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Single-Sex Versus Coeducational Schooling: A Systematic Review

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Executive Summary

Single-sex education refers most generally to education at the elementary, secondary, or postsecondary level in which males or females attend school exclusively with members of their own sex. This report deals primarily with single-sex education at the elementary and secondary levels. Research in the United States on the question of whether public single-sex education might be beneficial to males, females or a subset of either group (particularly disadvantaged youths) has been limited. However, because there has been a resurgence of single-sex schools in the public sector, it was deemed appropriate to conduct a systematic review of single-sex education research.

A number of theoretical advantages to both coeducational (CE) and single-sex (SS) schools have been advanced by their advocates, a subset of whom have focused specifically on the potential benefits of SS schooling for disadvantaged males who have poor success rates in the educational system. The interpretation of results of previous studies in the private sector or the public sectors of other countries has been hotly debated, resulting in varying policy recommendations based on the same evidence. However, no reviews on this topic have been conducted using a systematic approach similar to that of the Campbell Collaboration (CC) or the What Works Clearinghouse (WWC). Thus, the objective of this review is to document the outcome evidence for or against the efficacy of single-sex education as an alternative form of school organization using an unbiased, transparent, and objective selection process adapted from the standards of the CC and WWC to review quantitative studies.

Concurrently with this review of the quantitative literature, we conducted a review of the qualitative literature on the subject of single-sex schooling using parallel coding techniques. Unlike quantitative studies, qualitative studies are not viewed by WWC as appropriate methodology when determining causal relationships. Rather, they contribute to theory building and provide direction for hypothesis testing. Few qualitative studies satisfied the criteria for inclusion. Therefore, the primary focus of this paper is the systematic review of quantitative research.

The following are the major research questions addressed by the systematic quantitative review:

1. Are single-sex schools more or less effective than coeducational schools in terms of concurrent, quantifiable academic accomplishments?
2. Are single-sex schools more or less effective than coeducational schools in terms of long-term, quantifiable academic accomplishment?
3. Are single-sex schools more or less effective than coeducational schools in terms of concurrent, quantifiable indicators of individual student adaptation and socioemotional development?

4. Are single-sex schools more or less effective than coeducational schools in terms of long-term, quantifiable indicators of individual student adaptation and socioemotional development?
5. Are single-sex schools more or less effective than coeducational schools in terms of addressing issues of procedural (e.g., classroom treatment) and outcome measures of gender inequity?
6. Are single-sex schools more or less effective than coeducational schools in terms of perceptual measures of the school climate or culture that may have an impact on performance?

As in previous reviews, the results are equivocal. There is some support for the premise that single-sex schooling can be helpful, especially for certain outcomes related to academic achievement and more positive academic aspirations. For many outcomes, there is no evidence of either benefit or harm. There is limited support for the view that single-sex schooling may be harmful or that coeducational schooling is more beneficial for students.

THE SYSTEMATIC REVIEW PROCESS

The systematic review of the literature consisted of the following steps:

1. An exhaustive search of electronic databases for citations, supplemented by other sources. This search strategy yielded 2,221 studies.
2. An initial Phase I exclusion of sources whose subject matter falls outside the defined scope of the study. Criteria used for exclusion in Phase I included:

Population—To be included, the students had to be enrolled in a full-time school. They had to be in elementary, middle, or high school as opposed to college and beyond. Finally, the schools being studied had to be in English-speaking or Westernized countries somewhat comparable to American public-sector schools.

Intervention—The single-sex school had to be one in which students were either completely segregated by sex or were completely segregated for all classes, even if co-located in the same building (i.e., dual academies). Studies of single-sex classes in a coeducational school were excluded from review.

This initial screening yielded 379 publications that fit the initial inclusion criteria.

3. A Phase II exclusion based on obvious methodological considerations (e.g., nonstudy, weak study). On the basis of titles and abstracts, citations that appeared to be essays, reviews, opinion pieces, and similar items were excluded, and only qualitative and quantitative studies that were likely to be codable in Phase III were retained. During Phase II, 114 citations were culled from the 379 items and coded as appropriate for review as quantitative (88) or qualitative (26) studies. Of the 26 qualitative studies, 4 met the criteria for final inclusion and were reviewed separately.

4. A Phase III evaluation and coding of the remaining quantitative articles. According to the guidelines of the WWC, all studies other than randomized controlled trials, quasi-experimental designs (QED) with matching, or regression discontinuity designs would be excluded prior to Phase III. Under the WWC criteria for inclusion, virtually all single-sex studies would have been eliminated from the review process because of the lack of experimental research on this topic. Therefore, for this review, a conscious decision was made to relax these standards and include all correlational studies that employed statistical controls. By relaxing the WWC standards, the number of candidate studies to be screened in Phase III was greatly increased. A more streamlined and efficient checklist was developed requiring dichotomous responses rather than descriptive responses in order to facilitate rater decision making. To be included in the quantitative review, a study had to use appropriate measurement and statistical principles. A primary criticism of previous single-sex literature has been the confounding of single-sex effects with the effects of religious values, financial privilege, selective admissions, or other advantages associated with the single-sex school being studied. Therefore, in particular a study had to include statistical controls to account for individual differences (e.g., socioeconomic status [SES], individual ability, and age) as well as school and class differences that might account for the differences between single-sex and coeducational schools. Even so, many studies that included at least one covariate lacked other important covariates such as ethnic or racial minority status, socioeconomic status, and grade level or age. Also, it is important to note that the inclusion of covariates cannot control for important unobservable differences between the groups, such as motivation. Because correlational studies cannot adequately address the issue of differences in unobservables (or selection bias), the studies in this review may over or understate the true effects of SS schooling.

THE QUANTITATIVE REVIEW

Two reviewers coded each study independently, using a quantitative coding guide. A quantitative study was coded for its treatment of the following broad issues: sample characteristics, psychometric properties, internal validity, effect, and bias. Each of these categories had several criteria by which they were coded. To be retained, a study did not have to meet all criteria.

Of the 88 quantitative studies, 48 were eliminated after further review using the coding guide, and 40 studies met the inclusion criteria and were retained. The reasons for the exclusion of these articles were 1) failure to operationalize the intervention properly; 2) failure to apply statistical controls during the analyses; 3) work that was actually qualitative in nature rather than quantitative; 4) work performed in a non-Westernized country and therefore not comparable; 5) work written in a foreign language and therefore not codable by the researchers; 6) failure to draw comparisons between SS and CE schools; and 7) participants not of high school, middle, or

elementary school age. In all, 40 studies met the inclusion criteria and were retained in the quantitative review. The following table shows results of each study according to the seven broad questions listed above and is broken into specific criteria within each larger category. Because some studies addressed multiple criteria, the total number of findings is greater than 40. Specifically, there are 112 findings considered in the 40 quantitative studies.

A table summarizing the findings is below. In each row, one of the 32 outcome categories is listed, as well as the total number of studies related to that outcome category and the raw number and percent of findings that either support SS schooling, support CE schooling, are null, or mixed (supporting both CE and SS schooling). While eight of the outcome categories have four or more studies, others have as few as one or two studies. For any outcome category, the percentage of studies falling in any of the dispositions (supporting SS, supporting CE, null, or mixed) and the confidence with which one can use the findings will increase with the number of studies. Therefore, the percentages in the summary table should be treated with caution when only one or two studies appear for that outcome category.

As shown in the Summary Table, every study falls into one of four categories: Pro-SS, Pro-CE, Null, or Mixed. If a study's findings all supported SS schooling for a given outcome variable, it was coded as "Pro-SS". If the study's findings all supported CE for a given outcome variable, it would be coded "Pro-CE". A study was coded "Null" if for all findings regarding that outcome variable, there were no differences between the SS and CE schools. A study was coded "Mixed" if the study had significant findings in opposite directions for different subgroups on the same variable. For example, a study would be coded "Mixed" if on a specific outcome, support was found for single-sex schooling in the case of boys and support was found for coeducation in the case of girls. Another example would be a finding favoring single-sex in a 10th-grade sample and coeducation in a 12th-grade sample for the same outcome variable within a single study. If a study had findings that were both pro-SS and null, it was coded a pro-SS; if the study had findings that were both pro-CE and null, it was coded as pro-CE. Only studies with findings favoring both single-sex and coeducation were coded as mixed. It should also be kept in mind that some researchers evaluated multiple outcome variables in their research; therefore, it is possible that a single published study would yield information that appears in multiple rows of the Summary Table.

Table 1—Summary of Findings

<i>Outcome</i>	<i>Total Number of Studies</i>	<i>Pro-SS</i>		<i>Pro-CE</i>		<i>Null</i>		<i>Mixed</i>	
		<i>Number of Studies</i>	<i>Percent</i>	<i>Number of Studies</i>	<i>Percent</i>	<i>Number of Studies</i>	<i>Percent</i>	<i>Number of Studies</i>	<i>Percent</i>
Concurrent Academic Accomplishment									
1) All-Subject Achievement Test Scores	9	6	67%	1	11%	2	22%	0	0%
2) Mathematics Achievement Test Scores	14	3	22%	0	0%	8	56%	3	22%
3) Science Achievement Test Scores	8	2	25%	0	0%	5	62%	1	13%
4) Verbal/English Achievement Test Scores	10	3	30%	0	0%	7	70%	0	0%
5) Grades	1	0	0%	0	0%	1	100%	0	0%
6) Social Studies Achievement Test Scores	1	1	100%	0	0%	0	0%	0	0%
Subtotal	43	15	35%	1	2%	23	53%	4	10%
Long-Term Academic Accomplishment									
7) Postsecondary Test Scores	2	1	50%	0	0%	1	50%	0	0%
8) College Graduation	1	0	0%	0	0%	1	100%	0	0%
9) Graduate School Attendance	1	0	0%	0	0%	1	100%	0	0%
Subtotal	4	1	25%	0	0%	3	75%	0	0%
Concurrent Adaptation and Socioemotional Development									
10) Self-concept	7	4	57%	0	0%	3	43%	0	0%
11) Self-esteem	6	1	17%	2	33%	3	50%	0	0%
12) Locus of Control	5	3	60%	0	0%	2	40%	0	0%
13) School Track/Subject Preference	14	5	36%	2	14%	6	43%	1	7%
14) Educational Aspirations	3	2	67%	0	0%	1	33%	0	0%
15) Career Aspirations	2	2	100%	0	0%	0	0%	0	0%
16) Delinquency	4	2	50%	0	0%	2	50%	0	0%
17) Attitudes Toward School	5	1	20%	1	20%	1	20%	2	40%
18) Time Spent per Week on Homework	2	1	50%	0	0%	1	50%	0	0%
19) Attitudes Toward Working Women	1	1	100%	0	0%	0	0%	0	0%
Subtotal	49	22	45%	5	10%	19	39%	3	6%

Continued on next page

Table 1—Summary of Findings (cont'd)

<i>Outcome</i>	<i>Total Number of Studies</i>	<i>Pro-SS</i>		<i>Pro-CE</i>		<i>Null</i>		<i>Mixed</i>	
		<i>Number of Studies</i>	<i>Percent</i>	<i>Number of Studies</i>	<i>Percent</i>	<i>Number of Studies</i>	<i>Percent</i>	<i>Number of Studies</i>	<i>Percent</i>
Long-term Adaptation and Socioemotional Development									
20) School Completion	1	1	100%	0	0%	0	0%	0	0%
21) Postsecondary Success	1	0	0%	0	0%	1	100%	0	0%
22) Postsecondary Unemployment	2	1	50%	0	0%	1	50%	0	0%
23) Eating Disorders	1	0	0%	1	100%	0	0%	0	0%
24) Choice of College Major	1	1	100%	0	0%	0	0%	0	0%
25) Sex-Role Stereotyping	2	1	50%	1	50%	0	0%	0	0%
26) Political Involvement	1	1	100%	0	0%	0	0%	0	0%
27) Percent Married to First Spouse	1	0	0%	0	0%	1	100%	0	0%
Subtotal	10	5	50%	2	20%	3	30%	0	0%
Perceived School Culture									
28) Climate for Learning	1	1	100%	0	0%	0	0%	0	0%
29) Opportunities for Leadership Roles	2	1	50%	0	0%	1	50%	0	0%
30) School Environment	1	0	0%	0	0%	1	100%	0	0%
Subtotal	4	2	50%	0	0%	2	50%	0	0%
Subjective Satisfaction									
31) Satisfaction with School Environment	1	0	0%	1	100%	0	0%	0	0%
32) College Satisfaction	1	1	100%	0	0%	0	0%	0	0%
Subtotal	2	1	50%	1	50%	0	0%	0	0%
TOTALS	112	46		9		50		7	

Implications of Review

Summary of Findings in Each Domain

Concurrent, quantifiable academic accomplishments

In general, most studies reported positive effects for SS schools on all-subject achievement tests. Studies examining performance on mathematics, science, English, and social studies achievement tests found similar findings with one caveat. Within each of these subject-specific categories, roughly a third of all studies reported findings favoring SS schools, with the remainder of the studies split between null and mixed results. This minimal to medium support for SS schooling applies to both males and females and in studies pertaining to both elementary and high schools. The overall picture is split between positive findings for SS schooling and no differences or null findings, with little support for CE schooling. The one study that found advantages for CE schooling found advantages for white females but not for Asian or black females. Males continue to be underrepresented in this realm of research.

Long-term, quantifiable academic accomplishment

As opposed to concurrent indicators of academic achievement, any positive effects of SS schooling on longer-term indicators of academic achievement are not readily apparent. No differences were found for postsecondary test scores, college graduation rates, or graduate school attendance rates. However, all the findings in this domain came from a pair of studies, indicating the lack of high-quality research on these important criteria. Although some studies favor single-sex education in the case of postsecondary test scores, there is a dearth of recent studies using controls. There has been a similar lack of research on other potential criteria in this domain, such as college grade point average, meritorious scholarships or funding attained, postgraduate licensure test scores, and any career achievement that could ostensibly be tied to quality of schooling.

Concurrent, quantifiable indicators of individual student adaptation and socioemotional development

This category includes a range of outcomes that are not easily grouped together, and the results are mixed. Regarding self-concept and locus of control, the studies are split between those showing positive effects for SS schooling and those showing no differences. In the case of self-esteem, a third of the studies supported CE schooling while half found no difference. Given a recent extensive review concluding that self-esteem's relationship to school success, occupational success, better relationships, leadership, delinquent behavior, and other desirable outcomes is modest to nonexistent, the implications of findings regarding self-esteem appear complementary. Furthermore, CE schooling only had a positive impact on the self-esteem of males.

Findings regarding school track and subject preferences were mixed, with the overall weight of the findings lying somewhere between pro-SS findings and no differences. A majority of studies favored SS schools on the outcome of higher educational aspirations, as evidenced by SS students showing more interest in and taking more difficult courses. SS schools fostered higher educational and career aspirations for girls. More studies emphasized the positive effect of SS schools on career aspirations than CE schools for boys, but evidence regarding their educational aspirations was mixed.

A category called “attitudes toward school” showing mixed results was actually a combination of single studies using somewhat different outcome variables, thus reducing the meaningfulness of the category. In terms of actual behaviors, a few studies focused on delinquency, reporting differences in favor of SS schools that were moderated by individual developmental differences. What is lacking is a conceptual framework to tie together the myriad academic-attitude outcome measures used in this realm so that studies will be more directly comparable.

Long-term, quantifiable indicators of individual student adaptation and socioemotional development

The outcomes in this domain generally do not appear in more than one or two studies that made it to Phase III review. Therefore, one must be cautious in generalizing from these results. Having said that, the results still suggest the potential that SS schooling could be associated with a number of post-high school, long-term positive outcomes. These include postsecondary success or participation in collegiate activities while maintaining full-time enrollment for a four-year period, reduced unemployment (males and females), reduced propensity to drop out of high school (males and females), the choice of a nontraditional college major (for females), and political activism (for females). The sole exception is eating disorders; one study found more SS students to have eating disorders than CE students.

Procedural (e.g., classroom treatment) and outcome measures of gender inequity

This question could not be addressed because of a lack of any quantitative studies that used gender equity as an outcome variable at the school level. Any studies that compared SS and CE classrooms within a CE school were outside the purview of this study and were not reviewed.

Perceptual measures of the school climate or culture that may impact performance

This category includes a number of disparate, single-study results. One of the two studies addressing leadership opportunities found more opportunities for both males and females in SS schools; however, the statistical significance of this finding depended on what other variables had been controlled for. The other found that both males and females in SS schools put more value on grades and leadership and less on attractiveness and money. However, there remains a dearth of high-quality empirical studies using this class of outcome variables as criteria.

A final category of outcomes examined as a subset of culture was the realm of subjective satisfaction of students, parents, and teachers with the school environment. The one study in this review that found the social environment more appealing in CE schools is a good case in point in that the same study found that SS students are more interested in grades and leadership and less interested in money and looks. Some qualitative studies have looked at why certain parents prefer SS schooling, and studies in other cultures have found mixed results regarding teacher satisfaction with CE versus SS schooling. However, no empirical studies comparing current parental satisfaction in equivalent SS and CE schools were available for review using the stated guidelines. There remains a lack of research both on this class of criteria and on the relationship of subjective satisfaction to other more critical criteria.

Expected Outcomes Not Seen in the Review

Teenage pregnancy, college performance, differential treatment by teachers, parental satisfaction, bullying in school, and teacher satisfaction were among the many outcomes that we expected to see in the review or that should be addressed but were not found in any included study.

General Trends

A few trends are apparent across all outcomes. The preponderance of studies in areas such as academic accomplishment (both concurrent and long term) and adaptation or socioemotional development (both concurrent and long term) yields results lending support to SS schooling. A limited number of studies throughout the review provide evidence favoring CE schooling. It is more common to come across studies that report no differences between SS and CE schooling than to find outcomes with support for the superiority of CE. In terms of outcomes that may be of most interest to the primary stakeholders (students and their parents), such as academic achievement test scores, self-concept, and long-term indicators of success, there is a degree of support for SS schooling.

The overwhelming majority of studies employ high school students, with a small minority using elementary school students. The preponderance of SS research has been conducted in Catholic SS schools in which students are separated by sex only when entering adolescence. Therefore, opportunities to study SS elementary or middle schools in either the public or private sector have been limited.

