Within each subject-specific category, roughly a third of all studies reported findings favoring single-sex schools, with the remainder of the studies split between null and mixed results. "…The overall picture is split between positive findings for single-sex schooling and no differences or null findings, with little support for co-education schooling."

The second report, published in August 2009 and titled "Early Implementation of Public Single-Sex Schools: Perceptions and Characteristics," was undertaken after the U.S. Department of Education

amended the Title IX regulation in October 2006 to provide school districts additional flexibility to implement single-sex programs. The study included a descriptive survey of public single-sex schools and an exploratory observational study of a sub-sample of public single-sex schools that were operational as of fall 2003. Eighteen single-sex schools in the United States (of the 20 in operation in 2003) were the focus of this study, eight of which were elementary or middle schools. These schools served primarily non-white, high-poverty students in urban areas. The data from this IES study suggest that "public single-sex schools may have advantages for both boys and girls in terms of fostering socio-emotional health and promoting positive peer interactions. Other perceived benefits of single-sex schooling cited by teachers and principals included a greater degree of order and control and fewer distractions in the classroom." The study design does not support inferences about the effects of these schools on student achievement. "The study team did, however, identify a need for more professional development for teachers on meeting the distinct needs of boys and girls in single-sex public schools."

A new study, released by the University of Otago in New Zealand, was reported in August 2009. Published in the *Australian Journal of Education*, the study compared the educational achievements of more than 900 boys and girls who attended single-sex and co-educational secondary schools in New Zealand. There was a slight tendency for boys who attended single-sex secondary schools to outperform girls. For girls who attended co-educational secondary schools, there was a clear tendency to outperform boys. The pattern remained when students were followed up to age 25. The effects of single-sex schooling on the gender gap were evident also in university attendance and results.

III. Background Research on Gender Differences in Reading Achievement

A. National indices on gender differences in academic achievement

Most public schools in the United States have been co-educational since their inception. A few older cities on the East Coast maintained separate high schools for boys and girls until well after WWII, and many religious groups have long maintained single sex middle and high schools. So why the interest in single-sex classes for public schools at the end of the 20th century and beginning of the 21st? There seem to be two major sources of the educational interest in separating boys and girls as they approach adolescence: concerns about academic achievement and concerns about the disruptive effects of adolescent hormones on academic achievement. These concerns reflect in part a growing body of neurological research showing how boys and girls differ innately and developmentally (e.g., Sax, 2005). They also reflect in part a growing awareness of an achievement gap that has received little attention from educators or policy makers so far.

There have been two visible gender gaps in U.S. educational history: one favoring boys in their interest and achievement in mathematics and science, and one favoring girls in their interest and achievement in reading and writing, as we will note in detail below. Enormous efforts have been made in the past three or four decades by federal and state policy makers to encourage girls to take advanced high school coursework in mathematics and science and to enter highly male-dominant fields in science. In K-12, enormous efforts have also been made by textbook publishers and curriculum specialists to redesign classroom curricula and pedagogy in mathematics and science to appeal to what were considered girls' particular interests, attitudes, aptitudes, and "ways of thinking" in order to make mathematics and science more appealing to them. By and large, these efforts have been effective for girls. Parity has almost been reached, if not superseded by female dominance, on most indices of educational achievement, in K-12 and at the college level. The physical sciences (physics and chemistry) and computer science still enroll and graduate more male than female students, but there are now more females than males graduating from

high school, enrolling in and graduating from college, and majoring and doing graduate work in the life sciences.

On the other hand, almost no effort has been made in the past three or four decades by federal and state policy makers to address the obvious discrepancy in achievement between boys and girls in reading and writing. Remedial classes in reading and writing have long been filled with boys, and more boys than girls drop out of school in adolescence. Indeed, if anything, the kinds of changes in curriculum and pedagogy that have been made to promote female achievement may have exacerbated this discrepancy. The pedagogical techniques that teachers have been encouraged to use in reading, writing, and literature classes, and the changes that publishers were advised to make in reading and literature textbooks by education school faculty and others, often in the name of reducing gender stereotypes, were always in the direction of presumed girls' needs and interests, not boys', despite the fact that girls were always better readers and writers. Moreover, these techniques often went counter to what was actually known about boys' interests, attitudes, and aptitudes--and, ironically enough, about what was equally appealing and possibly more effective for both boys and girls (see Stotsky, 2009a; Stotsky, 2009b for a more detailed discussion of these issues).

We see these ironic results in the scores on the National Assessment of Educational Progress--our national "report card." Results on the main assessment of grade 12 reading achievement by NAEP in 2002 suggested that a decline is occurring among both males and females even though the decline in reading skills is far more a young male than a young female phenomenon. From 1992 to 2002, among high school seniors, girls lost two points in reading scores, while boys lost six points, leaving a 16-point difference in their average scores. Results on the 2005 grade 12 assessment of reading achievement, released in February 2007, still showed over one grade level difference between girls and boys, although female students outscored male students by "only" 13 points, the slight decrease in the gap occurring because both groups had declined.[1]

On the other hand, it should be noted that NAEP's long-term trend tests in reading, which began in the 1970s and have always shown a difference between boys' and girls' average scores, now show a 14-point difference among 17-year olds (although this is an increase in the gap of only two points over 30 years). Overall, high school scores are flat after four decades of efforts to improve students' reading skills. What is the difference between these two NAEP tests? The long-term trend tests assess what were seen as basic reading skills in the early 1970s, while the main tests, introduced in the 1990s, were designed to capture the results of contemporary teaching practices and curricula. But, regardless of the tests used, and despite all the funds expended on reading over the past 35 years, both boys and girls at the high school level read no better than they did decades ago if not less well by the time they graduate from high school. Moreover, regardless of the test, girls consistently outscore boys by a wide margin.

Thus, to accommodate both sets of academic concerns, single-sex classes in K-12 might be seen as one of many possible strategies to address what is known about the differences between girls and boys in their interests and aptitudes in mathematics and reading. They might accelerate girls' interest and achievement in mathematics and the physical sciences, and they might address the decreasing achievement of boys in reading and writing. They might also accelerate each group's skills in areas where they have strengths.

[1] http://nationsreportcard.gov/reading_math_grade12_2005/s0206.asp.