There is also a pronounced tendency to study girls' schools more than boys' schools: 76 studies compared SS and CE girls, and 20 of those focused exclusively on girls. Of those 20, 18 were split evenly between support for SS schooling and no differences (nine pro-SS and nine no differences). The other two studies resulted in findings supporting CE schooling. SS and CE schooling for boys was compared in 55 studies, of which only three were studies exclusively devoted to boys' schools.

There is a dearth of quality studies (i.e., randomized experiments or correlational studies with adequate statistical controls) across all outcomes. Even using the more relaxed criterion of allowing correlational studies, each outcome has only limited candidate studies. Too few researchers report descriptive statistics or effect sizes. Mathematics achievement test scores, English achievement test scores, and school subject preference were the only outcomes to have 10 or more qualifying studies. Even within these three categories, the studies differ in the criteria they use and the statistical controls they use to compare SS and CE schooling. This somewhat limits the arguments that can be built and extended from this quantitative review and renders it nearly impossible to conduct a meta-analysis on any outcome area. Many of the remaining studies have other conceptual or interpretive flaws. Many of the studies lacked well-developed hypotheses, and the hypotheses were often not linked directly to the outcomes being studied.

The list of outcomes of interest needs to be expanded in future research and defined more clearly. For example, outcomes such as teenage pregnancy and bullying in school did not appear in a single study of sufficient quality to be reviewed. Other outcomes that are implicit in arguments for and against SS schooling need to be addressed explicitly. These include work-related long-term outcomes such as job performance, leadership performance, mixed-sex work team performance, performance and leadership in volunteer associations, job involvement, and organizational commitment. Few studies

address important moderators, that is, variables that may have differential effects for single-sex schooling. For example, a number of authors have proposed that SS schools are particularly effective for students of lower socioeconomic status and perhaps specifically for those who are members of minority or disadvantaged communities. Unfortunately, only three studies addressed this moderator.

This review should not be interpreted as a condemnation of the work of the dedicated researchers who have chosen to study SS-CE differences, as they may not have been in a position to conduct a randomized experiment on this topic. Such a study has yet to be conducted. However, it could be argued that instead of trying to conduct only all-or-nothing studies of whether SS schooling is better or worse than CE schooling, more careful specification of hypotheses and direct linkage of hypotheses to specific outcomes may show ways to also conduct smaller studies that prove whether certain aspects of SS or CE schooling are beneficial.

Finally, there are limits to what a systematic review can accomplish when an intervention is being judged by multiple criteria and all stakeholders do not share the hierarchy of these criteria. Some issues cannot be resolved by any type of research, even randomized experiments, because they involve issues of philosophy and worldview and represent the relative priorities of dueling stakeholders. There is no way to resolve whether an outcome that is important to one stakeholder group, such as parents, students, civil libertarians, and feminists on both sides of the issue, should be accorded more weight than an outcome valued by another group. What is possible is to separate out fact in the form of evidence from fiction by converting as many claims as possible to testable hypotheses and performing the necessary research. In this way, the two parallel debates can be separated from each other. “Does SS schooling benefit or harm the students, and in what ways?” can be separated from “Is it worth it for society regardless of the benefits or costs?” with each debated on its own merits.

These general implications of the review provide a stepping-stone for future research through the continuation of quality research on extant outcomes, the refinement of methodology, better statistical reporting, and the expansion of the theoretical domain. If heeded, these implications can improve the generalizations made about single-sex schooling and coeducation.

Introduction

Single-sex education refers most generally to schools at the elementary, secondary, or postsecondary level in which males or females attend school exclusively with members of their own sex. A related though different phenomenon is single-sex classes, whereby schools that are otherwise coeducational provide separate classes for males and females in selected subjects for one or more years. This report focuses on single-sex schools at the elementary and secondary levels.

For a number of decades, the question of whether public single-sex education might be beneficial to males, females, or a subset of either group (particularly disadvantaged youths) was mainly theoretical. As described in this review, research on the question of whether public single-sex education might be beneficial to males, females, or a subset of either group (particularly disadvantaged youths) has been limited. However, because in recent years there has been a resurgence of single-sex schools in the public sector, it seems only fitting that an unbiased systematic review of single-sex education research that is interpretable and cognizant of other factors on the relationship between single-sex schools and educational outcomes be conducted. Today, public single-sex schools are operating in Albany, Boston, Philadelphia, Chicago, New York, San Diego, Long Beach, Washington, Milwaukee, Houston, Cincinnati, Toledo, Seattle, Louisville, East Palo Alto, Hartford, and Baltimore.

A number of theoretical advantages to both coeducational (CE) and single-sex schools (SS) have been advanced by their advocates (Dale, 1971, 1974; Fox-Genovese, 1991, 1994; Gilder, 1973; Kenway and Willis, 1986; Riordan, 2002), a subset of whom have focused specifically on the potential benefits of SS schooling for disadvantaged males who have poor success rates in the educational system (Hamilton, 1986; Hanson, 1959; Levine, 1964; Sexton, 1969; Whitehead, 1994). The interpretation of results of previous studies in the private sector or the public sectors of other countries has been hotly debated (Kenway and Willis, 1986; Lee and Bryk, 1986, 1989; Marsh, 1989; Riordan, 1985, 1990; Rowe, 1988; Marsh and Rowe, 1996). As noted by Caspi (1995), “The extant evidence—containing many contradictory conclusions—has been used to support widely differing policy recommendations” (pp. 57–58).

A relatively recent review (Mael, 1998) concluded that there were indications that SS schooling could be helpful for a range of desired outcomes. However, he noted that a paucity of research on SS schooling, especially for males, was an ongoing concern, as was the lack of public-school studies in the United States. Moreover, no reviews on this topic have been conducted using a systematic approach similar to that of the Campbell Collaboration (CC) or the What Works Clearinghouse (WWC). Thus, a systematic review is currently needed.

The objective of this review is to document the outcome evidence for or against the efficacy of single-sex education as an alternative form of school organization. The review summarizes what is known about the effects of single-sex schooling. Benefits to students, especially those from disadvantaged circumstances, as well as any evidence that such schooling is not desirable for students, are reviewed. Critical and systematic selection of the most valid quantitative studies available, using an unbiased, transparent, and objective selection process adapted from the standards of the WWC and the Campbell Collaboration, was chosen as the review methodology.

Concurrently with this review of the quantitative literature, we conducted a review of the qualitative literature on the subject of single-sex schooling. Unlike quantitative studies, qualitative studies do not contribute to the body of evidence on a subject. Rather, they contribute to theory building and provide direction for hypothesis testing. The primary focus of this paper is the systematic review of quantitative research, and the vast majority of the high-quality literature was empirical. However, because search activities were conducted in parallel and diverged only afterward, we describe both efforts in this paper.

The following are the major research questions addressed by the systematic quantitative review:

1. Are single-sex schools more effective than coeducational schools in terms of concurrent, quantifiable academic accomplishments? Conversely, are any adverse effects associated with single-sex schools in this realm?
2. Are single-sex schools more effective than coeducational schools in terms of long-term, quantifiable academic accomplishment? Conversely, are any adverse effects associated with single-sex schools in this realm?
3. Are single-sex schools more effective than coeducational schools in terms of concurrent, quantifiable indicators of individual student adaptation and socioemotional development? Conversely, are any adverse effects associated with single-sex schools in this realm?
4. Are single-sex schools more effective than coeducational schools in terms of long-term, quantifiable indicators of individual student adaptation and socioemotional development? Conversely, are any adverse effects associated with single-sex schools in this realm?
5. Are single-sex schools more effective than coeducational schools in terms of addressing issues of procedural (e.g., classroom treatment) and outcome measures of gender inequity? Conversely, are any adverse effects associated with single-sex schools related to gender equity?
6. Are single-sex schools more effective than coeducational schools in terms of perceptual measures of the school climate or culture that may have an impact on performance? Conversely, are any adverse effects associated with single-sex schools in this realm?

Review Methodology

A systematic review of literature on a topic consists of the following steps:

1. An exhaustive search of electronic databases for citations, supplemented by other sources
2. An initial Phase 1 exclusion of sources whose subject matter falls outside the defined scope of the study
3. A Phase 2 exclusion based on obvious methodological considerations (e.g., nonstudy, weak study)
4. A Phase III evaluation and coding of remaining articles

SEARCH STRATEGY

The first step in a systematic review is to conduct an exhaustive search of the extant literature. Various search strategies were used to identify relevant studies. First, we conducted an electronic search of popular academic databases. Next, articles by authors mentioned by a panel of subject-matter experts were obtained. Finally, we used the Social Sciences Citation Index (SSCI) to locate any recent articles that cited a small number of influential studies on this topic.

The electronic search strategy began by reviewing the following databases: 1) ERIC, Educational Resources Information Center; 2) PsycINFO; 3) Campbell Collaboration's C2-SPECTR (Social, Psychological, Educational, and Criminological Trials Register); and 4) Dissertation Abstracts International. Each electronic database was searched from 1988 to the present, except for C2-SPECTR because year limitations cannot be set within that database. The following key words were used: Single Sex, Single Gender, Same Sex, Same Gender, Separate Sex, Separate Gender, Coeducation, Coeducational, and Mixed Sex. We selected 1988 as the starting point because of the seminal pieces by Lee and Bryk (1986) and Marsh (1989), which fueled the debate throughout the research community. Still, it is important to note that our search was not limited to studies published in 1988 or later. Studies from years prior to 1988 were collected from subsequent phases of searching, such as citation searches in the Social Sciences Citation Index and three core review publications.

The next phase of searching identified all citations in three core publications containing relevant reviews of the literature: 1) the book *Same, Different, Equal: Rethinking Single-Sex Schooling* by Rosemary Salomone (2002); 2) *Gender in Policy and Practice: Perspectives on Single-Sex and Coeducational Schooling*, a book of edited chapters by Amanda Datnow and Lea Hubbard (2002); and 3) a review article by Fred Mael (1998). All single-sex school research references from these sources provided a baseline of most relevant articles and theoretical arguments advanced for and against single-sex schooling. Any supplemental references from these three sources were added to the list of references compiled through the electronic databases.

The final phase of the search entailed using the SSCI to find all articles that had cited any one of a few seminal pieces in the topic area. Publications that cited these influential articles were then added to, and crosschecked against, the database of references.

This search strategy across all phases yielded 2,221 studies. All studies were then examined for inclusion in the quantitative review or the qualitative review. Quantitative studies were included in the review because of their ability to provide empirical evidence either for or against single-sex schooling. Qualitative studies were included because they could provide arguments or observations to be employed in the theory-building process.

PHASES OF REVIEW

The review consisted of three review phases. In Phase I, it was determined that study abstracts would be reviewed to make sure that the subject matter of the study matched the topic of interest, the population in question matched the desired population of interest (e.g., elementary, middle, and high school boys and girls in industrialized countries where English was the recognized official language), and the intervention (i.e., single-sex schooling and not single-sex classrooms for certain subjects) was operationalized properly. In Phase II, study abstracts were again reviewed to ensure that information decided upon in Phase I was accurate based upon the complete studies in text. In Phase II, if the abstract made it clear that statistical controls were not applied, we dropped the study. Further, studies were coded in Phase II to ensure that researchers controlled for preexisting student or school-level differences (e.g., ability scores, socioeconomic status [SES], or age). Finally, in Phase III the remaining studies were coded for all criteria present in the Quantitative Coding Guide. If during the initial screening of the study *texts* in Phase III, we found that statistical controls were not applied, we ceased to review that study. That and other criteria such as the inappropriate operationalization of single-sex schooling (i.e., the use of single-sex classes in a coed school) that would have merited exclusion at earlier stages were used at the outset of Phase III.

Phase I

In Phase I, an initial relevance screen of the 2,221 references obtained from the literature search was performed. During this phase, studies that were clearly not pertinent were coded for exclusion. In cases where that information was unclear, studies were coded for inclusion rather than exclusion. This initial screening yielded 379 publications that fit the initial inclusion criteria.

Three criteria were used for exclusion in Phase I:

1. *Subject matter*—Numerous papers with the key words in the title were actually about same-sex marriages or other unrelated topics.
2. *Population*—Studies that were considered for review were limited to specific populations. Four criteria were used. The first was that the students had to be enrolled in a full-time school, as opposed to a summer camp or camping program. The second was that the students had to be in elementary, middle, or high school. Studies pertaining to college or beyond were excluded from further consideration. Third, studies had to be written in English so as to be codable by the researchers, and finally, the schools being studied had to be in Westernized countries so that they were somewhat comparable to American public-sector schools. Although a number of important studies have been conducted in other countries, they were in schools deemed sufficiently different from American schools to be

not comparable. Studies that did not meet these criteria were excluded regardless of their technical merit.

3. *Intervention*—To be considered for the review, the single-sex school had to be one in which students were either completely segregated by sex or were completely segregated for all classes, even if colocated in the same building (i.e., dual academies). Studies pertaining to single-sex classes in a coeducational school were not considered for further review.

Phase II

In Phase II, the 379 citations that survived the Phase I screening were reexamined. On the basis of abstracts and if necessary titles, citations that were essays, reviews, opinion pieces, and similar items were excluded and only qualitative and quantitative studies that were likely to be codable in Phase III were retained.

A primary criticism of previous single-sex literature has been the confounding of single-sex effects with the effects of religious values, financial privilege, selective admissions, or other advantages associated with the single-sex school being studied. Therefore, a study had to include statistical controls to account for individual differences (e.g., SES, individual ability, and age) as well as school and class differences that might account for the differences between single-sex and coeducational schools. Without accounting for these differences by using statistical controls, a study would not be able to distinguish between the effects of single-sex education or some other extraneous influence. Such a study would not be a candidate for inclusion in Phase III coding. Thus, if it was clear from the abstract that no statistical controls were applied in a quantitative study comparing the SS and CE schools, the study was dropped during Phase II. If the abstract was unclear or intimated that there were appropriate statistical controls, the study was retained. Where there was doubt about inclusion, decisions were made in consultation with other research staff members and the research team coordinator. At the end of Phase II, 102 studies that could be classified as either quantitative with adequate controls (88) or qualitative (14) were culled from the 379 citations.

Phase III

At the beginning of Phase III, the full texts of the 102 retained studies were assembled and read and prepared for formal review using a coding scheme that departed somewhat from the screening process used by the WWC. According to the guidelines of the WWC, all studies other than randomized controlled trials, quasi-experimental designs with matching (QED), or regression discontinuity designs would be excluded prior to Phase III. For this review, a conscious decision was made to relax these standards and include all correlational studies that employed statistical controls. This was decided because of the lack of experimental research on this topic. Under the WWC criteria for inclusion, virtually all single-sex studies would have been eliminated from the review process. Because we relaxed the WWC standards, we greatly increased the number of candidates to be screened in Phase III. We also used a coding scheme that was less time consuming than the WWC coding scheme because of a shorter timeline. To code the large number of studies, we developed a checklist requiring dichotomous responses rather than descriptive responses, to facilitate rater decision-making. Appendix 1 shows the quantitative checklist.

Other differences are that the checklist items require dichotomous responses rather than quantitative or descriptive responses and are written to facilitate rater decision-making. The WWC Design and Implementation Assessment Device (DIAD) method uses a hierarchical method, excluding and including studies at each step and culminating in an accept or reject decision for each article. The WWC method of selection is sensitive to each decision made at each hierarchical step in the evaluation. Include or exclude decisions made at one step can affect the yield significantly. The current checklist method does not exclude a study on the basis of a single deficiency. The current coding scheme and checklist that are less time consuming than the WWC coding scheme were justified by the shorter timeline and the less-developed body of literature in this study.

Phase III Coding

A number of studies retained after Phase II based on their abstracts proved to be unusable once the full text had been obtained. Thus, if it was clear from the full text that no statistical controls were applied in a quantitative study comparing the SS and CE schools, the study was dropped during Phase III. Studies were excluded from further review for other reasons as well even though the abstracts had seemed promising. The research staff reviewed the full text of 88 quantitative studies at the onset of Phase III. Of the 88 quantitative studies coded, 48 were eliminated after further review. One reason for the exclusion of these articles were 1) failure to operationalize the intervention properly (e.g., single-sex classes for part of the day rather than single-sex schooling). For example, in some cases authors purported to have measured the impact of single-sex schooling when, in fact, this impact could not be established given the fact that the school was not a single-sex school with only one gender in the classroom for the entire school day. Other reasons for exclusion include: 2) failure to apply statistical controls during the analyses; 3) work that was actually qualitative in nature rather than quantitative; 4) work written in a foreign language; 5) failure to draw comparisons between SS and CE schools; and 6) participants not of high school, middle, or elementary school age (Appendix 3). In all, 40 studies met the inclusion criteria and were retained in the quantitative review.

Two reviewers coded each study independently, using a quantitative coding guide (Appendix 1). A quantitative study was coded for its treatment of the following issues: 1) sample characteristics (i.e., Was the sample randomly assigned to single-sex or coed conditions? Were subjects from the same area? Were subjects matched by demographics or other variables?); 2) psychometric properties, or the ability of a test to accurately and reliably measure what it purports to measure (i.e., reliability assessed by means of internal consistency, test-retest, or inter-rater methods; construct validity); 3) internal validity, or the ability of a study to accurately answer the question it intended to answer (i.e., differential statistical regression, proper alignment of intervention, appropriate unit of measurement, intervention sensitivity, attrition, or local history events); 4) effect, or the measured impact of intervention on outcomes (i.e., Were means and standard deviations reported? Was an effect size reported? Is the direction of the effect interpretable?); and 5) bias, or a preference or an inclination, especially one that inhibits impartial judgment (i.e., Was the study published in a peer-reviewed journal? Were hypotheses properly operationalized without biases?).

Scores for each checklist item were recorded to establish a consensus regarding the treatment of key methodological issues. When discrepancies occurred, they were resolved in team meetings. It is important to note, however, that cumulative scores were not calculated and were not used to rank

studies or to exclude them from review. Summative scores did not play a role in the review because there was no theoretical basis for creating these summative scores as a tool for comparing studies. Further, it is not useful at this time to compare studies given that all studies with a score were included in the review. If a study was not coded, it did not receive a score. In fact, it was considered premature to assign any significance to a higher summative score on this checklist and would be misleading without independent validation of the relative importance of the dimensions. The individual items on the checklist and their relative importance in determining the quality of the paper have not been validated against an independent evaluation of study quality. It would therefore be premature to assign each item equal weight in evaluating the study. The checklist was used merely to provide a listing of methodological issues addressed by researchers in the study. The only methodological criterion that was used to exclude a study from consideration was lack of statistical controls. Coding averaged one to three hours per reviewer for each quantitative article (unpublished quantitative dissertations generally required about four to five hours per reviewer) and two hours per reviewer for each qualitative article.

Validation of Evaluations

To confirm that we had accurately captured the intentions of the authors whose papers we reviewed, we attempted to give these authors an opportunity to comment on our summaries and evaluations of their work and correct anything that we may have misinterpreted. We attempted to contact all authors of the 40 quantitative papers reviewed in Phase III; we were able to contact all but five authors, whose works on the topic were primarily doctoral dissertations. To contact the authors of each reviewed paper, we searched for their contact information in conference directories of the American Educational Research Association (AERA), used contact information taken directly from their papers (if available), and searched for curricula vitae or any other citations on the Internet. We provided the lead authors with the coding guide of the papers and the paragraphs that we wrote summarizing the findings. We gave them at least four weeks, or in some cases longer, to review and comment (reminders were sent twice via e-mail), and we received comments on 35 of the 40 studies¹ that we were able to locate. The comments and textual emendations received were very useful and have been incorporated in this review where appropriate.

THE QUALITATIVE REVIEW

The role of qualitative research in determining the effectiveness of an intervention has been all but eliminated by the WWC. The WWC position, as noted in the DIAD (Version 1.0) (Valentine and Cooper, 2003), states:

The fact that the Study DIAD focuses on research pertaining to the causal effects of educational interventions does not mean we believe that research designs meant to uncover causal relationships are the *only* tool that should be used by social scientists. Nor does it mean we believe that to be truly “scientific,” social science must be limited to randomized trials. To the

¹ Four study authors chose not to participate in the verification of our summary. These authors declined when their review of our findings summary was requested.

contrary, we believe that (a) no single method can be used to address all interesting and important questions about educational interventions and (b) even when causal relationships are of primary interest qualitative studies and quantitative surveys, among other types of research, yield important information about when, why, and how interventions work, and for whom. However, because of our mission our central focus, and the focus of the DIAD, is on research designs—such as experiments, quasi-experiments and regression discontinuity designs—that have as their primary purpose uncovering causal relationships (Shadish, Cook, and Campbell, 2002).”

Some members of the WWC community believe that the only evidence that a qualitative study can provide is to qualify hypotheses for testing in empirical studies. Others, as shown in the quotation above, believe that qualitative studies can contribute other, unspecified forms of evidence. However, for the current research question about the efficacy of SS schooling, it appears that qualitative studies would not be able to provide definitive *evidence*, defined narrowly as compelling evidence that SS schooling is either helpful or harmful. The reason is that the primary and most contentious issue among researchers has been whether the SS and CE schools in a study have been comparable. Critics have argued when a SS school has been superior, it is because the SS school had superior characteristics unrelated to its single-sex status. These could include a religious framework, private school status, a more educated parent body, and a more select student body. Thus, controlling statistically between two schools or school systems has been the only way to establish whether SS schooling is superior on a “level playing field.”

Invariably, qualitative studies that do not collect empirical data about the schools or the variables that they are studying will not be in a position to control for possible preexisting differences when evaluating their results. Even if the authors state that the schools are in the same geographical area and appear to draw from the same populations, one cannot guarantee that there are not subtle differences between the parent bodies, the faculties, or other factors. For this reason, qualitative studies, no matter how informative, would not be included in Phase III of this study using the stated criteria. To be certain, papers we have deemed to be quantitative often contain qualitative data. The qualitative portions set the background for understanding the data and put the data in the appropriate context and have value (Lipsey and Wilson, 2001; Slavin, 1995). In summary, it is the focus of the question that has mandated the choice of studies rather than a value judgment about qualitative studies.

When we conducted our initial search, we included qualitative studies among those citations that were not discarded. They were to be coded and analyzed separately from the quantitative studies. To ensure that valuable insights from the qualitative literature were not ignored or discarded for failing to meet quantitative standards, a checklist parallel to the one described was developed specifically for qualitative studies. This qualitative checklist appears in Appendix 2.

The Qualitative Study Coding instrument was constructed by drawing on the literature describing the characteristics of qualitative research (Yin, 2002; Cho and Bero, 1994) and on draft qualitative evaluation instruments from the WWC. The purpose of the instrument was not to evaluate psychometric rigor. Because qualitative studies are not statistical in nature, the characteristics of a good qualitative study rest on the care with which the study is conceptualized and carried out. The Qualitative Study Coding instrument consists of a series of items that, if present, suggest that

confidence can be placed in the data obtained. The instrument cannot completely reflect the quality of studies, since different studies have different circumstances that limit the degree to which evidence of validity can be acquired, but it was designed to capture a large part of the variance in quality.

Researchers in the area have developed criteria for conducting effective qualitative research that are reflected in the checklist instrument. Three key criteria, for instance, are triangulation, explanation building, and reflexivity. Triangulation, in this case, is the use of multiple data collection methods, data sources, investigators, and theories to corroborate findings. Explanation building is the explication of a systematic chain of reasoning and supporting evidence in a study to demonstrate linkage between intervention and outcome. Reflexivity is the inclusion of checks on theory development by allowing researchers and participants to reexamine data and theory as they develop.

A qualitative study was included in our review if it met the following criteria: 1) it employed triangulation of data or the evidence of the use of multiple data collection methods, data sources, investigators, and theories (e.g., surveys, interviews, and observation); 2) the authors attempted to build theoretical explanations from the observations made (explanation building); 3) the authors exhibited reflexivity, the tracking of one's thoughts over the course of the study, by keeping a field journal of personal reflections; and 4) the authors used a prolonged field experience to make observations.

One reviewer coded each qualitative study. The qualitative studies that emerged from Phase II screening included a greater proportion of books and dissertations than those obtained for quantitative review. Coding averaged four hours for each qualitative citation. In Phase II, 14 qualitative papers were available for review. Of these, 10 were rejected during the review process. The reasons for rejection were that 1) they were review papers and not about specific situations; 2) the methods used were largely quantitative; 3) they focused on gender equity and gender consciousness issues, not on efficacy of single-sex schooling instruction; and 4) they were about single-gender classes, not whole schools, or they did not compare students in single-sex schools with coed students. Of the four studies included in the review, two are books (Shmurak, 1998; Streitmatter, 1999), one is a dissertation (Svartoién-Conway, 2000) and one is a monograph (Datnow, Hubbard, and Woody, 2001).

Validation of Evaluations

To confirm that we had accurately captured the intentions of the authors whose papers we reviewed, we attempted to give these authors an opportunity to comment on our summaries and evaluations of their work and correct anything that we may have misinterpreted. We attempted to contact all authors of the four qualitative papers reviewed in Phase III; we were able to contact all four authors. To contact the author(s) of each reviewed paper, we searched for their contact information in conference directories of the American Educational Research Association (AERA), used contact information taken directly from their paper (if available), and searched for curricula vitae or any other citations on the Internet. We provided each lead author with the coding guide of the papers and the paragraphs that we wrote summarizing the findings. We gave them at least four weeks, or in some cases longer, to review and comment (reminders were sent twice via e-mail), and we received comments on one of the four studies that we were able to locate. The comments and textual recommendations received were useful and have been incorporated in this review where appropriate.

Results

THE QUANTITATIVE REVIEW

The results of the quantitative review will be framed by outcome. As a result, a summary of findings regarding three comparisons will be presented for each outcome: 1) Did the collective works present findings in favor of single-sex schooling when compared with coeducational schooling or vice versa?; 2) When considering males and females separately, did the collective works present findings in favor of single-sex schooling when compared with coeducational schooling or vice versa?; and 3) When considering elementary school and high school children separately, did the collective works present findings in favor of single-sex schooling when compared with coeducational schooling or vice versa? To report on the collective findings of researchers, we emphasized computing the percentage of total studies examining a specific outcome that found support for single-sex schooling, found support for coeducational schooling, or did not find significant support for either single-sex schooling or coeducational schooling (null results). Ideally, we would have liked to provide an aggregate or meta-analytic estimate of effect size; however, a host of researchers did not provide an effect size estimate or the basic elements needed to compute an effect size. Further, we did not compute effect sizes or perform meta-analyses because the studies did not meet WWC standards for evidence of causality. Consequently, the only option left for summarizing findings on each outcome was to provide an estimate of the general direction of the effects reported.

The review is organized around salient outcomes that have been used to evaluate the efficacy of single-sex schools versus coeducational schools. They can be grouped into seven broad categories:

1. Concurrent, quantifiable academic accomplishment (e.g., class grades, concurrent standardized test scores). Common examples are mathematics and science achievement test scores because of their tendency to be treated as “male subjects.”
2. Long-term, quantifiable academic accomplishment (e.g., postsecondary grades, college and graduate school standardized test scores, completion of postsecondary schooling, graduate school attendance). Other examples included career success.
3. Concurrent, quantifiable indicators of individual student adaptation and socioemotional development (e.g., self-esteem, school track and subject preference). Locus of control, self-esteem, and interests in subjects were the most common outcomes.
4. Long-term, quantifiable indicators of individual student adaptation and socioemotional development (e.g., teenage pregnancy, dropping out of school). Other indicators were eating disorders onset, juvenile disciplinary actions, and career choice.
5. Indicators of process (e.g., differential treatment by teachers in the classroom) and outcome measures of gender inequity.
6. Perceptual measures of the school climate or culture that may affect performance (e.g., climate for learning, quality of teacher-student interactions, opportunities for female leadership roles, perceived bullying in school).

7. Subjective satisfaction with the school experience by students, parents, and teachers. Teacher satisfaction with student behavior in single-sex schooling and parental satisfaction with schooling were the major outcomes in this category.

A summary of findings for each outcome follows. To use this summary, readers should turn to the specific outcome table (e.g., Table X) and consider all the information provided. For instance, Table 1 (page 12) provides a summary of findings for studies examining academic achievement as an outcome. The first column is the citation. The second column is a description of the study findings. The next columns present a visual indication of findings for three comparisons: 1) single-sex versus coeducation; 2) boys in single-sex schools versus boys in coed schools; and 3) girls in single-sex schools versus coed schools. The final two columns are an indicator of the age of the subjects used in each study. A check mark (✓) in any column represents a finding in favor of the specific category in the comparison. A “Null” under any comparison column refers to a null result or a lack of significant differences between any two categories reported by the researchers. A “Mixed” in any comparison column refers to a mixed result such as the reporting of significant differences favoring both single-sex schooling and coeducation for varying comparisons. For example, a “Mixed” would be placed in the single-sex schooling versus coeducation comparison if support was found for single-sex schooling in the case of boys and support was found for coeducation in the case of girls. Further, results can be mixed within any one of the categories of comparisons, such as favoring single-sex in the 10th-grade sample and coeducation in the 12th-grade sample within a single study. Both single-sex and coeducational schooling are supported under certain conditions leading to a mixed result. If a study had findings that were both pro-SS and null, it was coded a pro-SS; if the study had findings that were both pro-CE and null, it was coded as pro-CE. Only studies with findings favoring both single-sex and coeducation were coded as mixed. It is important to note that “mixed” and “null” results should not be considered negative results against single-sex or coeducation but rather indicative of the need for more single-sex research on the given outcome. Moreover, if a cell is left blank in any particular study, it means that no reviewed studies tested this comparison. This is best exemplified in the case of eating disorders, an outcome in which no studies used male participants and, as such, no comparison between single-sex males and coed males is reported. The text of the paper that appears before each outcome table summarizes the preponderance of evidence. The full references for each reviewed study and for those studies rejected in Phase III appear in the references. The findings across all outcomes are summarized in Table 33 and are also found in the Executive Summary). The percentages in Table 33 should be treated with caution when only 1-2 studies appear for that outcome

Concurrent, Quantifiable Indicators of Academic Accomplishment

Proponents and opponents of SS education have proposed a range of dimensions that might be affected by whether schooling is single-sex or coed. One outcome of major interest for the purpose of this review is all-subject achievement test scores, defined by composite scores on standardized achievement tests in various subjects such as English, science, social studies, and mathematics. Other outcomes that are considered indicators of academic accomplishment might include test scores on individual subject tests like mathematics achievement test scores and grades. The following tables (Tables 1 to 6) refer to short-term outcomes related to academic accomplishment.

All-Subject Achievement Test Scores

Traditionally, all-subject achievement test scores have been defined as scores indicating the composite mastery of specific skills or scholastic content areas (i.e., mathematics, verbal, science, etc.) acquired over a restricted span of time (Murphy and Davidshofer, 2001). Of the nine studies that examined the relationship between type of school and overall all-subject achievement test scores, six (67 percent) reported results supporting SS schooling, two (22 percent) found null results, and one (11 percent) reported results supporting coeducation. When comparing SS and CE for girls, five of eight (63 percent) studies reported results supporting SS schooling, one study (13 percent) reported null effects, and two studies (25 percent) reported results supporting CE. When comparing SS and CE for boys, three of four studies (75 percent) reported evidence in favor of single-sex schooling and one (25 percent) reported null results. All nine studies examined the impact of single-sex schooling versus coeducation using high school samples. Only Garcia (1998) and Riordan (1990) examined the relationship between ethnicity (African American, Asian, or white) and SS schooling versus coeducation. Despite finding differences favoring coeducation for all three groups, the author reports null differences between SS and CE students when controlling for preexisting differences among African Americans and Asians. In the case of white students, the differences remain even after controlling for preexisting differences. Riordan (1990) did report significant difference among whites, African American, and Hispanic students in SS schools and those in coed schools.

Table 2—All-Subject Achievement Test Scores

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Carpenter and Hayden (1987)	Carpenter and Hayden (1987), in comparing SS Catholic versus CE public high schools, found significant differences in all-subject achievement test scores for girls; SS girls' achievement score (SS mean: 61.879, sd = 10.337) was higher than that of CE girls (CE mean: 51.657, sd = 11.676). Sex composition of schools predicted (significant) all-subject achievement test scores of girls in SS schools (beta = .131, R-square = .053). In the case of all-subject achievement test scores of girls in CE schools, sex composition of schools did not predict (no) all-subject achievement test scores (beta = .032, R-square = .032).	√				√			√

Continued on next page

Table 2—All-Subject Achievement Test Scores (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
2) Caspi (1995)	Caspi (1995), when comparing SS school girls with CE high school girls (Catholic and public), found significant differences in test scores for one of two achievement tests: 1) School Certificate Form and 2) Sixth Form Examination (significant; beta = -.10). The relationship is a moderated one. Early-maturing CE girls (significant; t = 2.2) and late-maturing CE girls (significant; t = 2.5) performed less well than their respective counterparts in SS schools. (n = 976).	√				√			√
3) Daly (1996)	Daly (1996) compared 10th-grade students in two cohorts attending SS and CE schools in Northern Ireland and found no advantage for girls attending SS schools in overall achievement on examinations in mathematics and English. Parameters for multilevel modeling are reported with no effect sizes.	Null				Null			√
4) Garcia (1998)	Garcia (1998), when comparing SS versus CE schools (12th-grade females in two public high schools) on overall SAT scores, found that girls in CE schools had higher scores (SS mean: 941 vs. CE mean: 1027, p < .001 for black girls (n = 104); SS mean: 1003 vs. CE mean: 1138, p < .001 for white girls (n = 86); and SS mean: 939 vs. CE mean: 1120, p < .001 for Asian girls (n = 47)]. When controlling for initial ability, SES, and quality of previous education, these differences became null for Asian and black girls. However, when controls were made in the analysis of white girls, the CE girls continued to have higher SAT scores.		√				√		√

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Table 2—All-Subject Achievement Test Scores (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
5) Lee and Bryk (1986)	Lee and Bryk (1986), in a study using the High School and Beyond data, found effects of attending SS high schools on achievement in sophomore and senior years. Gain scores were overall positive, but reached significance only in seven out of the 24 comparisons made. No correction was made for multiple comparisons. Lee and Bryk present evidence that in this situation, an effect size of .20 represents a full year of extra learning.	√		√		√			√
6) Marsh (1989) ^a	Marsh (1989) compared achievement scores for seniors in Catholic SS and Catholic CE schools. When controls for background variables were introduced, almost no differences could be attributed to type of school, and statistically significant differences did not consistently favor one type of school over another.	Null							√
7) Riordan (1994)	Riordan (1994), in considering a large sample of black and Hispanic Catholic high school students (N = 690), found significant effects favoring SS schools on a set of cognitive tests (standardized d score = 0.21 and 0.21) when controlling for home background and initial cognitive ability.	√		√			√		√

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Table 2—All-Subject Achievement Test Scores (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
8) Spielhofer, O'Donnell, Benton, Schagen, and Schagen (2002)	Spielhofer, O'Donnell, Benton, Schagen, and Schagen (2002), in comparing students in SS versus CE high schools across England, found mostly nonsignificant differences for males on all-subject achievement test scores when using multilevel analyses and partialling out the effects of prior academic attainment and school-level factors (using 16,868 males in boys-only schools and more than 100,000 males in CE schools). However, they did find some significant performance gains for students of lower prior all-subject achievement test scores in SS schools. For females, many of the differences between students in SS and CE schools on all-subject achievement test scores were significant in favor of SS schools, using multilevel modeling and controlling for prior attainment and school factors (including 23,477 females in girls-only schools and more than 100,000 females in CE schools). The measured difference was particularly striking for science scores, where females in SS schools could be expected to score over one-third of a point (on an eight-point scale) better than comparable students from CE schools. Also, SS schooling appeared to particularly benefit females with lower levels of previous academic attainment.	√		Null		√			√

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Table 2—All-Subject Achievement Test Scores (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
9) Woodward, Fergusson, and Horwood (1999)	Woodward, Fergusson, and Horwood (1999), in comparing SS versus CE high schools in New Zealand, found significant differences for males (SS mean: 4.39 vs. CE mean: 2.37; $p < .0001$ based on t-test) and significant differences for females (SS mean: 4.65 vs. CE mean: 2.89; $p < .0001$) on School Certificate examinations ($n = 657$). Findings for both sexes favored SS schools, and no sex by type of school interaction was found. When parental background variables, previous school behaviors, and previously measured cognitive ability were controlled, students from SS schools still scored significantly higher, albeit to a smaller degree (mean: 4.00 vs. 3.06; $p < .0001$).	√		√		√			√

^a Marsh (1989) provided a series of statistical controls (e.g., school-related factors) that were applied beyond those prescribed in the quantitative coding guide. It is important to note that many of the findings reported failed to reach statistical significance after these controls were employed. Independent reviewers did not report this failure to reach significance because the controls at this secondary level went beyond those that are normally employed and needed in SS research.