B. Indices on Gender Differences in Academic Achievement in Arkansas

We looked at the indices on gender differences in academic achievement in Arkansas to supply a context for the establishment of single-sex classes in the state. Scores on these indices suggest why a strategy like single-sex classes can be justified if they significantly increase boys' reading skills. Differences between girls and boys in Arkansas in reading achievement reflect the national picture and show up in different ways. There are some gender differences on the ACT tests, the ACT College Readiness Benchmarks, and the SAT tests with respect to scores in mathematics, as we can see below. Girls tend to do less well in mathematics. On the other hand, fewer boys than girls take these tests.

1. ACT scores

ACT scores in 2009 in Arkansas show that there is not much of a difference between males and females on any test: females have a slightly higher average score in English, males have a slightly higher average score in Mathematics, and they are about the same in Reading. However, more females than males took the ACT tests (54% to 46%).

Table 1: Average ACT scores by gender in 2009

	N	Percent	English	Mathematics	Reading	Science	Composite
Males	10,348	46	20.3	20.7	21.1	20.7	20.8
Females	12,131	54	20.8	19.6	21.0	19.8	20.4
Missing	44	0	18.4	19.1	19.3	19.3	19.2

2. Scores on the ACT College Readiness Benchmarks

Scores for Arkansas students on the ACT College Readiness Benchmarks in 2009, on the other hand, show that while the percentage of females is somewhat higher than that of males on English, the percentage of males is much higher than that of females in Mathematics. The percentages are about the same in Reading. It is not clear why the Mathematics and Science scores on the ACT College Readiness Benchmarks are so different from the ACT scores themselves.

Table 2: Percent of students meeting ACT College Readiness Benchmarks by gender in 2009

	English	Mathematics	Reading	Science	All Four
Males	65	40	51	28	22
Females	69	31	50	20	15

3. SAT scores

Few high school students in Arkansas take the Scholastic Assessment Tests (SAT). These students tend to be applying to colleges out of state and many come from private schools. Of the students who took the SAT in 2009, males have a higher average score than females in Critical Reading and Mathematics but not in Writing. Again, fewer males than females take the SAT tests.

Table 3: SAT mean scores by gender in 2009

	Number of Test-Takers	Critical Reading	Mathematics	Writing
Female	768	569	553	561
Male	692	576	593	551

4. Advanced Placement test scores

There is a mixture of good and bad news with respect to Advanced Placement course-taking. Although the number of Arkansas students taking AP courses is rising rapidly, the percentage with a score of 3, 4, or 5 is not high. According to the 2008 College Board report, 4716 grade students took the AP English Literature and Composition Test (most of whom were in grade 12), but only 1491 received scores of 3, 4, or 5. Moreover, girls (3004) comprised the majority of test-takers (64%) and those who scored 3, 4, or 5 (937). Conversely, boys (1712) comprised only 36% of test-takers, and only 554 boys earned a score of 3, 4, or 5. Thus, less than one-third of Arkansas students who took this test in 2008 passed (3 is a passing score), and boys were a distinct minority of those taking the test and of those getting 3, 4, or 5.

Table 4: Distribution of scores on the AP English Literature and Composition Test, 2008

Total Number = 4716	Total Number of Females = 3004	Total Number of Males = 1712
Score of 5 = 68	Score of 5 = 45	Score of 5 = 23
Score of 4 = 403	Score of 4 = 270	Score of 4 = 133
Score of 3 = 1020	Score of 3 = 622	Score of 3 = 398
Score of 2 = 1930	Score of 2 = 1281	Score of 2 = 649
Score of 1 = 1295	Score of 1 = 786	Score of 1 = 509

From a different perspective, however, these results are good news; just a few years ago, many fewer students even took the test; in 2003, 1319 students took this test, in 2004, 1622 did, and in 2005, 3443 did. (The huge increase in the number of students taking AP tests in 2005 is related to the fact that the state began to pay for taking the test that year.) Thus, more students received a score of 3, 4, or 5 in 2008 than took the test in 2003. However, the gender gap today is slightly larger than it was years ago. In 2002, of the 1265 students who took the AP English Literature and Composition test, 781, or 62%, were girls, and 484, or 38%, were boys.

It is not clear why so many students got 1s and 2s in 2008; no conjectures have been offered publicly by Arkansas officials or the College Board. Although syllabi for the AP English Literature and Composition course vary across teachers and schools, their outlines must be approved by the College Board, and all students are expected to read at least several novels or other long works. It does not appear that the low pass rates are related to excessively demanding content in this AP course. Moreover, the state does require all teachers of AP classes to take professional development offered by the College Board in order to be certified to teach an AP course. However, the fact that students must take the AP test in order to get weighted credit for the AP course means that there is an incentive to take the test whether or not a student feels prepared for it.[2]

C. Differences between boys and girls in reading interests

Research on children's reading interests goes back almost a century and shows distinct differences in literary preferences between children and adults and between boys and girls. According to reading interest surveys, these two sets of differences have been remarkably constant over the course of the past century. Boys have consistently preferred adventure tales, historical nonfiction, science fiction, and biographies, while girls have preferred stories about personal relationships and fantasy (Greenlaw & Wielan, 1979). Findings from a more recent study (Coles & Hall, 2002) confirmed that boys read less fiction than girls, preferring books about war, sports, and humorous books, although both boys and girls

[2] http://arkansased.org/communications/ppt/ap_1007.ppt

like science fiction and fantasy. Moreover, when given choices, boys do not choose titles or stories that feature girls. On the other hand, girls frequently select titles and stories that appeal to boys.

D. Differences in what students read in elementary school today

At the elementary school level, gender differences in the cultural content of what students are assigned to read were noted in a comprehensive survey of the six major reading instructional textbooks for grades 4, 5, and 6 in the mid-1990s (Stotsky, 1999). The lead characters in their reading selections tell a good part of the story: few strong and active male role models. Gone are the once inspiring biographies of the most important American presidents, inventors, scientists, and entrepreneurs. Only stories about President Lincoln and George Washington Carver appear. (Carver carries a heavy burden—he apparently represents all of American science in publishers' eyes.) No military valor, no high adventure, no male bonding. On the other hand, stories about adventurous and brave females abound.

The kind of reading that appeals to boys may no longer be readily found in social studies classes, either. Children are rarely assigned biographies of high-achieving individuals unless their achievement reflects the triumph of "social justice" or the overcoming of adversity. Unusual or distinguished intellectual achievement is rarely featured. Moreover, the elementary history curriculum is frequently oriented to boring socio-cultural topics (e.g., the clothing, food, and homes of Pilgrim and Wampanoag children) (e.g., see Stotsky, 2004).