Mathematics Achievement Test Scores

Mathematics achievement test scores have been defined as an indicator of composite mastery over the scholastic content-area skills required in mathematics acquired over a restricted span of time. Of the 14 studies that examined the impact of type of school on mathematics achievement test scores, eight (56 percent) reported null results, three (22 percent) reported results supporting single-sex schooling, three (22 percent) reported mixed results, and none (0 percent) reported results supporting coeducation for all students. When comparing single-sex education and coeducation for girls, eight of 11 (73 percent) studies reported null results, three (27 percent) studies reported results supporting single-sex schooling, and no studies reporting results supporting coeducation. When comparing single-sex and coeducation for boys, four of nine studies (44 percent) reported null results, three (33 percent) reported finding evidence in favor of single-sex schooling, and two (23 percent) reported results in favor of coeducation. All 14 studies used high school samples. Only one study also used an elementary school sample, which yielded null results.

Table 3—Mathematics Achievement Test Scores

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Baker, Riordan, and Shaub (1995)	Mathematics Achievement Test Scores: Baker, Riordan, and Schaub (1995) in comparing SS versus coed schools (High School: Public and Private) found significant differences in Mathematics Achievement Test Scores for males in SS schools versus those in CE schools in three countries (Belgium, Thailand, and Japan). CE males scored higher on Mathematics Achievement Test Scores than did SS males in the three countries (Belgium: $d = -0.74$, Thailand: $d = -3.21$, Japan: $d = -3.57$). There was no difference between SS males and CE males in terms of Mathematics Achievement Test Scores in New Zealand. For girls, the difference between math achievement in SS and CE schools was significant in Thailand and Japan ($d = 2.92$ and $d = -1.25$, respectively). SS girls performed higher in Thailand, and CE girls did better than their counterparts in Japan. In the case of New Zealand and Belgium, the differences were no. (n's = Belgium 2,714, New Zealand 1,152, Thailand 3,651, Japan 7,605).	Mixed			√	√			√
2) Conway (1996)	Conway (1996), in comparing female seniors in one SS Catholic high school versus one CE Catholic high school, found no differences (SS mean: 471 vs. CE mean: 461; $t = 1.07$, $p > .05$) on the SAT mathematical reasoning section ($n = 270$). Also, when preexisting math ability was accounted for (based on the High School Proficiency Test [HSPT] score from freshman year), the differences between schools were still not statistically significant. However, this study used just two Catholic high schools in one local area, so these results should not be generalized to other SS or CE schools.	Null				Null			√

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Table 3—Mathematics Achievement Test Scores (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
3) Daly and Shuttleworth (1997)	Daly and Shuttleworth (1997), in comparing all-boys, all-girls, and CE high schools in Ireland, found no differences in Mathematics Achievement Test Scores among all types of schools when controlling for covariates at the student level and the school level. In fact, the only potentially significant result is that CE students tend to fare better than all-boys school students on math achievement; however, the difference is practically insignificant as pointed out by the authors.	Null		Null		Null		√	√
4) Harker (2000)	Harker (2000), in comparing SS versus CE schools (high school students from public and Catholic schools), found significant differences in Mathematics Achievement Test Scores for students (SS mean: 31.08 vs. CE mean: 29.24; n = 622 vs. 1209; t = -1.84) where SS students scored higher on Mathematics Achievement Test Scores than CE students. Mathematics Achievement Test Scores on a later test differed significantly in favor of SS students (n = 533; SS mean: 52.57; t = -3.86), who scored higher than did CE students (n = 1,031; CE mean: 48.71). When adjustments were made for prior achievement, SES, and ethnic differences, the achievement differences were no longer significant.	Null							√
5) Harker and Nash (1997)	Harker and Nash (1997), in comparing SS versus CE secondary schools, found significant differences for females on math scores (CE mean: 29.24 vs. SS mean: 31.08, p < .01, based on t-test; n = 1,831). However, this significant difference disappeared when SES, initial ability, and ethnic group were considered. Males were not considered in this analysis.	Null				Null			√

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Table 3—Mathematics Achievement Test Scores (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
6) Lee and Bryk (1986)	Lee and Bryk (1986) in a study using the High School and Beyond data, found girls in SS high schools had no significant differences in Mathematics Achievement Test Scores for sophomores, seniors, or gain scores between sophomores and senior years, when compared with girls in CE schools. All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. This study also showed that boys in SS schools had significantly higher Mathematics Achievement Test Scores for sophomores ($d = .26$) and seniors ($d = .18$), but not for gain scores, when compared with boys in CE high schools.	√		√		Null			√
7) Lee and Lockheed (1990)	Lee and Lockheed (1990), in comparing SS versus CE schools (ninth-graders in Nigeria), found significant differences on Mathematics Achievement Test Scores for males (beta = $-.11$; $p < .05$; $n = 785$) and significant differences on Mathematics Achievement Test Scores for females (Beta = $.12$; $p < .05$; $n = 227$), when controlling for student and school characteristics. These results indicate that SS schools positively affect Mathematics Achievement Test Scores for girls and negatively affect Mathematics Achievement Test Scores for boys.	Mixed			√	√			√
8) Lee and Marks (1990)	Lee and Marks (1990), in comparing SS versus CE schools (SS Catholic vs. CE public high schools) on differences in Mathematics Achievement Test Scores, found no differences between SS male students ($n = 328$) and CE male students ($n = 262$); SS males scored higher than CE males ($d = 0.08$). No differences were found when comparing SS females ($n = 335$) with CE females ($n = 337$); SS females scored lower than CE females ($d = -0.07$).	Null		Null		Null			√

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Table 3—Mathematics Achievement Test Scores (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
9) LePore and Warren (1987)	LePore and Warren (1987), in comparing SS Catholic high schools versus CE public high schools, found significant differences in Mathematics Achievement Test Scores in grade 8 for males (n = 159) (SS mean: = 43.19, sd = 9.92 vs. CE mean: 39.24, sd = 10.86)). They found no differences in Mathematics Achievement Test Scores for females (n = 140) in grade 8 (SS mean: 39.72, sd = 11.60 vs. CE mean: 39.85, sd = 9.90). In grade 10, Mathematics Achievement Test Scores of SS males differed significantly from that of CE males (SS mean: 53.06, sd = 10.45 vs. CE mean: 48.81, sd = 10.70) and there was no difference between Mathematics Achievement Test Scores of SS and CE females (SS mean: 49.11, sd = 13.23 vs. CE mean: 48.91, sd = 11.05). In grade 12, Mathematics Achievement Test Scores of SS males differed significantly from that of CE males (SS mean: 58.54, sd = 10.45 vs. CE mean: 54.94, sd = 11.47) and there was no difference between Mathematics Achievement Test Scores of SS and CE females (SS mean: 54.28, sd = 14.63 vs. CE mean: 53.95, sd = 11.32). In terms of gain scores from grade 8 to grade 12, Mathematics Achievement Test Scores differences between SS males and CE males were no (SS mean: 15.35, sd = 20.37 vs. CE mean: 15.70, sd= 22.32) and there was no difference between Mathematics Achievement Test Scores of SS and CE females (SS mean: 14.55, sd = 26.24 vs. CE mean: 14.10, sd = 21.22). Grade 8 scores served as a control for preexisting achievement differences.	√		√		Null			√

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Table 3—Mathematics Achievement Test Scores (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
10) Marsh (1991)	Marsh (1991), in comparing CE Catholic high schools versus SS Catholic high schools while statistically controlling for background variables such as SES, sex, and initial ability, found no differences in mathematic achievement in Year 10 between public schools versus Catholic SS schools (SS Catholic mean: 27.41, sd = 11.56 vs. CE Catholic mean: 26.59, sd = 11.54). In Year 12, when comparing Catholic SS schools versus Catholic CE schools, the difference was not significant (SS Catholic mean: 31.94, sd= 12.55 vs. CE Catholic mean: 26.59, sd = 11.54). (N=10,507).	Null							√
11) Marsh, Smith, Marsh, and Owens (1988)	Marsh, Smith, Marsh, and Owens (1988), in comparing two SS high schools that transitioned to two CE high schools, found no differences for males and females between pre- and posttransition. The characteristics of the sample included in this study are unclear. Over the four-year period of transition, math achievement scores were not different when accounting for background and growth.	Null							√
12) Riordan (1985) ^a	Riordan (1985), in comparing SS versus CE schools (Catholic SS high schools, Catholic CE high schools, and public CE high schools), found significant differences in Mathematics Achievement Test Scores, such that Catholic SS students performed better on math tests than public CE students (Catholic SS vs. public CE = .26 sds) (n = 22,652). In the case of males, no differences were found for math achievement such that Catholic SS students outperformed public CE students on math achievement tests (Catholic SS vs. public CE = .19). For females, there was a significant difference in math test scores; Catholic SS students outperformed public CE students (Catholic SS vs. public CE = .28).	√		Null		√			√

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Table 3—Mathematics Achievement Test Scores (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
13) Riordan (1990)	Riordan (1990), in comparing SS versus CE schools (Catholic high schools) found significant differences in Mathematics Achievement Test Scores where at-risk males in SS schools outperformed at-risk males in CE schools (sd = 1.5) when controlling for initial ability, race, and home background (n = 200–283). No differences were found for at-risk females.	Mixed		√			Null		√
14) Young and Fraser (1992) ^b	Young and Fraser (1992), in comparing SS versus CE schools (level: 14-year-olds in middle or high school; public, private, and Catholic) on scores on a national Australian physics test, found no differences for males (n = 2,353, SS n = 581, CE n = 1,977) and no differences for females (n = 2,565, SS n = 426, CE n = 1,919). The control variables, such as SES, were found to be more significant differentiators.	Null					Null		√

^a This paper does not report statistical significance opting to present the results as effects sizes (standard deviation units or sdu). At that time (1985), this was a popular way to present school effects.

^b In Young and Fraser (1992) the authors suggest that the physics test used for achievement was a science test; however, in reading their description the independent reviewers came to an agreement that the test was indeed a test of mathematics skills. The reason for this is that the test used is described as one that requires students to use physics formulas provided for them and does not require any application of theory.

Science Achievement Test Scores

Science achievement test scores have been defined as an indicator of composite mastery over the scholastic content-area skills required in sciences acquired over a restricted span of time. Of the eight studies that examined the relationship between type of school and science achievement test scores, five (62 percent) reported null results, two (25 percent) reported results supporting single-sex schooling, and one (13 percent) reported mixed findings. When comparing single-sex and coeducation for girls, three of five (60 percent) studies reported null results, and two (40 percent) study reported results supporting single-sex schooling. When comparing single-sex and coeducation for boys, one study (33 percent) of three reported evidence in favor of single-sex schooling, and the others (67 percent) reported null findings. All eight studies used high school samples.

Table 4—Science Achievement Test Scores

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Daly (1995)	Daly (1995), in comparing SS versus CE schools (high school and elementary; public, private, and Catholic; in Northern Ireland and Wales) found no differences in science course achievement for students. ($b = -.38$, n.s. and $b = .61$, n.s.) ($N = 1,837$).	Null							√
2) Harker (2000)	Harker (2000), in comparing SS versus CE schools (high school students from public and Catholic schools), found significant differences in science achievement for students (SS mean: 44.09 vs. CE mean: 39.85; $n = 679$ vs. 1,251; $t = -4.23$) where SS students scored higher on science achievement tests than CE students. Science achievement scores on a later test differed significantly in favor of SS students ($n = 550$; 55.26; $t = -2.73$) who scored higher than did CE students ($n = 1,048$; 52.53). When adjustments were made for prior achievement, SES, and ethnic differences, the achievement differences were no longer significant.	Null							√
3) Harker and Nash (1997)	Harker and Nash (1997), in comparing SS versus CE secondary schools, found significant differences for females on science scores (CE mean: 39.85 vs. SS mean: 44.09, $p < .01$; $n = 1,930$). However, this significant difference disappeared when SES, initial ability, and ethnic group were considered. Males were not considered in this analysis.	Null				Null			√

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Table 4—Science Achievement Test Scores (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
4) Lee and Bryk (1986)	Lee and Bryk (1986) in a study using the High School and Beyond data, found girls in SS high schools had no differences in science achievement scores for sophomores and seniors, but had significantly better gain scores ($d = .20$) between sophomore and senior years, when compared with girls in CE schools. All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. For boys in SS schools, there were no differences in sophomore scores, senior scores and gain scores, when compared with boys in CE schools.	√		Null		√			√
5) LePore and Warren (1987)	LePore and Warren (1987), in comparing SS Catholic versus CE public high schools, found significant differences in science achievement in grade 8 for males ($n = 159$) (SS mean = 21.59, $sd = 4.40$ vs. CE mean: 19.95, $sd = 4.41$). They found no differences in science achievement for females ($n = 140$) in grade 8 (SS mean: 19.54, $sd = 4.78$ vs. CE mean: 19.37, $sd = 4.01$). In grade 10, science achievement of SS males differed significantly from that of CE males (SS mean: 24.83, $sd = 5.36$ vs. CE mean: 22.80, $sd = 5.37$) and there was no difference between science achievement of SS and CE females (SS mean: 22.66, $sd = 5.63$ vs. CE mean: 23.12, $sd = 4.92$). In grade 12, science achievement of SS males did not differ significantly from that of CE males (SS mean: 27.15, $sd = 5.67$ vs. CE mean: 25.93, $sd = 5.14$) and there was no difference between science achievement of SS and CE females (SS mean: 24.01, $sd = 5.78$ vs. CE mean: 24.85, $sd = 4.95$). In terms of gain scores from grade 8 to grade 12, science achievement differences between SS males and CE males were no (SS mean: 5.57, $sd = 10.07$ vs. CE mean: 5.98, $sd = 9.55$) and there was no difference between science achievement of SS and CE females (SS mean: 4.48, $sd = 10.57$ vs. CE mean: 5.48, $sd = 8.96$).	√		√		Null			√

Table 4—Science Achievement Test Scores (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
6) Marsh (1991)	Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in science achievement in Year 10 between SS Catholic schools and CE Catholic schools (Catholic SS mean: 10.04, sd = 4.06 vs. Catholic CE mean: 10.24, sd = 3.95). In Year 12, science achievement differences were no when comparing Catholic SS schools versus Catholic CE schools (Catholic SS mean: 11.40, sd = 4.01 vs. Catholic CE mean: 11.17, sd = 4.01). (N = 10,507).	Null							√
7) Proach (2000)	Proach (2000) compared females in SS versus CE Catholic schools (10th grade) and found significant differences on a standardized biology examination for pretest scores (SS mean: 27.88 vs. CE mean: 34.83) and posttest scores (SS mean: 35.56 vs. CE mean: 40.17). However, when pretest scores were accounted for, there was no difference in the learning of biology between types of schools. Despite these results, it is important to note that this study used a total of just 48 students from one SS school and two CE schools; these factors severely limit the value of the study and any conclusions that can be made from it.	Null				Null			√
8) Riordan (1990)	Riordan (1990), in comparing SS versus CE schools (Catholic high schools) found significant differences in science achievement, such that white females in SS schools outperformed white females in CE schools (.9 sds) when controlling for initial ability and home background (n = 477-619). Senior-year test scores were significantly different, such that SS at-risk girls outperformed CE at-risk girls (1.5 sds) when controlling for only initial ability, race, and home background.	Mixed		Null		√			√

Verbal and English Achievement Test Scores

Verbal and English achievement test scores has been defined as an indicator of composite mastery over the scholastic content-area verbal skills required in English (i.e., reading, phonics, and writing) acquired over a restricted span of time. Of the ten studies that examined the relationship between type of school and verbal achievement test scores, seven (70 percent) reported null results and three (30 percent) reported results supporting single-sex schooling. When comparing single-sex and coeducation for girls, six of eight (75 percent) studies reported null results, one study (12.5 percent) reported mixed results, and one study (12.5 percent) reported results supporting single-sex schooling. When comparing single-sex and coeducation for boys, three of six (50 percent) studies reported null results, two of six studies (33 percent) reported finding evidence in favor of single-sex schooling, and one (17 percent) reported mixed findings. All ten studies used high school samples.

Table 5—Verbal and English Achievement

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Conway (1996)	Conway (1996), in comparing female seniors in one SS Catholic high school versus one CE Catholic high school, found no differences (SS mean: 511 vs. CE mean: 499; $t = 1.17$, $p > .05$) on the SAT verbal reasoning section ($n = 270$). Also, when preexisting verbal ability was accounted for (based on the High School Proficiency Test (HSPT) score from freshman year), the differences between schools were still not statistically significant. However, it is important to note that these results are based on just two Catholic high schools in one local area, so these results should not be generalized to other SS or CE schools.	Null				Null			√
2) Harker (2000)	Harker (2000), in comparing SS versus CE schools (high school students from public and Catholic schools), found significant differences in English achievement for students (SS mean: 71.41 vs. CE mean: 68.19; SS $n = 674$ vs. CE $n = 1251$; $t = -3.22$) where SS students scored higher on English achievement tests than CE students. English achievement scores on a later test differed significantly in favor of SS students ($n = 646$; SS mean: 57.81; $t = -4.09$) who scored higher than did CE students ($n = 1271$; CE mean: 53.73). When adjustments were made for prior achievement, SES, and ethnic differences, there were no differences in achievement.	Null							√

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Table 5—Verbal and English Achievement (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
3) Harker and Nash (1997)	Harker and Nash (1997), in comparing SS versus CE secondary schools, found significant differences for females on English scores (CE mean: 68.19 vs. SS mean: 71.41, $p < .01$; $n = 1,925$). However, this significant difference disappeared when SES, initial ability, and ethnic group were considered. Males were not considered in this analysis.	Null				Null			√
4) Lee and Bryk (1986)	<p>Lee and Bryk (1986), in a study using the High School and Beyond data, found girls in SS high schools had no differences in sophomore reading scores, significantly better senior reading scores ($d = .21$) and significant improvement in reading gain scores between sophomore and senior years ($d = .14$) when compared with girls in CE schools. All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. Boys in SS schools had significantly higher reading scores than those in CE schools as sophomores ($d = .20$), but only higher scores for seniors and for gain scores.</p> <p>Lee and Bryk (1986), in a study using the High School and Beyond data, found girls in SS high schools had no differences in writing achievement for sophomores, seniors and gain scores between sophomore and senior years when compared with girls in CE schools. All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. Boys in SS high schools had higher writing achievement scores in the sophomore year ($d = .24$) when compared with boys in CE schools, but not for seniors or gain scores.</p>	√		Mixed		Mixed			√

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Table 5—Verbal and English Achievement (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
5) Lee and Marks (1990)	Lee and Marks (1990), in comparing SS versus CE schools (Catholic) for differences in verbal achievement, found no differences between SS male students and CE male students such that SS males scored slightly higher than CE males ($d = -0.01$) ($n = 732$). No differences were found when comparing SS females ($n = 335$) with CE females where SS females scored slightly lower than CE females ($d = -0.06$) ($n = 801$).	Null		Null		Null			√
6) LePore and Warren (1987)	LePore and Warren (1987), in comparing SS Catholic versus CE public high schools, found no differences in verbal achievement for females ($n = 140$) in grade 10 (SS mean: 31.93, $sd = 7.67$ vs. CE mean: 31.51, $sd = 7.82$). In grade 10, verbal achievement of SS males differed significantly from that of CE males (SS mean: 35.57, $sd = 8.15$ vs. CE mean: 32.81, $sd = 8.78$), and there was no difference between verbal achievement of SS and CE females (SS mean: 35.17, $sd = 9.86$ vs. CE mean: 35.58, $sd = 8.22$). In grade 12, verbal achievement of SS males differed significantly from that of CE males (SS mean: 37.96, $sd = 7.93$ vs. CE mean: 35.45, $sd = 9.07$) and there was no difference between verbal achievement of SS and that of CE females (SS mean: 38.84, $sd = 7.47$ vs. CE mean: 39.03, $sd = 8.10$). In terms of gain scores from grade 8 to grade 12, verbal achievement differences between SS males and CE males were no (SS mean: 6.78, $sd = 16.03$ vs. CE mean: 6.74, $sd = 17.82$), and there was no difference between verbal achievement of SS and CE females (SS mean: 6.91, $sd = 15.13$ vs. CE mean: 7.52, $sd = 15.92$). Grade 8 achievement scores were used to control for preexisting differences. When using this control variable, only SS boys demonstrated higher achievement.	√		√		Null		√	

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Table 5—Verbal and English Achievement (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
7) Marsh (1991)	<p>Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in reading achievement in Year 10 between SS Catholic schools and CE Catholic schools (Catholic SS mean: 9.13, sd = 4.36 vs. Catholic CE mean: 8.22, sd = 4.52). In Year 12, reading achievement differences were no when comparing Catholic SS schools versus Catholic CE schools (Catholic SS mean: 10.83, sd = 4.53 vs. Catholic CE mean: 9.92, sd = 4.71). (N = 10,507).</p> <p>Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in writing achievement in Year 10 between SS Catholic schools and CE Catholic schools (Catholic SS mean: 10.89, sd = 4.24 vs. Catholic CE mean: 10.33, sd = 4.58). In Year 12, writing achievement differences were no when Catholic SS schools versus Catholic CE schools (Catholic SS mean: 12.77, sd = 3.82 vs. Catholic CE mean: 12.16, sd = 4.16). (N = 10,507).</p> <p>Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in vocabulary achievement in Year 10 between SS Catholic schools and CE Catholic schools (Catholic SS mean: 11.65, sd = 4.76 vs. Catholic CE mean: 8.95, sd = 5.28). In Year 12, reading achievement differences were no Catholic SS schools versus Catholic CE schools (Catholic SS mean: 14.28, sd = 4.41 vs. Catholic CE mean: 13.46, sd = 4.74). (N = 10,507).</p>								√
8) Marsh et al. (1988)	<p>Marsh, Smith, Marsh, and Owens (1988), in comparing two SS high schools that transitioned to two CE high schools, found no significant differences between males and females ($F(1, 367) p > .05$) between pre- and posttransition.</p>	Null		Null		Null			√

Table 5—Verbal and English Achievement (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
9) Riordan (1985)	Riordan (1985), in comparing SS versus CE schools (Catholic SS high schools and Catholic CE high schools) found significant differences in vocabulary achievement, such that Catholic SS students perform better on vocabulary tests than either Catholic CE students or public CE students (Catholic SS vs. Catholic CE = .22 sds; Catholic SS vs. public CE = .43 sds) (n = 22,652). In the case of males, significant differences were found for vocabulary achievement such that Catholic SS students outperformed public CE students on vocabulary achievement tests (Catholic SS vs. public CE = .32 sds). For females, there was a significant difference in vocabulary test scores; Catholic SS students outperformed public CE students (Catholic SS vs. public CE = .50 sds). Riordan also found significant differences in reading achievement scores; Catholic SS students performed better on reading tests than either Catholic CE students or public CE students (Catholic SS vs. Catholic CE = .14 sds; Catholic SS vs. public CE = .31 sds). In the case of males, no differences were found for reading achievement. For females, there was a significant difference in vocabulary test scores where Catholic SS students outperformed public CE students (Catholic SS vs. public CE = .48 sds).	√		√		√			√
10) Woodward et al. (1999)	Woodward, Fergusson, and Horwood (1999), in comparing SS versus CE high schools in New Zealand, found significant differences for males (SS mean: 100.29 vs. CE mean: 94.33; $p < .0001$) and significant differences for females (SS mean: 101.84 vs. CE mean: 96.32; $p < .0001$) on the Burt Word Reading Test (n = 657). Findings for both sexes favored SS schools, and no sex by type of school interaction was found. However, when parental background variables, previous school behaviors, and previously measured cognitive ability were controlled, the difference between schools was virtually nonexistent (SS mean: 97.8 vs. CE mean: 97.6; $p > .05$).	Null		Null		Null			√

Grades

Grades have long served as a measure of a student’s performance across all types of schooling. One study examined the impact of type of school on grades and reported null results. This study did not make comparisons on the basis of sex. The sample consisted of high school students.

Table 6—Grades

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Marsh (1991)	Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in grades in Year 10 between SS Catholic schools and CE Catholic schools (Catholic SS mean: 5.95, sd = 1.42 vs. Catholic CE mean: 5.88, sd = 1.44). In Year 12, grade differences were no when Catholic SS schools versus Catholic CE schools (Catholic SS mean: 6.11, sd = 1.32 vs. Catholic CE mean: 6.01, sd = 1.34). (N = 10,507).	Null							√

Social Studies Achievement Test Scores

Social studies achievement test scores have been defined as an indicator of composite mastery over the scholastic content-area verbal skills required in civics (i.e., social studies, government, civics, and history) acquired over a restricted span of time. One study examined the relationship between type of school and social studies achievement test scores and reported results favoring single-sex schooling. This study reported results favoring single-sex schooling for girls and null findings when comparing boys in SS and CE schools. The sample consisted of high school students.

Table 7—Social Studies Achievement Test Scores

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Riordan (1990)	Riordan (1990), in comparing SS versus CE schools (Catholic high schools), found significant differences in civics achievement, such that white females in SS schools outperformed white females in CE schools (.6 sds) when controlling for initial ability and home background (n = 477–619). Senior-year test scores were significantly different: SS at-risk girls outperformed CE at-risk girls (1.9 sds) when controlling for only initial ability, race, and home background. It should be noted that this significant difference becomes no when controlling for course work, preparatory track, homework, and adolescent subculture as represented by the formal structure of the school. No differences were found in males.	√		Null		√			√

Long-Term, Quantifiable Academic Accomplishment

Long-term, quantifiable indicators of academic accomplishment are outcomes that provide some indication of the protracted effects of attending a single-sex high school. Proponents of single-sex schooling have long argued that postsecondary test scores, college graduation rates, and graduate school attendance are higher for students in single-sex schools because the single-sex experience provides an academic subculture focused on achievement and studying. Presumably, this would train students to work hard and focus on academic achievement even after they leave the single-sex school. The following tables (Tables 7 to 9) represent all findings reviewed for this type of outcome. It is important to note that all of these findings came from single studies by Marsh (1989) and Riordan (1990), so this clearly is an underresearched outcome of single-sex schooling.

Postsecondary Test Scores

Postsecondary test scores can be operationalized as scores on standardized tests such as the Graduate Record Examination, the Graduate Management Admissions Test, the Medical College Admissions Test, and the Law School Admissions Test, all of which are

measured in a collegiate setting after secondary schooling. This is a long-term outcome as opposed to all prior outcomes. Two studies examined the relationship between the type of school and postsecondary test scores. One reported findings favoring single-sex schooling and the other reported null results. Only one study made comparisons on the basis of sex with results favoring single-sex girls and boys. In both studies, the sample consisted of high school students.

Table 8—Postsecondary Test Scores

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Marsh (1989)	Marsh (1989) compared postsecondary test scores for seniors in Catholic SS and Catholic CE schools. When controls for background variables were introduced, almost no differences could be attributed to type of school, and statistically significant differences did not consistently favor one type of school over another.	Null							√
2) Riordan (1990)	Riordan (1990) compared postsecondary test scores for seniors in SS Catholic and CE Catholic high schools. When controlling for SES, initial ability, and prior education, Riordan found significant differences in verbal and mathematics test scores between SS and CE girls. When controlling for SES, initial ability, and prior education, Riordan found significant differences in mathematics ability between SS and CE boys.	√		√		√			√

College Graduation

College graduation has been used as a long-term measure of success for students. Further, it has been used as a long-term outcome in the arguments both for and against single-sex schooling. One study examined the relationship between type of school and college graduation and reported null results. This study did not make comparisons based on sex. The sample consisted of high school students.

Table 9—College Graduation

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Marsh (1989)	Marsh (1989) compared college graduation for seniors in Catholic SS and Catholic CE schools. When controls for background variables were introduced, almost no differences could be attributed to type of school, and statistically significant differences did not consistently favor one type of school over another.	Null							√

Graduate School Attendance

Graduate school attendance has long been used as a long-term measure of success for students. Further, it has been used as a long-term outcome in the arguments both for and against single-sex schooling. One study examined the relationship between type of school and graduate school attendance and reported null results. This study did not make comparisons on the basis of sex. The sample consisted of high school students.

Table 10—Graduate School Attendance

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Marsh (1989)	Marsh (1989) compared graduate school attendance for seniors in Catholic SS and Catholic CE schools. When controls for background variables were introduced, almost no differences could be attributed to type of school, and statistically significant differences did not consistently favor one type of school over another.	Null							√

Concurrent, Quantifiable Indicators of Individual Student Adaptation and Socioemotional Development

A number of attitudinal and socioemotional outcome measures are of interest as well. These include school track and subject preference (e.g., school subject preferences and course enrollment) and higher academic aspirations, self-reported delinquency, locus of control, perceived cognitive competence, reduced stereotypical attitudes toward one's own and opposite sex, and self-esteem. Proponents of single-sex education have argued that students of single-sex schools develop higher aspirations for academics and careers while building healthier self-images about competence, control, and abilities. The following tables (Tables 10 to 19) represent the summarized findings for these outcomes.

Self-Concept

The consensus among researchers is that self-concept can be defined as “the totality of a complex, organized, and dynamic system of learned beliefs, attitudes and opinions that each person holds to be true about his or her personal existence” (Purkey, 1970, pp. 15). Of the seven studies that examined the relationship of single-sex schooling to self-concept, four (57 percent) reported results in favor of single-sex schooling and three (43 percent) reported null results. When comparing single-sex and coeducation for girls, three of four (75 percent) studies reported results supporting single-sex schooling and one study reported null results (25 percent). When comparing single-sex and coeducation for boys, two of three (67 percent) studies reported null results, and the other study (33 percent) reported finding evidence in favor of single-sex schooling. All seven studies examined the relationship of self-concept to type of school by using high school samples.

Table 11—Self-Concept

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Cipriani-Sklar (1996)	<p>Cipriani-Sklar (1996), in comparing SS versus CE schools (9th grade girls; public vs. Catholic), found no differences in general self-concept for females (SS mean: 3.6046, sd = .3374 vs. CE mean: 3.6116, sd = .4929); $F(1,213) = .0146$ ($n = 213$).</p> <p>Cipriani-Sklar (1996), in comparing SS versus CE schools (9th grade girls; public vs. Catholic), found significant differences in mathematics self-concept for females, such that females in SS schools had higher academic self-concept than their counterparts in CE schools (SS mean: 2.8096, sd = .3252 vs. CE mean: 2.3897, sd = .5757; $F(1,213) = 42.03$) ($n = 213$).</p> <p>Cipriani-Sklar (1996), in comparing SS versus CE schools (9th grade girls; public vs. Catholic), found significant differences in science self-concept for females, such that females in SS schools had higher science self-concept than their counterparts in CE schools (SS mean: 3.2402, sd = .3057 vs. CE mean: 2.8578, sd = .5446; $F(1,213) = 39.07$) ($n = 213$).</p>								
2) Cuddy (2000)	<p>Cuddy (2000), in comparing SS versus CE schools (public CE high schools vs. Catholic SS high schools), found significant differences in “multiple selves,” where SS students exhibited a higher number of possible selves than CE students ($F(1,159) = 6.12$).</p>	√							√
3) Lambert (1998)	<p>Lambert (1997), in comparing girls in SS versus girls in CE schools (Catholic high school, seniors), found no differences in overall self-concept ($F(6,41) = .76$). In the case of self-concept subdimensions, no differences were found between SS and CE girls for all six subdimensions (Academic: $F(1,46) = .01$; Affect: $F(1,46) = .01$; Family: $F(1,46) = 1.15$; Competence: $F(1,46) = .06$; Physical: $F(1,46) = .41$; and Social: $F(1,46) = .34$). Only SES and SAT scores covaried with the overall self-concept.</p>								

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Table 11—Self-Concept (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
4) Lee and Bryk (1986)	Lee and Bryk (1986), in a study using the High School and Beyond data, found girls in SS high schools had higher self-concept scores in their sophomore year ($d = .18$), but not in senior year or in their gain scores between sophomore and senior year, when compared with girls in CE schools. All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. For boys in SS high schools, there were no significant differences in self-concept when compared to boys in CE schools for sophomore year, senior year and gain scores.	Null		Null		Null			√
5) Marsh (1991)	Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in academic self-concept in Year 10 . (N = 10,507). In the case of academic self-concept in Year 12, no differences were found.	Null							√
6) Marsh et al. (1988)	Marsh, Smith, Marsh, and Owens (1988), in comparing two SS schools that transitioned to two CE schools (high school, public) found significant differences for males (F tests) and significant differences for females (F test) (n = grades, not students) on multiple dimensions of the SDQ II self-concept measure in favor of the later, posttransition CE period. Researchers said change was made at parental request and did not discuss possible Hawthorne and parental suggestion effects on students. Within-subject changes were not studied because of lack of identifiers.	√		√		√			√

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Table 11—Self-Concept (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
7) Riordan (1990)	Riordan (1990), in comparing SS versus CE schools (high school, Catholic) found no differences in self-concept. However, in the case of white females, SS students reported higher self-concept than white females in CE schools when controlling for initial ability and home background. No differences were found in males or at-risk students of either gender. (n = 902).	√		Null		√			√

Self-Esteem

The consensus among researchers is that self-esteem can be defined as pride in one’s self; holding a good opinion of one’s self; a feeling of pride in oneself, or the quality of being worthy of esteem (Silber and Tippett, 1965). Of the six studies that examined the relationship between SS schooling and self-esteem, one (17 percent) reported results in favor of SS schooling, three (50 percent) reported null results, and two (33 percent) studies reported results in favor of coeducation. When comparing SS and CE for girls, three of three (100 percent) studies reported null findings. When comparing SS and CE for boys, two of three (67 percent) studies reported results in favor of coeducation, and the other (33 percent) reported finding evidence in favor of single-sex schooling. Of the two studies that used elementary school samples, one found evidence favoring single-sex schooling and the other study found evidence favoring coeducation. Of the four studies using high school samples, one (25 percent) reported results supporting coeducation, and three (75 percent) reporting null results. Only one study reported ethnic comparisons with null results for African American, white, and Asian students.

Table 12—Self-Esteem

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Brutsaert and Bracke (1994) ^a	Brutsaert and Bracke (1994), in comparing SS versus CE schools (elementary private Catholic) found significant differences in self-esteem for boys where SS boys reported higher self-esteem than CE boys (no numbers reported but listed in results) (N = 1,130 boys; 965 girls). Differences were no in the case of girls when comparing self-esteem for SS girls and CE girls.	√		√		Null		√	
2) Conway (1996)	Conway (1996), in comparing female seniors in one SS high school to female seniors in one CE high school (Catholic), found no differences on the Piers-Harris Children's Self-Concept Scale (SS mean: 59.37 vs. CE mean: 58.83; $t = 0.51$, $p > .05$) (n = 293). Also, differences between groups were considered using preexisting cognitive ability as a covariate (based on questionable logic), and no significant differences were shown. Further, it is important to remember that this study used just two Catholic high schools in one local area.	Null							√
3) Garcia (1998)	Garcia (1998), in comparing SS versus CE schools (12th-grade females in two public high schools) on self-esteem scores, found that black females in CE schools had significantly higher scores than black females in SS schools (SS mean: 34.65 vs. CE mean: 36.50, $p > .01$) (n = 104). The differences were not significant for white or Asian girls (SS mean: 31.42 vs. CE mean: 31.21, $p > .05$ for white girls; n = 86); (SS mean: 30.84 vs. CE mean: 32.07, $p > .05$ for Asian girls; n = 47). When controlling for initial ability, SES, and quality of previous education, the differences were not significant for each group (black, white, and Asian) of girls.	Null				Null			√

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Table 12–Self-Esteem (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
4) LePore and Warren (1987)	LePore and Warren (1987), in comparing SS Catholic schools versus CE public high schools, found no significant differences in self-esteem in grade 8, grade 10, grade 12, or from grade 8 to 12 for males (n = 159). They found no differences in self-esteem in grade 8, grade 10, grade 12, and from grade 8 to 12 for females (n = 140). Grade 8 scores served as a control for preexisting achievement differences.	Null							√
5) Riordan (1994)	Riordan (1994), in considering a large sample of black and Hispanic Catholic high school students (N = 690), found significant effects favoring CE schools on a measure of self-esteem for males, but no differences for females (standardized d score = 0.28 and 0.09) when controlling for home background and initial cognitive ability.		√		√	Null			√
6) Sanders (1992)	Sanders (1992), in comparing SS versus CE African American elementary schools (grades 3, 4, and 5), found no differences for fourth- and fifth-grade males ($p > 0.05$; based on F test) and significant differences for third-grade males ($p = 0.001$; based on F test) (total n = 196). Results for third-graders showed that self-reports of self-esteem were higher for students in the CE school than students in the SS school when pretest scores on self-esteem and math ability scores were used as covariates. However, this study was limited to just two schools with quite different curricula, so no conclusions should be drawn.		√		√			√	

^a Brutsaert and Bracke (1994) have suggested that in the case of self-esteem, school commitment, and study commitment for boys, the differences attributed to SS schooling can be explained largely by the presence of male faculty in SS schools.