The interests or concerns of teachers and school librarians, most of whom are female, also affect what is available in classrooms or school libraries, as suggested by Sokol (2002) and Sullivan (2004). A study by Worthy, Moorman, and Turner (1999) showed a mismatch between the reading preferences of sixth grade students in several middle schools in Texas and what was available in their schools, with both similarities and differences between boys and girls. The limited availability of books of interest to boys in school classrooms and libraries may also reflect the fact that relatively few boys' books have been published in the past 30 years, according to a supplier of children's trade books (Moynihan, personal communication[3]). The renewal of interest in and republication of some of the well-written biographies in the Landmark series of biographies, an inspirational stimulant to extensive leisure reading for both boys and girls several decades ago, is another signal of the impoverishment of the reading fare now available to young boys.[4]

E. Differences in what students read in middle school today

At the secondary school level, surveys of what students read in their English classes were once fairly common. But, no educational organization or researcher has reported a national survey of the literary works assigned in the school curriculum for over 15 years. Fortunately, a 2008 report by Renaissance Learning gives us empirical information on what over three million American students in grades 1-12 are currently reading, whether assigned or self-selected. Using the database for Accelerated Reader (a computerized system for keeping track of what students read and how well they read, now in thousands of schools across the country), the report reveals a taste for contemporary "young adult fantasy" by both boys and girls that overwhelms every other genre in middle and high school. The report lists the top 20 books read in 2007 in each grade from 1 to 8, and in 9 to 12 as a whole, by the total number of students in the database, by gender, by U.S. census region, and by the top 10% in reading achievement. The numbers are startling.

[3] Personal communication from David Moynihan, 2006.
[4] http://www.boston.com/news/globe/living/articles/2007/02/27/an_adventure_in_finding_books_for_boys/

As can be seen in the list below for boys and girls in grade 8, there are differences between them in their reading interests. Every one of the seven Harry Potter books was on the grade 8 list for boys, but only three were listed by girls. On the other hand, six of the titles listed by girls that are written for girls (i.e., titles by Meyer, Harrison, Westerfeld, and Brashares) are not listed by boys. Nevertheless, most of the titles for both girls and boys were contemporary young adult fantasies. To judge from this list, the grade 8 assigned curriculum today seems to consist chiefly of *To Kill a Mockingbird, The Outsiders, Holes, The Giver, Night,* and *My Brother Sam Is Dead*--all written since WWII. Only two of the top 20 titles likely assigned by English teachers, one in the boys' list, the other in the girls'--*The Call of the Wild* (a novella) and *The Tell-Tale Heart* (a short story)--were written before World War II--and, interestingly, had the highest readability scores of the top 20 for boys or girls, 8.0 and 7.3 respectively.

Table 5: Top 20 Titles and their Readability Level for Eighth Grade Boys and Girls in the 2008 Accelerated Reader Database*

BOYS	GIRLS
1 The Outsiders, S.E. Hinton (4.7)	**The Outsiders**, S.E. Hinton (4.7)
2 Holes, Louis Sachar (4.6)	**The Giver,** Lois Lowry (5.7)
3 Harry Potter and the Deathly Hallows (6.9)	**A Child Called "It"** Dave Pelzer (5.8)
4 Harry Potter and the Sorcerer's Stone (5.5)	**Twilight**, Stephenie Meyer (4.9)
5 Harry Potter and the Chamber of Secrets (6.7)	**Harry Potter and the Deathly Hallows** (6.9)
6 The Giver, Lois Lowry (5.7)	**Holes,** Louis Sachar (4.6)
7 Harry Potter and the Goblet of Fire (6.8)	**Harry Potter and the Chamber of Secrets** (6.7)
8 Eragon, Christopher Paolini (5.6)	**The Clique,** Lisi Harrison (4.9)
9 Hatchet, Gary Paulsen (5.7)	**Harry Potter and the Sorcerer's Stone** (5.5)
10 Harry Potter and the Order of the Phoenix, J.K. Rowling (7.2)	**Uglies**, Scott Westerfeld (5.2)
11 Harry Potter and the Half-Blood Prince, J.K. Rowling (7.2)	**To Kill a Mockingbird**, Harper Lee (5.6)
12 Harry Potter and the Prisoner of Azkaban, J.K. Rowling (6.7)	**The Bad Beginning**, Lemony Snicket (6.4)
13 The Bad Beginning, Lemony Snicket (6.4)	**My Brother Sam Is Dead**, James Lincoln Collier (4.9)
14 The End, Lemony Snicket (7.3)	**New Moon: A Novel**, Stephenie Meyer (4.7)
15 My Brother Sam Is Dead, James Lincoln Collier (4.9)	**Best Friends for Never: A Clique Novel**, Lisi Harrison (4.9)
16 Eldest, Christopher Paolini (7.0)	**Night**, Elie Wiesel (4.8)
17 To Kill a Mockingbird, Harper Lee (5.6)	**Roll of Thunder, Hear My Cry**, Mildred D.Taylor (5.7)
18 The Call of the Wild, Jack London (8.0)	**Bridge to Terabithia**, Katherine Paterson(4.6)
19 Night, Elie Wiesel (4.8)	**The Tell-Tale Heart**, Edgar Allan Poe (7.3)
20 The Reptile Room, Lemony Snicket (6.3)	**The Sisterhood of the Traveling Pants,** Ann Brashares(4.5)

*Data come from 258,261 students in eighth grade who read a total of 1,823,149 books. Readability level is in parentheses. The average book readability level of the top 20 books was 6.2 overall, 6.4 for boys, and 5.8 for girls.

Perhaps boys find in the Harry Potter books the adventurous, courageous, and clever male characters that are likely not in their middle or high school English curriculum. The problem, so far as we can tell from the novels listed in the top 20, is that their tastes and skills have not been developed for mature fiction, biographies, and historical nonfiction by what teachers assign in grades 5-8. We don't see most of the titles in grades 5-8 that boys once enjoyed. In the largest survey ever undertaken (50,000 students in grades 7 to 12), conducted by a state supervisor of English in New York State in the late 1940s, the four most highly ranked novels by boys in grades 7 to 9 were, in this order, *Tom Sawyer, Huckleberry Finn, Call of the Wild,* and *Treasure Island* (Norvell, 1950). These four novels were likely all in the school curriculum at the time, and three of them (*Tom Sawyer, Call of the Wild,* and *Treasure Island)* are at or above the grade 8 level in readability--an indication of the decline in the reading level of today's middle grade literature curriculum.