Locus of Control

Locus of control is a concept describing whether people feel that control of their lives rests in their own hands (internal locus of control) or in the hands of others (external locus of control) (Rotter, 1966). In the case of students, it refers to whether the students feel

they have control over their academic life or not. Of the five studies that examined the relationship between SS schooling and locus of control, three of five studies (60 percent) reported results in favor of single-sex schooling and two (40 percent) reported null results. When comparing SS and CE for girls, three of their (100 percent) studies reported results supporting SS schooling. When comparing SS and CE for boys, two of three studies (67 percent) reported results supporting SS schooling and the other (33 percent) reported null results. All five studies used high school samples. Finally, two studies reported results for disadvantaged youths whereby both found results favoring SS education.

Table 13—Locus of Control

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Lee and Bryk (1986)	Lee and Bryk (1986) in a study using the High School and Beyond data, found girls in SS high schools had no differences in scores for locus of control in their sophomore year, significantly higher scores for seniors ($d = .21$) and no differences for gain scores between sophomore and senior years, when compared with girls in CE schools. All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. For boys, there were no differences in locus of control between students in SS high schools and those in CE schools (for sophomore year, senior year and gain scores).	√		Null		√			√
2) LePore and Warren (1987)	LePore and Warren (1987), in comparing SS Catholic versus CE public high schools, found no differences in locus of control in grade 8, grade 10, grade 12, or from grade 8 to 12 for males ($n = 159$). They found no differences in locus of control in grade 8, grade 10, grade 12, and from grade 8 to 12 for females ($n = 140$). Grade 8 scores of locus of control were used as a control variable for preexisting differences.	Null							√

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Table 13—Locus of Control (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
3) Marsh (1991)	Marsh (1991), in comparing SS Catholic and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in locus of control in Year 10 between SS and CE Catholic schools (Catholic SS mean: .19, sd = .59 vs. Catholic CE mean: .12, sd = .57) (N = 10,507). For Year 12, no differences were found between SS and CE Catholic schools (Catholic SS mean: .19, sd = .59 vs. Catholic CE mean: .14, sd = .58).	Null							√
4) Riordan (1990)	Riordan (1990), in comparing SS versus CE schools (high school, Catholic), found significant differences in locus of control. White females in SS schools reported higher self-esteem than white females in CE schools when controlling for initial ability and home background. SS at-risk males expressed significantly higher sense of internal locus of control than did CE at-risk males (30 percent of 1 sd), even when controlling for initial attitude, initial ability, home background, preparatory track, homework, and adolescent subculture (n = 902).	√		√		√			√
5) Riordan (1994)	Riordan (1994), in considering a large sample of black and Hispanic Catholic high school students (N = 690), found significant effects favoring SS schools on a measure of environmental control for both males and females (standardized d score = 0.25 and 0.22, respectively) when controlling for home background and initial cognitive ability.	√		√		√			√

School Track and Subject Preferences

Course participation, course attitudes, or course enrollment have all been examined as outcomes relating to school track and subject preference. Of the 14 studies that examined the impact of single-sex schooling on school track and subject preferences, five (36 percent) reported results in favor of single-sex schooling, six (43 percent) reported null results, one reported mixed results (7 percent), and two (14 percent) studies reported findings in favor of coeducation. When comparing single-sex and coeducation for girls, five of eight studies (63 percent) reported results supporting single-sex schooling; one study (13 percent) reported results in favor of coeducation and two (25 percent) reported null results. When comparing single-sex and coeducation for boys, two of seven studies (29 percent) reported results in favor of single-sex schooling, three studies (43 percent) reported null results, and two studies (29 percent) reported findings in favor of coeducation. Of the 13 studies employing a high school sample, six studies (46 percent) reported results in favor of single-sex schooling, five (39 percent) reported null results, one reported mixed results (8 percent), and one (8 percent) reported results supporting coeducation. Of the two studies using elementary school students, both reported results in favor of coeducation (100 percent).

Table 14—School Track/Subject Preferences

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Ainley and Daly (2002)	Ainley and Daly (2002) found attendance at SS girls' high schools increased the likelihood of participation in physical science courses (SS score: 8.3 percent vs. CE score: 5.1 percent), but the parameter did not reach significance ($p < .05$) after controlling for gender, language, SES, earlier school achievement, metropolitan location, and independent versus Catholic school. They found that a large amount of variance in participation remained after these factors were accounted for.	Null				Null			√

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Table 14—School Track/Subject Preferences (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
2) Bornholt and Möller (2003)	Bornholt and Möller (2003) compared attributions for success or failure in math and English for Australian boys and girls, ages 11–16, at one CE high school and two SS high schools. Attributions were “remarkably similar” for boys and girls at CE and SS schools. Ability was viewed as a reason for success in English by girls at CE schools but not SS girls ($b = -.19$). There were no differences between boys at SS and CE schools. For math, effort was viewed as a reason for success by CE girls ($b = -.27$) but girls in SS schools. There were no differences for boys at SS and CE schools. Overall, differences suggest that ability and effort are viewed as equally important reasons for success or failure by SS boys and CE boys but not by SS girls or CE girls.	√		Null		√			√
3) Daly (1995)	Daly (1995), in comparing SS versus CE schools (high school and elementary levels of all three kinds: public, private, and Catholic in Northern Ireland and Wales), found significant differences in science course participation favoring CE students ($b = -.475$ and $b = .418$) ($N = 4,107$). However, this was moderated by gender, whereby SS girls participated less in science courses than did CE girls, but no difference was found between SS boys and CE boys.		√	Null			√	√	√

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Table 14—School Track/Subject Preferences (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
4) Daly and Ainley	Daly and Ainley, in comparing students in SS versus CE Australian high schools, found no differences for males and no differences for females in attending advanced math classes as high school seniors (total n = 2,002). These results were found using multilevel modeling in which student-level variables (earlier math achievement, parental education, and ethnic background) and school-level variables (type of school, school location, and coeducational status) were considered simultaneously. In general, results showed that the major influences on advanced mathematics participation are gender and prior Mathematics Achievement Test Scores, rather than school-level factors.	Null		Null		Null			√
5) Daly, Ainley, and Robinson (1996)	Daly, Ainley, and Robinson (1996) examined the effect of SS versus CE schooling on participation of Australian high school seniors in science courses, taking into account family background and public versus private school. They found attendance at a SS school produced no significant difference for participation in a physics or biology curriculum.	Null							√
6) Daly and Shuttleworth (1997)	Daly and Shuttleworth (1997), in comparing all-boys', all-girls', and CE high schools in Ireland, found no differences in mathematics test enrollment among all types of schools when controlling for covariates at the student level and the school level.	Null							√

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Table 14—School Track/Subject Preferences (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
7) Lee and Bryk (1986)	Lee and Bryk (1986), in a study using the High School and Beyond data, found girls attending SS high schools had a significantly higher interest in math ($p < .05$, $d = 0.23$) and English ($p < .05$, $d = 0.26$), were more likely to enroll in mathematics ($p < .05$, $d = 0.16$), and had more association with academically oriented friends ($p < .05$, $d = 0.23$) than those in CE schools. Boys in SS high schools were more likely to enroll in mathematics ($p < .05$, $d = 0.46$) and physical science ($p < .05$, $d = 0.40$) and less likely to enroll in vocation studies ($p < .05$, $d = -0.26$) than those in CE schools. All of the reported effects include adjustments for many personal, family, and school characteristics.	√		√		√			√
8) Lee and Lockheed (1990)	Lee and Lockheed (1990), in comparing SS versus CE schools (ninth-graders in Nigeria), found significant differences for males ($\beta = .08$; $p < .05$; $n = 785$) and significant differences for females ($\beta = -.10$; $p < .05$; $n = 227$), on stereotypic views of mathematics, when controlling for student and school characteristics. These results indicate that SS schools decrease stereotypical views for girls and (increase) stereotypical views for boys.	Mixed			√	√			√
9) Marsh (1989)	Marsh (1989) compared course selection for seniors in Catholic SS and Catholic CE schools. When controls for background variables were introduced, almost no differences could be attributed to type of school, and statistically significant differences did not consistently favor one type of school over another.	Null							√

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Table 14—School Track/Subject Preferences (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
10) Marsh (1991)	<p>Marsh (1991), in comparing SS Catholic and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in mathematics participation in Year 12 between SS Catholic schools and CE Catholic schools (Catholic SS mean: 3.10, sd = .67 vs. Catholic CE mean: 2.96, sd = .72) (N = 10,507).</p> <p>Marsh (1991), in comparing SS Catholic and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in science participation in Year 12 between SS and CE Catholic schools (Catholic SS mean: 2.79, sd = .80 vs. Catholic CE mean: 2.68, sd = .80) (N = 10,507).</p> <p>Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in vocational participation in Year 12 between SS Catholic schools and CE Catholic schools (Catholic SS mean: 2.18, sd = .76 vs. Catholic CE mean: 2.25, sd = .73) (N = 10,507).</p> <p>Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in academic credits received by Year 12 between SS Catholic schools and CE Catholic schools (Catholic SS mean: 14.89, sd = 3.20 vs. Catholic CE mean: 14.43, sd = 4.29) (N = 10,507).</p>	Null							√

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Table 14—School Track/Subject Preferences (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
10) Marsh (1991) continued	<p>Marsh (1991), in comparing SS Catholic high schools with CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in participation in academic track by Year 10 between SS Catholic schools and CE Catholic schools (Catholic SS mean: .69, sd = .46 vs. Catholic CE mean: .57, sd = .50). In the case of academic track participation by Year 12, no differences were found between SS Catholic schools and CE Catholic schools (Catholic SS mean: .74, sd = .44 vs. Catholic CE mean: .69, sd = .46).</p> <p>Marsh (1991), in comparing SS Catholic and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in participation in vocational track by Year 10 between SS and CE Catholic schools (Catholic SS mean: .05, sd = .22 vs. Catholic CE mean: .06, sd = .24) (N = 10,507). In the case of vocational track participation by Year 12, no differences were found between SS Catholic schools and CE Catholic schools (Catholic SS mean: .10, sd = .30 vs. Catholic CE mean: .11, sd = .31).</p> <p>Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in participation in honors courses by Year 12 between SS Catholic schools and CE Catholic schools (Catholic SS mean: 1.34, sd = .41 vs. Catholic CE mean: 1.32, sd = .40) (N = 10,507).</p>								

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Table 14—School Track/Subject Preferences (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
11) Sanders (1992)	Sanders (1992), in comparing SS versus CE African American elementary schools (grades 3, 4, and 5), found no differences for fourth- and fifth-grade males ($p > .05$; based on F test) and significant differences for third-grade males ($p = .033$; based on F test) (total $n = 196$). Results for third-graders showed that self-reports of attitudes toward school were higher for students in the CE school than students in the SS school when pretest scores regarding attitudes toward school were used as covariates. However, these findings were based on just two schools with quite different curricula and many other differences, so no conclusions should be drawn.		√		√			√	

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Table 14—School Track/Subject Preferences (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
12) Spielhofer et al. (2002)	<p>Spielhofer, O’Donnell, Benton, Schagen, and Schagen (2002), in comparing students in SS versus coed CE high schools across England, (level: high school) found that males in SS schools were significantly more likely than males in CE schools to be enrolled in higher levels of mathematics and science classes, when controlling for prior academic attainment and school factors (using 16,868 males in boys-only schools and more than 100,000 males in CE schools). More important, girls in SS schools were also significantly more likely than girls in CE schools to be entered for higher levels of math and science, when controlling for prior ability and school factors (including 23,477 females in girls-only schools and more than 100,000 females in coed CE schools).</p> <p>Spielhofer, O’Donnell, Benton, Schagen, and Schagen (2002), in comparing students in SS versus CE high schools across England, (level: high school) found that girls in SS schools were significantly less likely to take the courses in traditional foreign languages than girls in CE schools, when controlling for prior scholastic attainment and school factors (including 23,477 females in girls-only schools and more than 100,000 females in CE schools). In addition, girls in SS schools were less likely to take Food Technology (a traditionally female subject) and more likely to take Resistant Materials (a traditionally male subject), when statistical controls were included. Despite the trends for SS schools to increase the likelihood of taking non-traditional-gender school subjects for girls, males in boys’ schools were even less likely to take traditionally female subjects.</p>	√		√		√			√

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Table 14—School Track/Subject Preferences (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
13) Stables (1990)	Stables (1990), in comparing SS versus CE schools (sample included more than 2,300 third-year high school students from 13 schools in England), found significant differences for males in attitudes toward biology (SS mean: 57.8 vs. CE mean: 52.5; $p < .001$), physics (SS mean: 44.2 vs. CE mean: 47.8; $p < .001$), and school in general (SS mean: 12.6 vs. CE mean: 12.0; $p < .05$); no differences were found for science in general (SS mean: 40.3 vs. CE mean: 40.2) and chemistry (SS mean: 61.9 vs. CE mean: 61.7). For females, Stables found significant differences for attitudes toward science in general (SS mean: 39.3 vs. CE mean: 37.9; $p < .001$), biology (SS mean: 56.7 vs. CE mean: 59.3; $p < .001$), physics (SS mean: 41.2 vs. CE mean: 39.1; $p < .001$), chemistry (SS mean: 59.5 vs. CE mean: 58.4; $p < .05$), and school in general (mean: SS mean: 12.1 vs. CE mean: 13.0; $p < .001$). These results indicate that SS education may reduce sex differences in preferences for different school subjects, especially physics, where sex differences are particularly large in CE schools.	√							√
14) Steinback and Gwizdala (1995)	Steinback and Gwizdala (1995) compared female students from an all-female Catholic high school before and after they merged with a similar all-male school (173 females took part in both years of the study). They found some apparent differences in female attitudes toward math, such that their attitudes toward math were lower when the school was CE; for instance, 87 percent of females reported that they were comfortable asking questions in math class in Year 1 (SS), but only 79.2 percent reported this in Year 2 (CE). However, these differences were apparently not analyzed for statistically significant differences between years, so that analysis was of limited value.	√				√			√

Educational Aspirations

Educational aspiration refers to the educational goals that a student has set for himself or herself to attain. In the case for single-sex education, researchers have argued that students of single-sex schools set loftier goals, such as seeking a college education or an advanced degree. Of the three studies that examined the impact of single-sex schooling on educational aspirations, two (67 percent) reported results in favor of single-sex schooling and the other (33 percent) reported null findings. Two studies compared single-sex and coeducation for girls. Both studies (100 percent) reported results supporting single-sex schooling for girls. In comparing single-sex and coeducation for boys, both studies (100 percent) reported null results. All three studies used high school students as participants.

Table 15—Educational Aspirations

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Lee and Bryk (1986)	Lee and Bryk (1986) in a study using the High School and Beyond data, found girls in SS high schools had significantly higher educational aspirations in their sophomore years ($d = .19$), senior years ($d = .23$) and gain scores between sophomore and senior years ($d = .15$) when compared with girls in CE schools. All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. Boys in SS high schools had no differences with boys in CE schools on educational aspirations in sophomore and senior years, as well as in their gain scores.	√		Null		√			√

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Table 15—Educational Aspirations (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
2) Lee and Marks (1990)	Lee and Marks (1990), in comparing SS versus CE schools (Catholic high schools) for differences in educational aspirations, found that SS males scored higher than CE males, but there was no difference ($d = 0.06$)(SS $n = 328$; CE $n = 262$). Significant differences were found when comparing SS females ($n = 335$) with CE females ($n = 337$); SS females scored higher than CE females ($d = 0.21$).	√		Null		√			√
3) Marsh (1991)	Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in educational aspirations in Year 10 between SS Catholic schools and CE Catholic schools (Catholic SS mean: .52, $sd = .73$ vs. Catholic CE mean: .30, $sd = .80$). In the case of educational aspirations in Year 12, no differences were found between SS Catholic schools and CE Catholic schools (Catholic SS mean: .58, $sd = .73$ vs. Catholic CE mean: .42, $sd = .77$).	Null							√

Career Aspirations

Career aspirations refer to the career goals that a student has set for himself or herself to attain. In the case for single-sex education, researchers have argued that students of single-sex schools set loftier goals, such as seeking a graduate education or mounting a career that is viewed as profitable or successful. Of the two studies that examined the impact of single-sex schooling on career aspirations, both (100 percent) reported results in favor of single-sex schooling. When comparing single-sex and coeducation for girls, both (100 percent) reported results supporting single-sex schooling. One study compared single-sex and coeducation for boys, and it (100 percent) reported results favoring single-sex schooling. Both studies used high school students as participants.

Table 16—Career Aspirations

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Lee and Marks (1990)	Lee and Marks (1990), in comparing postbaccalaureate academic interests of students from the High School and Beyond study, found that students with SS high school education were more likely to consider applying to graduate school (CE males: 37.9 vs. SS males: 44.8 percent, $p = .05$; CE females: 31.3 percent vs. SS females: 41 percent, $p = .01$). In particular, they were more likely to consider applying to law school (SS males: 12.8 vs. CE males: 5.6 percent, $p = .01$; SS females: 13.0 vs. CE females: 7.7 percent, $p = .01$). A significant difference was found for males but not for females; males from SS schools were more likely to consider an MBA program (SS males: 26.6 vs. CE males: 19.1 percent, $p = .01$). Students from CE high schools were found to be more likely to consider another graduate degree (CE students: 18.0 vs. SS students: 10.9 percent, $p = .05$). Canonical Discriminant Function for the impact of SS schooling on career aspirations yields a coefficient of .387 for females and .270 for males.	√		√		√			√
2) Watson, Quatman, and Edler (2002)	Watson, Quatman, and Edler (2002), in comparing the career aspirations of high school students (10th- and 12th-grade females), found that females from SS schools (N = 351) had higher ideal (SS mean: 70.6) and realistic (SS mean: 67.5) career aspirations than did females from CE schools (N = 494) (CE mean: 67.9 and CE mean: 63.8, respectively). Further, the females in the SS schools did not demonstrate the drop in ideal ($F(1, 435) = 5.40$; $p < .05$) and realistic ($F(1, 415) = 4.06$; $p < .05$) career aspirations that females in CE schools had demonstrated between the 10th and 12th grades.	√				√			√

Delinquency

Delinquency refers to an antisocial misdeed in violation of the law or school policy by a minor. In the case for single-sex education, researchers have argued that students in single-sex schools perform fewer acts of delinquency, misbehavior, or norm violation and associate with fewer delinquent peers. Of the four studies that examined the relationship between single-sex schooling and delinquency, two (50 percent) reported results in favor of single-sex schooling and two (50 percent) reported null results. Three studies compared single-sex and coeducation for girls, and two (67 percent) reported results supporting single-sex schooling while the other (33 percent) reported null findings. One study (100 percent) reported null findings when compared single-sex and coeducation for boys. All studies used high school students as participants.

Table 17—Delinquency

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Caspi (1995)	<p>Caspi (1995), in comparing SS versus CE (public and Catholic) schools at the high school level, found significant differences in peer delinquency at age 13 in girls attending SS schools and girls attending CE schools ($t = 2.1$; $n = 850$), where SS girls knew fewer peers who were delinquent than their CE counterparts did. This relationship was moderated by menarcheal development: the difference is exhibited only in the case of girls who reached menarche early. However, in the case of girls who reached menarche on time or late, there was no significant difference between SS and CE girls. At age 15, the same relationship holds true; SS girls who reach menarche early differ significantly from CE girls ($t = 3.0$). Similarly, the difference between a girl who reaches menarche on time or late is not significant. ($n = 976$).</p> <p>Caspi (1995), in comparing girls in SS school versus CE high school girls (Catholic and public), found significant differences in self-reported delinquency between SS girls and CE girls ($t = 2.0$). However, this relationship holds true only for girls who reach menarche early ($n = 976$).</p>	√				√			√

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Table 17—Delinquency (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
2) Caspi, Lynam, Moffitt, and Silva (1993)	<p>Caspi, Lynam, Moffitt, and Silva (1993), in comparing girls in SS versus girls in CE schools (elementary public and private schools), found significant differences in familiarity with delinquent peers ($F(1, 263) = 6.73$). This relationship was moderated, however. In comparing girls in SS with girls in CE schools, there was a significant difference in familiarity with delinquent peers only for girls who reached menarche early ($t(263) = 2.12$). For girls who reach menarche on time or late, there was no significant difference in familiarity with delinquent peers.</p> <p>Caspi, Lynam, Moffitt, and Silva (1993), in comparing girls in SS versus girls in CE schools (elementary public and private schools), found no differences for norm violations ($F(1, 263) = .92$). This relationship was moderated, however. In comparing girls in SS versus girls in CE schools, a significant difference was found in norm violations only for girls who reached menarche early ($t(263) = 2.98$). For girls who reach menarche on time or late, there was no significant difference in norm violations.</p> <p>Caspi, Lynam, Moffitt, and Silva (1993), in comparing SS versus CE school girls in elementary public and private schools, found no differences for self-reported delinquency ($F(1, 263) = 1.88$). This relationship was moderated, however. In comparing girls in SS versus CE schools, there was a significant difference in self-reported delinquency only for girls who reached menarche early ($t(261) = 2.02$). For girls who reach menarche on time or late, there was no significant difference in self-reported delinquency.</p>	√				√			√

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Table 17—Delinquency (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
3) Lee and Bryk (1986)	Lee and Bryk (1986) in a study using the High School and Beyond data, found girls attending SS high schools had no significant differences with girls in CE schools on incidents of disciplinary behavior and unexcused absences. All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. For boys, there were also no significant differences between students in SS and CE high schools on incidents of disciplinary behavior and unexcused absences.	Null		Null		Null			√
4) Marsh (1991)	Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in disciplinary troubles over the course of the study between SS Catholic schools and CE Catholic schools (Catholic SS mean: $-.32$, $sd = .44$ vs. Catholic CE mean: $-.28$, $sd = .28$) (N = 10,507).	Null							√

Attitudes Toward School

Attitudes toward school refer to any cognition by a student about school in general regardless of whether it is accompanied by a behavioral manifestation. Examples of these attitudes might include study commitment, sense of belonging, or fear of subjects, which might lead to anxiety. One example of this type of anxiety is science trait and science state anxiety (Cipriani-Sklar, 1996). This researcher defined science state anxiety as the anxiety felt at an exact moment that is associated with science courses. Science trait anxiety was defined as the anxiety associated with science course that is experienced over the course of a normal day. Of the five studies that examined the relationship of single-sex schooling to general attitudes toward school, one (20 percent) reported results in favor of single-sex schooling, one (20 percent) study reported findings in favor of CE schooling, one (20 percent) study reported null results, and two (40 percent) reported mixed results. When comparing single-sex and coeducation for girls, one of three studies (33 percent) reported

results supporting single-sex schooling, one (33 percent) study reported results supporting CE schooling, and the other study (33 percent) reported findings in favor of coeducation. Three studies compared single-sex and coeducation for boys, and two (67 percent) reported results supporting single-sex schooling while one reported null results. Four of the five studies used high school students as participants, with one (25 percent) reporting null results, one (25 percent) reporting findings in favor of CE schooling, and two (50 percent) reporting mixed results. The one study that used an elementary school sample reported results supporting single-sex schooling.

Table 18—Attitudes Toward School

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Brutsaert and Bracke (1994)	<p>Brutsaert and Bracke (1994), in comparing SS versus CE schools (elementary Catholic), found significant differences in sense of belonging for boys; CE boys reported a higher sense of belonging than SS boys (N = 1,130 boys; 965 girls). Differences were no in the case of sense of belonging between SS girls and CE girls.</p> <p>Brutsaert and Bracke (1994), in comparing SS versus CE schools (elementary Catholic), found significant differences in school commitment for boys; SS boys reported higher school commitment than CE boys (no numbers reported but listed in results) (N = 1,130 boys; 965 girls). Differences were no when comparing school commitment for SS girls and CE girls.</p> <p>Brutsaert and Bracke (1994), in comparing SS versus CE schools (elementary Catholic), found significant differences in study commitment for boys; SS boys reported higher study commitment than CE (no numbers reported but listed in results) (N = 1,130 boys; 965 girls). Differences were not significant when comparing study commitment for SS girls and CE girls.</p>	Mixed		√			√		√

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Table 18—Attitudes Toward School (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
2) Cipriani-Sklar (1996)	<p>Cipriani-Sklar (1996), in comparing SS versus CE schools (ninth-grade girls; public vs. Catholic), found no significant differences in science state anxiety for females (SS mean: 2.6240, sd = .2325 vs. CE mean: 2.5877, sd = .1987; $F(1,213) = 3.33$) ($n = 213$).</p> <p>Cipriani-Sklar (1996), in comparing SS versus CE schools (ninth-grade girls; public vs. Catholic), found significant differences in science trait anxiety for females, such that females in SS schools have higher science trait anxiety than their counterparts in CE schools (SS mean: 2.4862, sd = .3453 vs. CE mean: 2.1873, sd = .2206; $F(1,213) = 55.71$). ($n = 213$).</p>		√				√		√
3) Lee and Bryk (1986)	<p>Lee and Bryk (1986) in a study using the High School and Beyond data, found girls in SS high schools had more positive attitudes toward academics than those in CE schools. These students were more likely to associate with academically oriented peers ($d = .23$) and to express interests in both mathematics ($d = .23$) and English ($d = .26$). All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. There were no significant differences between girls in SS and CE schools in attitudes toward socially active peers or student athletes. For boys in SS high schools, there were no differences in interests in math and English, as well as in their associations with academically oriented friends, when compared with boys in CE schools. Boys in SS schools had more positive attitudes toward socially active peers ($d = .26$) and athletes ($d = .30$).</p>	Mixed		Null		√			√

Table 18—Attitudes Toward School (cont'd)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
4) Marsh (1989)	Marsh (1989) compared attitudes for seniors in Catholic SS and Catholic CE schools. When controls for background variables were introduced, almost no differences could be attributed to type of school, and statistically significant differences did not consistently favor one type of school over another.	Null							√
5) Sanders (1992)	Sanders (1992), in comparing SS versus CE African American elementary schools (grades 3, 4, and 5), found no differences for third- and fourth-grade males ($p > .05$; based on F test), and significant differences for fifth-grade males ($p = .027$; based on F test) (total $n = 196$) when looking at academic achievement responsibility. Results for fifth-graders showed that self-reports of academic achievement responsibility were higher for students in SS school than for students in the CE school when pretest scores on academic achievement responsibility, as well as vocabulary and math ability scores, were used as covariates. However, this limited study used just two schools with quite different curricula, so conclusions should be drawn cautiously.	√		√				√	

Time Spent per Week on Homework

Time spent per week on homework has been used in the past as an indicator of effort by students, which can be seen as precursor to success. Two studies examined the relationship of single-sex education to time spent per week on homework. One study (50 percent) reported null results while the other reported results favoring SS schooling. Only one study examined time spent on homework by gender and reported results favoring single-sex schooling for both boys and girls. Both studies looked at high school students.

Table 19—Time Spent per Week on Homework

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Lee and Bryk (1986)	Lee and Bryk (1986) in a study using the High School and Beyond data, found girls attending SS high schools spent significantly more time on homework ($d = .36$) when compared with girls in CE schools, although there were no differences between amount of television watched. All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. Boys attending SS high schools also spent significantly more time on homework ($d = .23$) than those in CE schools, although there was no significant difference on amount of television watched.	√		√		√			√
2) Marsh (1991)	Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in time spent per week on homework in Year 10 between SS Catholic schools and CE Catholic schools (Catholic SS mean: 5.43, $sd = 1.15$; Catholic CE mean: 5.05, $sd = 1.21$).	Null							√

Attitudes Toward Working Women

This outcome refers to any cognition by a student toward the notion of women working rather than staying at home. In the case for SS education, researchers have argued that girls’ SS schools combat negative attitudes toward working women, whereas boys’ SS schools foster negative attitudes toward working women. One study examined the relationship between SS schooling and attitudes toward working women, reporting null results in the case of boys and results favoring SS education in the case of girls. This study used high school students as participants.

Table 20—Attitudes Toward Working Women

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Riordan (1990)	Riordan (1990), in comparing SS versus CE schools (high school public vs. private/Catholic), found significant differences in attitudes toward working women; white females in SS schools expressed a more accepting attitude than white females in CE schools (30 percent of 1 sd) when controlling for initial ability, initial attitude, preparatory track, homework, adolescent subculture, and home background. This same significant difference (identical) was found for at-risk females. For males (white or otherwise), there were no differences in attitudes toward working women.	√		Null		√			√

Long-Term, Quantifiable Indicators of Individual Student Adaptation and Socioemotional Development

Similar to their short-term counterparts, long-term, quantifiable indicators of individual student adaptation and socioemotional development include attitudinal outcomes as well as objective outcomes that reflect a wide range of effects of single-sex schooling on development and adaptation. In particular, single-sex proponents argue that students of single-sex schools do not drop out of school as much as coed students, experience greater success, and have fewer problems situating themselves after their secondary academic careers. The following tables (Tables 20 to 27) summarize findings for school completion, postsecondary success, unemployment, eating disorders, choice of college major, sex-role stereotyping in the workplace, and political involvement.

School Completion

One study examined the impact of single-sex education on dropping out. The reduction of dropouts has been of interest to all stakeholders because of the desire to ensure that all students increase their functionality and employability by graduating from high school. In the case of this study, results favoring single-sex schooling for both sexes were reported. This study used high school students.

Table 21—School Completion

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Woodward et al. (1999)	Woodward, Fergusson, and Horwood (1999), in comparing SS versus CE high schools in New Zealand, found significant differences for males (SS score: 11.3 percent vs. CE score: 33.0 percent; $p < .0001$ based on t-test) and significant differences for females (SS score: 7.5 percent vs. CE score: 30.0 percent; $p < .0001$) on percentage of students leaving school before the age of 17 ($n = 657$). Findings for both sexes showed that SS schools had lower dropout rates, and no SES by type of school interaction was found. When parental background variables, previous school behaviors, and previously measured cognitive ability were controlled, SS schools still scored significantly better, albeit to a smaller degree (SS score: 15.4 percent vs. CE score: 25.1 percent; $p < .05$).	√		√		√			√

Postsecondary Success

One study examined the relationship between single-sex education and postsecondary success. Postsecondary success is identified as participation in collegiate activities including academics, athletics, and clubs over the course of a four-year period without ever dropping full-time enrollment at a postsecondary institution. Null results were reported in this study. This study looked at high school students.

Table 22—Postsecondary Success

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Marsh (1991)	Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in postsecondary success between SS Catholic schools and CE Catholic schools (Catholic SS mean: 5.53, sd = 3.24; Catholic CE mean: 5.23, sd = 3.29) (N = 10,507).	Null							√

Postsecondary Unemployment

Postsecondary unemployment refers to the likelihood of a student of a single-sex or coed high school being unemployed after high school graduation. Two studies examined the impact of single-sex education on postsecondary unemployment, and one (50 percent) reported results supporting single-sex schooling while the other (50 percent) reported null results. One study reported results favoring single-sex education for boys and for girls. Both studies used high school students as participants.

Table 23—Unemployment

Authors	Study Findings	Advantage to:								
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School	
1) Marsh (1991)	Marsh (1991), in comparing SS Catholic high schools and CE Catholic high schools and statistically controlling for background variables such as SES, sex, and initial ability, found no differences in postsecondary unemployment between SS Catholic schools and CE Catholic schools (Catholic SS mean: -.32, sd = .44 vs. Catholic CE mean: -.28, sd = .28) (N = 10,507).	Null								√
2) Woodward et al. (1999)	Woodward, Fergusson, and Horwood (1999), in comparing SS versus CE high schools in New Zealand, found significant differences for males (SS score: 7.0 percent vs. CE score: 16.7 percent; $p < .05$) and significant differences for females (SS score: 5.3 percent vs. CE score: 18.0 percent; $p < .001$) on percentage of students who had been unemployed for three months or longer in the past two years ($n = 657$). Findings for both sexes showed that students from SS schools had lower rates of unemployment, and no sex by type of school interaction was found. When parental background variables, previous school behaviors, and previously measured cognitive ability were controlled, SS schools still scored significantly higher (SS score: 7.5 percent vs. CE score: 15.8 percent; $p < .05$).	√		√		√			√	

Eating Disorders

Eating disorders can be defined as syndromes where individuals develop an unhealthy view of their body and low self-esteem. This leads them to attempt to alter that body image by excessive weight change and through unhealthy means. One study examined the

likelihood of developing an eating disorder. Eating disorders occur predominantly in females and, as such, no results are reported for males. This study reported results favoring coeducation for high school females and measured eating disorders during high school.

Table 24—Eating Disorders

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Mensinger (2001)	Mensingher (2001), in comparing SS versus CE schools (high school, private, Australian, n = 142), found significant differences for females on eating disorders as measured by scores on a truncated version of the Eating Disorder Inventory (EDI), with higher scores for SS students ($F(1,138) = 14.623, p = .000$). SS students were more likely to develop an eating disorder than CE students.		√				√		√

Choice of College Major

One study examined the likelihood of choosing a major that is “gender mixed” (typical to both males and females) as opposed to choosing a feminine-oriented major (one traditionally dominated by females). This study reported results favoring single-sex schooling for high school females as more likely to lead to choice of a nontraditional major.

Table 25—Choice of College Major

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Thompson (2003)	Thompson (2003), in comparing SS versus CE secondary schooling (level: high school, public CE vs. private CE vs. Catholic SS girls), found significant differences between SS females and CE females when choosing a college major that is a gender-mixed major, as opposed to a feminine one (SS females are 1.6998 times more likely to choose a mixed major over a feminine one than CE females) (n = not listed; High School and Beyond data). Even when SES, religiosity, sophomore test scores, sophomore attitudes toward feminism, course work, senior test scores, and senior attitudes toward feminism were controlled for, the effect of all-girls schooling never loses statistical significance.	√				√			√

Sex-Role Stereotyping

Sex-role stereotyping refers to the endorsement of traditional attitudes toward the roles that men and women should take in the workplace. In general, stereotyping of this nature refers to the notion that women can take only certain roles in the workplace, whereas men can take broader, more powerful roles in the workplace. Two studies examined the likelihood that others will invoke stereotypes based on sex roles. One study (50 percent) reported results in favor of SS schooling and the other (50 percent) reported results in favor of coeducation. Both studies examined SS and CE differences in sex-role stereotyping for girls with one study (50 percent) finding in favor of coeducation and the other (50 percent) finding in favor of SS schooling. In the case of boys, one study examined differences between SS and CE and yielded a null result. All participants were high school students.

Table 26—Sex-Role Stereotyping (Work-Related)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Lee and Bryk (1986)	Lee and Bryk (1986) in a study using the High School and Beyond data, found girls in SS high schools had significantly less sex role stereotyping in their senior year ($d = -.25$) and in gain scores between sophomore and senior years ($d = -.17$) when compared with girls in CE schools, although there was a no difference for sophomores. All effects were calculated including adjustments for personal and family backgrounds, religious characteristics, academic background and orientation, school social context, and academic curricular track. For boys in SS high schools, there were no significant differences in students' views of stereotypical adult sex roles for sophomores, seniors and gain scores when compared to boys in CE schools.	√		Null		√			√
2) Lee and Marks (1990)	Lee and Marks (1990) found a significant difference for women, in that those women who attend SS Catholic high schools experienced more work-related sex-role stereotyping than did women who attended CE Catholic high schools ($d = 0.23$).		√				√		√

Political Involvement

Political involvement (activism) refers to one’s involvement in activities of a political nature. These activities can include attending debates, campaigning for office, and volunteering for elections, among others. These activities are viewed as being traditionally male activities. One study examined the relationship between single-sex schooling and political involvement among females. This study reported results in favor of single-sex education for women, meaning that female students of single-sex schools were more politically involved. All participants were high school students.