IV. Methodology in the Present Study

This study looked at single-sex classes in two public co-educational elementary schools in Arkansas chiefly to find out if they provided an educational setting for improving boys' reading skills significantly more than coed classes do. We collected test data from the annual state assessments of literacy in both School A and School B. In addition, in School B, we were able to obtain test score data from the Reading and Language sections of the nationally normed test the school also gives every year. We also collected data on boys' and girls' math scores on the state assessments and analyzed these as well. The analysis of the boys' and girls' math scores in both schools is reported in the Appendix. We also interviewed the principals of both schools, the teachers in the single-sex classes in both schools, several parents of children in the single-sex classes, and two children who had been in them. We were guided to these parents and the two children by the principals because they happened to be available in the school on the day we interviewed the teachers. We present our synthesis of their remarks because their perspectives helped us to better understand the dynamics of a single-sex class.

Group means were compared with a one between (type of class), one within (year of test) repeated measures analysis of variance using the .05 level of statistical significance. Individuals' test scores were matched with scores from the previous year and the effectiveness of the program was indicated by a statistically significant interaction term. Boys in single-sex classes were compared to boys in mixed classes, and girls in single-sex classes were compared to girls in mixed classes.

The grade levels of these single-sex classes differed, the organization of instruction differed, and data were obtained for only the year before students participated in a single-sex class and the year they spent in a single-sex class. Thus, we cannot combine the results across schools for academic or social outcomes. Nor can we generalize from what are, in essence, two case studies. We also collected data on their math scores as well as on the gains that girls made in math in an all-girls' class compared with girls in a mixed class. The boys' and girls' math scores are reported in Appendix A.

A. Elementary School A in Arkansas

School A contains classes through grade 5. It had single-sex classes only in grade 5 and for the academic years of 2007-2008 and 2008-2009. It has no single-sex classes for 2009-2010, but if the teachers want to provide such classes the following year, the school has the autonomy to do so. The single-sex classes were self-contained classes, each taught by the same teacher both years. The two teachers have taught self-contained mixed classrooms in the past and for many years. Both are married women with children of their own and, in one case, grandchildren. In both years, the school had three grade 5 classes, one mixed, one for boys, and one for girls--about 25 children in each classroom. Each teacher taught all subjects as outlined by state standards and assessments. Students were also with their own classmates for physical education (PE), music, and art. They had lunch and recess with the other students in the school.

According to the principal, the students were assigned to the three grade 5 classes (at the end of grade 4 each year) after rank ordering them by test scores so that each class would have about the same ability spread. The children were assigned in groups of three as she went from the top down. Adjustments were made to ensure about the same proportion of English Language Learners (ELL) and special education children in each class, sometimes on an individual basis, e.g., when it was deemed better to place shy ELL girls in the girls' class because "they take more risks when boys can't laugh at them." No objections

were received from parents about student placement. According to the principal, the three classes are similar with respect to all demographic variables except gender.

About half of the children in the school are ELL. Most of the ELL children are from Spanish-speaking homes, but about 10% of the district's ELL students are Marshall Islanders with respect to family origin, with a language that has only recently been put in written form.

Besides the principal and the two teachers, we interviewed four mothers of children in the grade 5 classes in 2008-2009 and the daughter of one of these mothers (now in grade 6 in the middle school to which most of the grade 5 children go for grade 6). One mother is a literacy teacher in the school today; the other three work in various capacities in the school. Three had girls in the girls' class, and one had a boy in the boys' class. We include the comments on the benefits and disadvantages of the all-girls' class, too.

1. Synthesis of the interview data

a. Teacher's comments on the benefits of an all-boys' class

* Less distraction for boys. Their attention is kept better. No showing off.
* Get along better with each other. They form "buddy" teams.
* They put in more effort. Have more of a sense of "honor and integrity" and pride.
* Have higher activity level than girls, which can be better accommodated in a boys' class. They need more breaks after 40 minutes of sitting.
* Leadership skills emerge more.
* Books in the classroom and other readings/examples for concepts can be better tailored to boys. They have different preferences in reading (e.g., history, wars, sports).

b. Teacher's comments on the disadvantages of an all-boys' class

* A full day of the energy in 28 young boys, day in and day out, is tough on a teacher, even one who has a son and grandsons of her own.
* May be harder to teach boys all the time, year in and year out, in a self-contained classroom.

c. Teacher's comments on the benefits of an all-girls' class

* Girls liked being with each other; talked about being more confident.
* More open and talked about pre-adolescent issues more easily.
* Felt freer to put on plays in school, bring in dolls, set up "spas" for feminine activities.
* No rough housing by boys to interrupt their activities or learning.
*Able to do more writing of various kinds, often passed notes (but within some limits set by the teacher), did more story telling about themselves.

d. Teacher's comments on the disadvantages of an all-girls' class

* Didn't see any. She "loved teaching a girls' class."

e. Parents' views on the benefits of a single-sex class

* Both boys and girls looked forward to being in the "experimental" class for the year--because of its novelty. Most students wanted to be in one of the single-sex classes.
* Girls could do things they enjoyed better than boys, such as class parties, sleep-overs. No "pesty" boys to bother them.
* It was easier for girls to talk about pre-adolescent issues without boys in their class.
* Girls could more easily put on little plays, skits, or dances in school without boys in their class.
* Boys were less self-conscious about girls without girls in their class.
* Boys in the single-sex class didn't have to worry about hurting girls' feelings.

* Boys are more competitive than girls and could be as competitive as they wanted.
* Natural differences in reading interests were more easily accommodated or stimulated by separate classes. One mother thought her son became a much better reader.

f. Parents' views on the disadvantages of a single-sex class

* Some girls may have done less math and science in the girls' class than the boys did in the boys' class, or, at least, more hands-on science.
* Girls are too talkative in an all girls' class. They are less talkative in a mixed class.
* Girls in an all-girls' class more readily exemplify the stereotypes about girls.

g. Student's comments on her single-sex class experience

* Enjoyed it. No loud boys. Some quiet girls in the class, as she is. Girls were able to work harder because no boys were there to get into trouble and cause distractions. Enjoyed having sleep-overs.
* Likes being in a mixed class in grade 6.

2. Analysis of the achievement data

Using the state's standardized achievement tests (CRT), analyses included only those students with test data from both their 4th and 5th grade years. Group means were compared with a one-between one-within repeated measures anova, using the .05 level of statistical significance. We show the girls' reading scores as well, whether in the single-sex class or the mixed class.

Literacy CRT

On the Literacy CRT, girls in the mixed class had an average gain score of 27 points, while girls in the all girls' class had an average gain score of 76 points. The differences were not significant.

Table 6: Girls' Scores on the Literacy CRT in School A

	Class	Mean	Std. Deviation	N
G4Literacy_CRT	Coed	674.73	134.45	11
	Girls	640.00	177.52	16
	Total	654.15	159.49	27
G5Literacy_CRT	Coed	701.55	149.43	11
	Girls	715.69	167.24	16
	Total	709.93	157.40	27
Change	Coed	26.82	75.87	11
In	Girls	75.69	111.09	16
Literacy CRT	Total	55.78	99.66	27

On the Literacy CRT, boys in the mixed class had an average loss of 8 points, while boys in the all boys' class had an average gain score of 56 points. The differences were significant.

Table 7: Boys' Scores on the Literacy CRT in School A

	Class	Mean	Std. Deviation	N
G4Literacy_CRT	Boys	472.05	188.81	21
	Coed	494.58	177.20	12
	Total	480.24	182.20	33
G5Literacy_CRT	Boys	527.62	165.84	21
	Coed	487.08	158.65	12
	Total	512.88	161.97	33
Change	Boys	55.57	63.74	21
In	Coed	-7.50	94.15	12
Literacy CRT	Total	32.64	80.85	33

We also compared each type of class on changes from 4th grade to 5th grade using the state's tests. Analyses included only those students with test data from both their 4th and 5th grade years. Group means were compared with a repeated measures ANOVA, using the .05 level of statistical significance. The results were as follows:

On the Literacy CRT, scaled scores increased significantly for the three classes from 4th grade to 5th grade. There were no significant differences in the gains between the three classes, but the differences between classes were nearly significant (p =.051). The girls' class mean increased 76 points, the boys' class mean increased 56 points, and the coed class mean increased 9 points on scaled scores between 4th and 5th grade on the state test.

Table 8: Comparison of Classes on the Literacy CRT in School A

	Class	Mean	Std. Deviation	N
G4LITERACY	Boys	472.05	188.81	21
	Coed	580.74	179.95	23
	Girls	640.00	177.52	16
	Total	558.50	191.90	60
G5LITERACY	Boys	527.62	165.84	21
	Coed	589.65	186.37	23
	Girls	715.69	167.24	16
	Total	601.55	186.87	60

Summary of Analysis of Achievement Test Scores

Scale scores on the 5th grade literacy exam were significantly higher than in the 4th grade for the same students. The gains each of the three classes made were not significantly different at the .05 level but nearly were (p = .051). The coed class did not gain as much as the girls' class or the boys' class during the 5th grade year.

Although not statistically significant, evidence from this cohort of students on the state's tests showed that students in coed classes did not gain as much as students in the all girls' and all boys' classes. Of particular relevance to our study, boys in the boys' class gained significantly more in literacy than boys in the coed class.

B. Elementary School B in Arkansas

Elementary School B is one of 19 elementary schools in its town. It has almost 700 students in classes for pre-school to grade 6. There is one boys' class, one girls' class, and one mixed class in grade 6--about 28 students in each. The school had single-sex classes in both grade 5 and grade 6 three years ago, but in the academic year of 2008-2009 and 2009-2010 they have been only in grade 6.

Before the school initiated single-sex classes, it had chiefly self-contained classes in which the classroom teacher taught all major subjects. It departmentalized instruction in grade 5 and grade 6 for mathematics, science, reading, and writing the same year it began single-sex classes and later decided that it was too much of an adjustment for the grade 5 children to make in one school year. The principal and teachers also decided that grade 6 was a better year for single-sex classes because of the relatively greater maturity of the children. Grade 6 children now have different teachers for the departmentalized subjects, but have a stable homeroom teacher. Classes remain intact for PE, music, art, and library.

As in Elementary School A, the principal with advice from her teachers assigns the children to the single-sex and mixed classes in grade 6 at the end of the grade 5 school year and aims for an even spread of ability and demographics. Parents are informed of the assignments ahead of time; there have been no requests for changes since the single-sex classes were initiated.

The seven departmentalized teachers we interviewed (all but one were female) gave us their perspectives on the differences they perceived teaching in boy's, girls', and mixed classes every day. Almost all these teachers have been teaching across all the grade 6 classes for the past two years. In addition to the principal and the library, reading, writing, mathematics, and science teachers, we also interviewed one parent. We later interviewed her son by telephone with her permission.

1. Synthesis of interview data

a. Teachers' comments on the benefits of single-sex classes

* The two mathematics teachers like separate classes. One thinks that boys work together better in them, and that girls are compelled to learn how to work together in them. The other (the only male teacher interviewed) also thinks that "learning styles" in mathematics are better accommodated in a single-sex class and sees more camaraderie and speaking up, especially by girls. He tailors activities and examples to sex differences in interests. For example, the mixed class keeps math "journals," the boys' class keeps "logs," and the girls' class keeps "diaries." Because boys like competitive activities, he uses illustrations for math concepts from football for them; for the girls, examples come from gymnastics. He tailors his teaching in other ways. He sees boys as more able than girls to generate patterns independently as preparation for algebra; the girls need more prompting, in his judgment.
* The library teacher also likes separate classes. She thinks boys may become more interested in reading what they see their peers reading when they are in a boys' class and that their engagement may be heightened in a single-sex class because more peer models are available. She can also cater better to the differences she perceives in reading interests. For example, she noted that boys prefer historical non-fiction and don't want to see girls on a book's cover. Girls, on the other hand, don't care what's on a cover. As another example, to help students learn the Dewey Decimal System for locating books, she finds that asking girls to find a "home" for a book, given some specific content, is a more effective teaching technique for them, and that asking boys to decide in what section a "robot they name and build" has to be located, depending on the specific characteristics they give the robot, motivates them to think about the different ways a book might be classified

and then located. In a mixed class, she uses more "neutral" kinds of prompts like job qualifications as the way to get the students to think about the location for a book.

* The three literacy teachers believe there is better writing from both sexes in single-sex classes. Each sex chooses what they prefer to read and write about, and these preferences differ across sexes. Boys prefer more cause and effect writing or expository writing on science and history topics. The teachers believe that each sex can indulge their specific reading interests better in a single-sex class. Boys like "gory or gross" books. Also adventure stories, fast action stories, graphic novels, sports stories (e.g., *Snow Treasure, Touching Bear*, authors like Walter Dean Myers, Anthony Horowitz). Girls like stories about "feelings or pets" (e.g., *A Dog's Life, So Be It Rules, Confidence, Number the Stars, Louisiana Sky, Out of the Dust, Great Gilly Hopkins*). Neither group tends to read biographies except of sports stars.

b. Teachers' comments on the disadvantages of single-sex classes

* The science teacher sees no advantages; she thinks that boys' behavior is better in mixed classes because they socialize boys better, and that girls' behavior is better in mixed classes because they reduce their social orientation. She does "inquiry-based projects" in all classes.
* Boys are louder and more active in single-sex classes.
* Girls are meaner, not accepting, more prone to holding grudges and to passing notes in a girls' class.
* Teachers can speak softly to girls and get their attention; they need more authority when speaking to boys. Boys also like sarcasm more than girls do.

c. Parents' views on the benefits of a single-sex class

* Saw more risk-taking and boy bonding.
* Thinks it makes boys more comfortable because boys talk less and like hands-on materials more than girls do.
*Noted importance of a homeroom teacher in a departmentalized instructional schedule. Thinks this person needs to be seen as a mother figure.
* Thought more manipulatives were used in math classes for boys, which she saw as good for them.
* Thought that the boys did more presenting of ideas after reading groups in the literature class in the boys' class--and that this was good for boys.

d. Parents' views on the disadvantages of a single-sex class

* Thought that there is more clothes-consciousness in a single-sex class (whether for boys or girls), but that this may be a function of their age.
* Thought that it made boys more competitive than normal.

e. Student's comments on the benefits and disadvantages of his single-sex class experience

* He liked it more than a mixed class. No distractions, easier to concentrate on work.
* Didn't see any disadvantages to a boys' class.

2. Analysis of behavioral and achievement data

For Elementary School B, we were able to examine data on absences and discipline referrals, as well as scores on the state's tests (CRT), and a norm-referenced test (NRT). Group means were compared with a repeated measures anova, using the .05 level of statistical significance. Analyses included only those students with data from standardized achievement tests in both their 5th and 6th grade years.

a. Girls' Literacy CRT

On this test, girls in the coed class gained on average 139 points, and girls in the girls' class gained on average 87 points, but the difference between classes in gains was not significant. The average gain for all girls from 5th to 6th grade was significant.

Table 9: Girls' Scores on the Literacy CRT in School B

	Class	Mean	Std. Deviation	N
G5Literacy_CRT	Coed	594.80	237.66	10
	Girls	667.17	190.42	23
	Total	645.24	204.83	33
G6Literacy_CRT	Coed	734.20	190.85	10
	Girls	754.13	153.90	23
	Total	748.09	163.14	33
Change	Coed	139.40	108.52	10
In	Girls	86.96	130.22	23
Literacy CRT	Total	102.85	124.77	33

b. Boys' Literacy CRT

On this test, boys in the coed class gained on average 100 points, and boys in the boys' class gained on average 44 points, but the difference between classes in gains was not significant. The average gain for all boys from 5th to 6th grade was significant.

Table 10: Boys' Scores on the Literacy CRT in School B

	Class	Mean	Std. Deviation	N
G5Literacy_CRT	Boys	696.33	131.67	24
	Coed	576.92	270.09	13
	Total	654.38	196.81	37
G6Literacy_CRT	Boys	740.83	125.67	24
	Coed	677.23	239.61	13
	Total	718.49	173.71	37
Change	Boys	44.50	103.80	24
In	Coed	100.31	83.63	13
Literacy CRT	Total	64.11	99.72	37

c. Girls' Reading NRT

On this test, girls in the coed class gained on average 26 points, and girls in the girls' class gained on average 12 points, but the difference between classes in gains was not significant. The average gain for all girls from 5th to 6th grade was significant.

Table 11: Girls' Scores on the Reading NRT in School B

	Class	Mean	Std. Deviation	N
G5Reading_NRT	Coed	637.70	46.07	10
	Girls	656.70	43.28	23
	Total	650.94	44.31	33
G6Reading_NRT	Coed	663.60	32.70	10
	Girls	668.83	23.43	23
	Total	667.24	26.15	33
Change	Coed	25.90	19.88	10
In	Girls	12.13	36.24	23
Reading NRT	Total	16.30	32.49	33

d. Boys' Reading NRT

On this test, boys in the coed class gained on average 26 points, and boys in the boys' class lost on average 5 points, and the difference between classes in gains was significant. The average gain for all boys from 5th to 6th grade was significant.

Table 12: Boys' Scores on the Reading NRT in School B

	Class	Mean	Std. Deviation	N
G5Reading_NRT	Boys	674.79	43.12	24
	Coed	632.69	58.01	13
	Total	660.00	52.20	37
G6Reading_NRT	Boys	670.04	30.06	24
	Coed	658.46	43.67	13
	Total	665.97	35.27	37
Change	Boys	-4.75	27.29	24
In	Coed	25.77	33.89	13
Reading NRT	Total	5.97	32.82	37

e. Girls' Language NRT

On this test, girls in the coed class gained on average 19 points, and girls in the girls' class gained on average 23 points, but the difference between classes in gains was not significant. The average gain for all girls from 5th to 6th grade was significant.

Table 13: Girls' Scores on the Language NRT in School B

	Class	Mean	Std. Deviation	N
G5Language_NRT	Coed	619.10	31.19	10
	Girls	620.43	37.71	23
	Total	620.03	35.38	33
G6Language_NRT	Coed	637.90	25.69	10
	Girls	642.87	29.56	23
	Total	641.36	28.14	33
Change In Language NRT	Coed	18.80	25.62	10
	Girls	22.44	28.61	23
	Total	21.33	27.39	33

f. Boys' Language NRT

On this test, boys in the coed class gained on average 2 points, and boys in the boys' class gained on average 13 points, but the difference between classes in gains was not significant. The average gain for all boys from 5th to 6th grade was significant.

Table 14: Boys' Scores on the Language NRT in School B

	Class	Mean	Std. Deviation	N
G5Language_NRT	Boys	628.75	28.40	24
	Coed	618.69	34.19	13
	Total	625.22	30.47	37
G6Language_NRT	Boys	641.42	27.19	24
	Coed	621.00	40.18	13
	Total	634.24	33.29	37
Change In Language NRT	Boys	12.67	17.97	24
	Coed	2.31	17.01	13
	Total	9.02	18.10	37

In the following analyses, classes are compared with each other by type.

a. Girls' Attendance

In the coed class, girls' absences decreased by less than one day, and in the girls' class girls' absences decreased by about two days. The differences were not significant.

Table 15: Girls' Attendance in School B

	Class	Mean	Std. Deviation	N
Absences G5	Coed	9.05	5.72	10
	Girls	12.67	10.61	23
	Total	11.58	9.46	33
Absences G6	Coed	8.45	7.74	10
	Girls	10.54	9.13	23
	Total	9.91	8.67	33
Change In Absences	Coed	-0.60	4.27	10
	Girls	-2.13	9.68	23
	Total	-1.67	8.37	33

b. Boys' Attendance

In the coed class, boys' absences decreased by over two days, and in the boys' class boys' absences increased by almost one day. The differences were not significant.

Table 16: Boys' Attendance in School B

	Class	Mean	Std. Deviation	N
Absences G5	Boys	7.54	6.22	24
	Coed	11.65	12.45	13
	Total	8.99	8.96	37
Absences G6	Boys	8.13	7.89	24
	Coed	9.19	7.48	13
	Total	8.50	7.66	37
Change In Absences	Boys	0.59	7.61	24
	Coed	-2.46	5.85	13
	Total	-0.49	7.11	37

c. Girls' Discipline Referrals

In the coed class, discipline referrals for girls showed no change, and in the girls' class a slight increase, but the differences were not significant.

Table 17: Girls' Discipline Referrals in School B

	Class	Mean	Std. Deviation	N
G5Discipline	Coed	.60	1.35	10
	Girls	.17	.39	23
	Total	.30	.81	33
G6Discipline	Coed	.60	.97	10
	Girls	.26	.54	23
	Total	.36	.70	33
Change In Discipline	Coed	.00	1.89	10
	Girls	.09	.51	23
	Total	.06	1.09	33

d. Boys' Discipline Referrals (one outlier was removed from the analysis)

In the coed class, boys' discipline referrals increased almost one point, and in the boys' class boys' discipline referrals increased only slightly. The differences were not significant.

Table 18: Boys' Discipline Referrals in School B

	Class	Mean	Std. Deviation	N
G5Discipline	Boys	.17	.39	23
	Coed	.69	.85	13
	Total	.36	.64	36
G6Discipline	Boys	.87	1.10	23
	Coed	.92	1.04	13
	Total	.89	1.06	36
Change In Discipline	Boys	.70	.97	23
	Coed	.23	.73	13
	Total	.53	.91	36

Summary of analysis of behavioral and achievement data

On the *Literacy CRT*, girls' and boys' scaled scores increased significantly from 5th to 6th, but gains did not differ significantly by class. On the *Reading NRT, g*irls' and boys' scaled scores increased significantly from 5th to 6th, but gains were significantly greater only for boys in the mixed class. On the *Language NRT, g*irls' and boys' scaled scores increased significantly from 5th to 6th, but gains did not differ significantly by class. For attendance and discipline referrals, absences and discipline referrals did

not differ significantly by year or class for either boys or girls. The major finding was that boys gained significantly more in the coed class than in the boys' class on the Reading NRT but not on the Literacy CRT.

VI. Common Themes in the Interview Data

1. The benefits of single-sex classes
* less distraction for either sex
* better accommodation of each sex's interests
* more suitable for shy or quiet children of either sex
* examples for academic concepts and class readings better tailored to each sex
* leadership skills of each sex emerged better
* teachers could learn more about the natural traits of each sex, positive or negative
* teachers could focus on each sex's general interests better

2. The disadvantages of single-sex classes
* socialization of both sexes is retarded; girls become chattier, boys less polite

VII. Concluding Remarks

There has been little research at the elementary level in this country or elsewhere to help guide educators' decision-making on the benefits of single-sex classes for improving boys' reading achievement. The purpose of this study was to help fill in that gap. We sought to find out if single-sex classes in two elementary schools in Arkansas, one in grade 5 and the other in grade 6, seemed to make a difference in the reading achievement of the boys in the 2008-2009 year, as judged by scores on annual state assessments. That is, did boys in an all-boys' class do better than, the same as, or worse than comparable boys in a mixed class? We were interested in whether boys' literacy scores significantly improved in a single-sex class because of the large and growing gap in reading and writing achievement between boys and girls by the high school years.

The single-sex classes in the two elementary schools for which we had state assessment data showed different results. In one school, boys in the boys' class gained significantly more in Literacy than boys in the mixed class. In the other school, boys in the boys' class did not gain significantly more or less than boys in the mixed class in Literacy, but they did gain significantly less than the boys in the mixed class on the Reading test. As the Appendix shows, girls did not gain significantly more in Mathematics in a girls' class than in a mixed class in either school, but they did not gain significantly less. However, the trends in gain scores for boys and girls in Literacy and in Mathematics tended to favor the single-sex classes.

There does not seem to be an academic downside in experimenting with single-sex classes so far as is suggested by these two elementary schools. The data on absenteeism and disciplinary procedures that were made available to us by one school also showed no significant differences, although there may be some possible trade-offs in social behaviors. That is, both desirable and undesirable behaviors may emerge in single-sex classes, according to the teachers and parents interviewed.

From a research perspective, it would be desirable to gather data on both academic achievement and on social behaviors in children who have been in single-sex classes for more than one year. What this study does suggest clearly is that there are a number of variables to explore in studies on single-sex classes.

VIII. Questions to consider for research on, or implementation of, single-sex classes in the upper elementary grades

As mentioned earlier, we cannot generalize from these two studies because the schools structured instruction for their single-sex classes differently, placed them at different grade levels, and maintained them only at this grade level. In addition, we cannot disentangle teacher effects from student achievement in School A, the school in which boys in the self--contained single-sex class did significantly better than the boys in the self-contained mixed class. A departmentalized approach in the upper elementary grades (as in School B) facilitates a clearer quasi-experimental design because the literacy teachers teach all three types of classes. For that reason, we will look in the future for elementary schools trying out single-sex classes in a departmentalized instructional context.

We set forth here questions about important variables that may influence the reading outcomes of single-sex classes in the upper elementary grades--variables that we infer from the data we obtained on test scores, attendance, and detention, as well as from informal interviews with the principals, teachers, and a few parents and children. These variables should be considered in long-term research studies on the benefits of single-sex classes for improving boys' reading achievement in the elementary grades.

1. Would there be more gains in reading, or would gains in reading be more likely, if boys were in single-sex classes for more than one year? One year may not be enough time for boys to show gains in reading in single-sex classes.

2. Can single-sex classes capitalize on the more visible differences in reading interests between boys and girls to get boys to read more varied and more sophisticated kinds of reading? It is not clear that boys are sufficiently challenged to read more mature works in a student choice-directed reading curriculum.

3. Does the organization of the instructional day make a difference in recruiting or retaining teachers of single-sex classes for boys? A departmentalized approach to instruction in the upper elementary day may help to reduce the amount of energy a teacher needs in dealing with the energy level of a classroom full of boys all day every day.

4. Does the sex of the teacher influence reading achievement or socio-behavioral issues in single-sex classes? For example, would more male teachers in the upper elementary grades lead to greater effectiveness of single-sex classes for boys in reading?

5. Should teachers of single-sex classes for boys address more directly the different but undesirable social behaviors that are exhibited? These behaviors are noted in comments that these classes may lead to more stereotypical behaviors (e.g., with respect to the deficiencies in manners in boys' classes).

6. Would professional development in reading for teachers in teaching single-sex classes for boys make a difference in reading achievement? The School A teachers indicated that they had read a great deal of information given to them by their principal on single-sex education and the differences between boys and girls; one had also gone to a local seminar on the education of girls and boys by two academic researchers. But none had had any focused professional development on single-sex instruction. The teachers at School B did not indicate that they had received any specialized professional development for teaching single-sex classes, in general or for any subject, although they expressed an understanding of the kinds of behavioral differences that can be found between boys and girls.

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Appendix A:

School A: Boys' and Girls' Scores in Mathematics

On the Mathematics CRT, girls in the mixed class had an average gain score of 19 points, while girls in the all girls' class had an average gain score of 28 points. The differences were not significant.

Girls' Scores by Class on the Mathematics CRT in School A

	Class	Mean	Std. Deviation	N
G4Math_CRT	Coed	649.64	71.70	11
	Girls	629.50	107.59	16
	Total	637.70	93.58	27
G5Math_CRT	Coed	668.18	105.83	11
	Girls	657.13	84.27	16
	Total	661.63	91.84	27
Change	Coed	18.55	58.18	11
In	Girls	27.62	70.01	16
Math CRT	Total	23.93	64.43	27

On the Mathematics CRT, boys in the mixed class had an average gain score of 11 points, while boys in the all boys' class had an average gain score of 33 points. The differences were not significant.

Boys' Scores by Class on the Mathematics CRT in School A

	Class	Mean	Std. Deviation	N
G4Math_CRT	Boys	563.24	91.37	21
	Coed	572.83	97.24	12
	Total	566.73	92.14	33
G5Math_CRT	Boys	596.00	87.23	21
	Coed	583.92	105.06	12
	Total	591.61	92.66	33
Change	Boys	32.76	45.56	21
In	Coed	11.08	64.89	12
Math CRT	Total	24.88	53.45	33

Summary: Girls' scaled scores did not change significantly from 4th to 5th, but boys' scaled scores increased significantly from 4th to 5th, although gains did not differ significantly by class for either sex.

We also compared each type of class with each other on changes from 4th grade to 5th grade using the state's tests. Analyses included only those students with test data from both their 4th and 5th grade years. Group means were compared with a repeated measures anova, using the .05 level of statistical significance. The results were as follows:

On the Mathematics CRT, scaled scores increased significantly for the three classes from 4th grade to 5th grade. There were no significant differences in the gains between the three classes. The boys' class mean increased 33 points, the girls' class mean increased 28 points, and the coed class mean increased 15 points on scaled scores between 4th and 5th grade on the state test.

Comparison of Classes on Mathematics CRT in School A

	Type	Mean	Std. Deviation	N
G4MATH	Boys	563.24	91.37	21
	Coed	609.57	92.76	23
	Girls	629.50	107.59	16
	Total	598.67	98.65	60
G5MATH	Boys	596.00	87.23	21
	Coed	624.22	111.63	23
	Girls	657.13	84.27	16
	Total	623.12	98.02	60

School B: Boys' and Girls' Scores in Mathematics

In School B, on the Mathematics CRT, girls in the coed class gained on average 95 points, and girls in the girls' class gained on average 105 points, but the difference between classes in gains was not significant. The average gain for all girls from 5th to 6th grade was significant.

Girls' Scores by Class on the Mathematics CRT in School B

	Class	Mean	Std. Deviation	N
G5Math_CRT	Coed	632.00	98.66	10
	Girls	622.65	65.30	23
	Total	625.48	75.42	33
G6Math_CRT	Coed	727.20	97.65	10
	Girls	727.91	78.56	23
	Total	727.70	83.22	33
Change In Math CRT	Coed	95.20	40.57	10
	Girls	105.26	60.47	23
	Total	102.22	54.77	33

In School B, on the Mathematics CRT, boys in the coed class gained on average 93 points, and boys in the boys' class gained on average 88 points, but the difference between classes in gains was not significant. The average gain for all boys from 5th to 6th grade was significant. The all boys' class scored significantly higher than the all girls' class both years.

Boys' Scores by Class on the Mathematics CRT in School B

	Class	Mean	Std. Deviation	N
G5Math_CRT	Boys	667.37	57.05	24
	Coed	599.23	121.84	13
	Total	643.43	90.08	37
G6Math_CRT	Boys	755.08	88.03	24
	Coed	692.38	122.86	13
	Total	733.05	104.42	37
Change	Boys	87.71	57.75	24
In	Coed	93.15	32.37	13
Math CRT	Total	89.62	49.87	37

In School B, on the Mathematics NRT, girls in the coed class gained on average 32 points, and girls in the girls' class gained on average 35 points, but the difference between classes in gains was not significant. The average gain for all girls from 5th to 6th grade was significant.

Girls' Scores by Class on the Mathematics NRT in School B

	Class	Mean	Std. Deviation	N
G5Math_NRT	Coed	659.40	39.00	10
	Girls	646.13	23.82	23
	Total	650.15	29.26	33
G6Math_NRT	Coed	691.10	47.87	10
	Girls	680.65	32.68	23
	Total	683.82	37.45	33
Change	Coed	31.70	33.23	10
In	Girls	34.52	24.76	23
Math NRT	Total	33.67	27.09	33

In School B, on the Mathematics NRT, boys in the coed class gained on average 21 points, and boys in the boys' class gained on average 29 points, but the difference between classes in gains was not significant. The average gain for all boys from 5th to 6th grade was significant.

Boys' Scores by Class on the Mathematics NRT in School B

	Class	Mean	Std. Deviation	N
G5Math_NRT	Boys	668.67	36.68	24
	Coed	652.54	44.66	13
	Total	663.00	39.81	37
G6Math_NRT	Boys	697.83	49.75	24
	Coed	673.23	51.01	13
	Total	689.19	50.89	37
Change	Boys	29.16	27.41	24
In	Coed	20.69	25.94	13
Math NRT	Total	26.19	26.86	37