Table 27—Political Involvement (Activism)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Lee and Marks (1990)	Lee and Marks (1990) found a significant difference for women, in that women who attended SS Catholic high schools are more likely to be involved in political activism than were women who attended CE Catholic high schools (d = 0.19).	√				√			√

Percent Married to First Spouse

The percentage of graduates of a school still married to their first spouse has been offered up as an indicator of long-term socioemotional development (Riordan, 1990). One study examined the relationship between single-sex schooling and the percentage of former students still married to their first spouses. This study reported null results for graduates of SS and CE high schools. However, it should be noted that results for this study might be altered by considering what percentage of those not still married to their first spouse were widows or widowers.

Table 28—Percent Married to First Spouse

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Riordan (1990)	Riordan (1990) found no differences between SS and CE males when comparing the percentage still married to first spouse. The same was true for females (n = 75–100).	Null		Null		Null			√

Indicators of Process and Outcome Measures of Gender Inequity

A fifth type of outcome measure of interest reflects indicators of process and gender inequity. These outcomes reflect on the interaction processes taking place in the classroom. For example, differential treatment of students by teachers represents one indicator of faulty process. Gender inequity is an example of a situation in which there is a perceived imbalance between the teacher resources

allotted to girls and those allotted to boys. During the search portion of this study, efforts were made to acquire as many studies in this topic area as possible. However, as studies were identified, it became apparent that there were no studies looking at indicators of process or gender inequity that might be included in this review. Empirical studies of gender inequity were not focused on single-sex versus coeducation in the classroom. Other studies were excluded because of the improper operationalization of the intervention or the use of subjects not characteristic of this study. Still others that did examine the relationship between gender composition of schools and gender equity or process failed to employ the appropriate statistical controls for inclusion in the review. As such, we were unable to include any studies treating this outcome.

Perceptual Measures of the School Climate or Culture That May Impact Performance

Another type of outcome measure may be organizational culture variables. These are variables that do not describe any differences in the students but instead focus on the quality of interactions in the school, such as parental involvement or amount of bullying in the school. Proponents of single-sex schooling argue that the environment or culture in a single-sex school works far more toward fostering pro-academic attitudes and increased growth opportunities. The following tables (Tables 28 to 30) examine these outcomes.

Climate for Learning

Climate for learning refers to a collection of attitudes, values, and beliefs about learning and schooling, shared by administrators, teachers, students, and parents, that support student learning (Ellsberry, 1999). Climate for learning is a vital outcome because of its potential impact on other outcomes such as self-concept and achievement. One study examined the impact of single-sex schooling on climate for learning. This study reported results in favor of single-sex education for high school boys and girls.

Table 29—Climate for Learning

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Schneider and Coutts (1982)	Schneider and Coutts (1982), in comparing SS versus CE schools (high school, private/Catholic, 10th and 12th grade), found significant differences for SS males on valuing grades and leadership activities more. SS males were also found to value athletics, looks, and money less than CE males. Significant differences for SS females were also found on valuing grades, leadership activities, and athletics more, and looks and money less, than CE females. However, scores on the HSCI Environmental Press Scale did not show SS schools to have a significantly more favorable academic environment.	√		√		√			√

Opportunities for Leadership Roles

Opportunities for leadership roles refer to the opportunity for females to participate in traditional leadership roles in clubs and extracurricular activities, which have generally been held by males. Two studies examined the impact of single-sex education on the opportunities for leadership roles. One (50 percent) study reported results favoring single-sex schooling; the other (50 percent) reported null findings. Both studies examined the relationship between single-sex and coeducation for girls; one (50 percent) reported null results and the other (50 percent) reported results in favor of single-sex schooling. One study compared single-sex and coeducation for black and Hispanic boys, and it (100 percent) reported results favoring single-sex schooling. Finally, it is also important to note that one study found that coeducational schools seemed to provide better leadership opportunities for Asian girls, although it was based on a small sample. Both studies employed only high school students as participants.

Table 30—Opportunities for Leadership Roles

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Garcia (1998)	Garcia (1998), in comparing SS versus CE schools (12th-grade females in two public high schools) on membership and leadership in extracurricular activities, found little differences between girls in SS and CE schools, except that Asian girls (total n = 47) in the CE school had more membership in these activities than Asian girls in the SS school. When controlling for initial ability, SES, and quality of previous education, this difference remained consistent, showing that Asian girls in the CE school participated in more activities than in the SS school. However, this individual finding is minor when compared with the overall null findings in the rest of the analysis.	Null				Null			√
2) Riordan (1994)	Riordan (1994), in considering a large sample of black and Hispanic Catholic high school students (N = 690), found significant effects favoring SS schools on opportunities for leadership for both males and females. When controlling for home background and initial cognitive ability, males and females in SS schools still had significantly more leadership opportunities (standardized d score = .24 and .26, respectively). When other formal and informal school variables were accounted for, the differences between SS and CE schools were not statistically significant, although the direction of the differences still favored SS schools.	√		√		√			√

School Environment

School environment refers to an academic setting comprising a facility and staff that support the welfare of students and their educational achievement by fostering safety and protection from outer elements. School environment is a crucial outcome because of its potential impact on student safety and functionality. One study examined the impact of single-sex schooling on school environment. This study reported null results for high school students.

Table 31—School Environment

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Cuddy (2000)	Cuddy (2000), in comparing public CE schools with Catholic SS schools, found no differences in the effect of grade or school environment on false self-attributes.	Null							√

Subjective Satisfaction with the School Experience by Students, Parents, and Teachers

The final type of outcome measure involves satisfaction with either the academic milieu or the social atmosphere in the school and may be of lesser interest than the previous three categories. Because these are not related to individual outcomes and reflect survey-type opinion questions, it may be hardest to find high-quality studies with these outcome measures. The outcomes included in this category are satisfaction with the learning environment and college satisfaction. Tables 31 and 32 examine the findings regarding these outcomes.

Satisfaction With School Environment

Satisfaction with the school environment refers to the overall attitude of pleasure with the academic setting. Satisfaction with school may or may not be important to learning and in fact could indicate a nonacademic subculture. One study examined the impact of single-sex schooling on satisfaction with the school environment. This study reported results in favor of coeducation for high school students.

Table 32—Satisfaction with School Environment

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Schneider and Coutts (1992)	Schneider and Coutts (1982), in comparing SS versus CE schools (high school, private/Catholic, 10th and 12th grade), found significant differences between school environments as perceived by students. CE schools were seen as more affiliative and pleasure oriented, with less emphasis on control and discipline.		√						√

College Satisfaction

Satisfaction with college academics refers to the overall attitude of acceptance or pleasure with one’s collegiate academic career. One study examined the impact of single-sex schooling on satisfaction with college academics. When comparing single-sex schooling with coeducation for girls, the study reported results in favor of single-sex schooling. Participants attended either a single-sex high school or a coeducational high school.

Table 33—College Satisfaction (Academic)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Elementary	High School
1) Lee and Marks (1990)	Lee and Marks (1990) found a significant difference for females, in that females who attended SS Catholic high schools were more likely to be satisfied with the academic part of their college experience than were women who attended CE Catholic high schools ($d = 0.32$). They also found a significant difference for females, in that females who attended SS Catholic high schools were more likely to be satisfied with the non-academic part of the college experience than were women who attended CE Catholic high schools ($d = 0.33$).	√				√			√

A table summarizing all of these findings is below. In each row, one of the 32 outcome categories is listed. The total number of studies related to that outcome category is listed, as well as the raw number and percent of findings that either support SS schooling, support CE schooling, are null, or mixed (supporting both CE and SS schooling). While eight of the outcome categories have four or more findings, others have as few as one or two findings. For any outcome category, the percentage of studies falling in any of the dispositions (supporting SS, supporting CE, null, or mixed) and the confidence with which one can use the findings will increase with the number of studies. Therefore, the percentages in Table 33 should be treated with caution when only one or two studies appear for that outcome as the dearth of studies in a given outcome category might skew the percentage associated.

Table 34—Summary of Findings

Outcome	Total Number of Studies	Pro-SS		Pro-CE		Null		Mixed	
		Number of Studies	Percent	Number of Studies	Percent	Number of Studies	Percent	Number of Studies	Percent
Concurrent Academic Accomplishment									
1) All-Subject Achievement Test Scores	9	6	67%	1	11%	2	22%	0	0%
2) Mathematics Achievement Test Scores	14	3	22%	0	0%	8	56%	3	22%
3) Science Achievement Test Scores	8	2	25%	0	0%	5	62%	1	13%
4) Verbal/English Achievement Test Scores	10	3	30%	0	0%	7	70%	0	0%
5) Grades	1	0	0%	0	0%	1	100%	0	0%
6) Social Studies Achievement Test Scores	1	1	100%	0	0%	0	0%	0	0%
Subtotal	43	15	35%	1	2%	23	53%	4	10%
Long-Term Academic Accomplishment									
7) Postsecondary Test Scores	2	1	50%	0	0%	1	50%	0	0%
8) College Graduation	1	0	0%	0	0%	1	100%	0	0%
9) Graduate School Attendance	1	0	0%	0	0%	1	100%	0	0%
Subtotal	4	1	25%	0	0%	3	75%	0	0%
Concurrent Adaptation and Socioemotional Development									
10) Self-Concept	7	4	57%	0	0%	3	43%	0	0%
11) Self-Esteem	6	1	17%	2	33%	3	50%	0	0%
12) Locus of Control	5	3	60%	0	0%	2	40%	0	0%
13) School Track and Subject Preference	14	5	36%	2	14%	6	43%	1	7%
14) Educational Aspirations	3	2	67%	0	0%	1	33%	0	0%
15) Career Aspirations	2	2	100%	0	0%	0	0%	0	0%
16) Delinquency	4	2	50%	0	0%	2	50%	0	0%
17) Attitudes Toward School	5	1	20%	1	20%	1	20%	2	40%
18) Time Spent per Week on Homework	2	1	50%	0	0%	1	50%	0	0%
19) Attitudes Toward Working Women	1	1	100%	0	0%	0	0%	0	0%
Subtotal	49	22	45%	5	10%	19	39%	3	6%

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Table 34—Summary of Findings (cont'd)

<i>Outcome</i>	<i>Total Number of Studies</i>	<i>Pro-SS</i>		<i>Pro-CE</i>		<i>Null</i>		<i>Mixed</i>	
		<i>Number of Studies</i>	<i>Percent</i>	<i>Number of Studies</i>	<i>Percent</i>	<i>Number of Studies</i>	<i>Percent</i>	<i>Number of Studies</i>	<i>Percent</i>
Long-term Adaptation and Socioemotional Development									
20) School Completion	1	1	100%	0	0%	0	0%	0	0%
21) Postsecondary Success	1	0	0%	0	0%	1	100%	0	0%
22) Postsecondary Unemployment	2	1	50%	0	0%	1	50%	0	0%
23) Eating Disorders	1	0	0%	1	100%	0	0%	0	0%
24) Choice of College Major	1	1	100%	0	0%	0	0%	0	0%
25) Sex-Role Stereotyping	2	1	50%	1	50%	0	0%	0	0%
26) Political Involvement	1	1	100%	0	0%	0	0%	0	0%
27) Percent Married to First Spouse	1	0	0%	0	0%	1	100%	0	0%
Subtotal	10	5	50%	2	20%	3	30%	0	0%
Perceived School Culture									
28) Climate for Learning	1	1	100%	0	0%	0	0%	0	0%
29) Opportunities for Leadership Roles	2	1	50%	0	0%	1	50%	0	0%
30) School Environment	1	0	0%	0	0%	1	100%	0	0%
Subtotal	4	2	50%	0	0%	2	50%	0	0%
Subjective Satisfaction									
31) Satisfaction with School Environment	1	0	0%	1	100%	0	0%	0	0%
32) College Satisfaction	1	1	100%	0	0%	0	0%	0	0%
Subtotal	2	1	50%	1	50%	0	0%	0	0%
TOTALS	112	46		9		50		7	

Expected Outcomes Not Seen in the Review

Teenage pregnancy, college performance, differential treatment by teachers, parental satisfaction, bullying in school, and teacher satisfaction were among the many outcomes that we expected to see in the review. However, no studies examining these outcomes met the criteria for inclusion in this review.

QUALITATIVE REVIEW

The qualitative review of literature yielded four quality studies that present observations about single-sex schooling and its impact on various outcomes. These authors also provide explanations built on phenomena observed throughout single-sex schools. Their work is summarized briefly below.

Datnow, Hubbard, and Woody's (2001) three-year, longitudinal case study of SS middle and high schools in California was concerned less with the effects of single-sex education on individual students and more with the problems encountered in implementing SS education in the public sector. The monograph describing their research describes six pairs of single-sex academies. Insights are offered on parental choice, educational ideology, and moral guidance. The authors conclude that situational concerns of state funding, additional available resources, low achievement, poverty, violence, and geographic isolation played more of a role in decision making than did attitudes about the value of single-sex education.

Svartoiien-Conway's dissertation (2000) was a retrospective study of 20 college seniors that tried to determine the impact that their attendance at all-girl high schools had on their subsequent leadership involvement. The scope of the study was smaller than any of the other studies and somewhat peripheral to school achievement. The attempt to gain a broader understanding of the ultimate impact of single sex education, however, is a useful addition to a literature dominated by shorter-term outcomes.

Shmurak (1998) followed girls at four schools (two SS, two CE) throughout her five-year longitudinal case study. She used a literary device whereby one girl from each school was made part of a quartet described by typological descriptors such as Scholastic Superstars, Students of Color, Athletes, Scientists, Artists and Actresses, and Different Drummers. This approach allowed her to appreciate the complexity of the circumstances and personal factors that influenced individual decisions. However, it also obscured general trends that might have led to hypotheses. Shmurak's typological approach produced little direction for causal hypotheses but provided a healthy corrective to the broad generalizations of quantitative studies.

The bulk of Streitmatter's (1999) book is anecdotal, but it also contains sections on the history and literature of the single-sex debate and a section on the implications for Title IX. It was reviewed because it included a case study of a single-sex high school in

addition to case studies of all-girl classes in otherwise coeducational schools. The book documents student attitudes toward and beliefs about single-sex education. Its contribution is largely in providing compelling illustrations of girls' experiences.

Table 35—Qualitative Studies

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Middle School	High School
1) Datnow, Hubbard, and Woody (2001)	Datnow, Hubbard, and Woody (2001) report on a three-year, longitudinal case study of twelve (six boys; six girls) public SS middle and high schools in California. Researchers found that, in some cases, situational concerns of state funding, additional available resources, low achievement, poverty, violence, and geographic isolation overwhelmed SS/CE distinctions. SS choice did not increase diversity of offerings in all cases and student distractions were not necessarily reduced. In several schools, curriculum and instruction were tailored to different needs of sexes, whereas in other schools, efforts were made to keep curriculum and instruction consistent for both sexes. Soon after the study five of the six school districts studied closed their SS schools and impending closure may have affected results.							√	√
2) Shmurak (1998)	Shmurak (1998) reported on a five-year longitudinal case study of SS and CE girls in four high schools. There were no differences between groups on a gender attitude measure. There were no significant differences in SAT scores, but SS girls had significantly higher Advanced Placement (AP) test scores, whereas CE girls took more science and got into significantly higher rated colleges. Girls in CE schools were more interested in sports, and girls in SS schools were more interested in art. Career aspirations for SS and CE were not different.					√	√		√

Continued on next page

Table 35—Qualitative Studies (cont’d)

Authors	Study Findings	Advantage to:							
		SS	CE	SS males	CE males	SS females	CE females	Middle School	High School
3) Streitmatter (1999)	Streitmatter’s (1999) case study studied a private day school for girls in preschool through high school. Two students and one teacher interviewed supported SS education, but other comments were idiosyncratic to the person interviewed. The study was limited in scope and generalizability.							√	√
4) Svartoi-Conway (2000)	Svartoi-Conway (2000) conducted one-hour interviews with 20 female college seniors in 1999 who had attended SS high schools to determine its effect on leadership involvement in college. Results suggested that women from SS high schools may have self-confidence impeded in CE colleges.								√

Implications of Review

Specific Implications

We begin our synopsis of this review by summarizing the findings within each broad domain of outcome measure, using the structure of the original research questions:

Are single-sex (SS) schools more effective than coeducational (CE) schools in terms of concurrent, quantifiable academic accomplishments? Conversely, are any adverse effects associated with single-sex schools in this realm?

In general, more studies reporting the positive effects of SS schools on all-subject achievement test scores were found than studies reporting the positive effect of CE schools on the same outcomes. Studies examining the mathematics, science, English, and civics achievement outcomes for SS schools reported findings similar to those of overall academic achievement with one caveat. In each case, roughly a third of all studies reported findings favoring SS schools, with the remainder of the studies split between null and mixed results. In the one study (Garcia, 1998) favoring CE schooling, the advantages accrued only to white females, but not to Asian or black females. Given this small to medium support for SS schooling, it is important to note that this finding applies to both males and females and in studies pertaining to both elementary and high schools. This is consistent with Mael's (1998) finding that "the assertion that SS schooling has positive benefits for the academic achievement of both sexes is supported by the predominance of research, though effects appear more pronounced and less ambiguous for females than for males" (p. 117). Males continue to be underrepresented in this realm of research.

Are SS schools more effective than CE schools in terms of long-term, quantifiable academic accomplishment? Conversely, are any adverse effects associated with single-sex schools in this realm?

As opposed to concurrent indicators of academic achievement, any positive effects of SS schooling on longer-term indicators of academic achievement are not readily apparent. No differences were found for postsecondary test scores, college graduation rates, or graduate school attendance rates. However, all the findings in this domain came from only two studies (Marsh, 1989; Riordan, 1990), indicating the lack of research on these important criteria. Although some evidence favors single-sex education in the case of postsecondary test scores, there is a dearth of recent studies using controls. There has been a similar lack of research on other potential criteria in this domain, such as college grade point average, meritorious scholarships or funding attained, postgraduate licensure test scores, and any career achievement that could ostensibly be tied to quality of schooling. This severely limits the ability to come to any conclusions about the efficacy of SS schooling in this domain. A series of studies by Tidball and colleagues, as well as additional studies supporting and refuting her findings (Oates and Williamson, 1978; Rice and Hemmings, 1988; Tidball, 1973; Tidball and Kistiakowsky, 1976), deal with the postschool accomplishments of graduates of women's colleges and are not directly relevant.

Are single-sex schools more effective than coeducational schools in terms of concurrent, quantifiable indicators of individual student adaptation and socioemotional development? Conversely, are any adverse effects associated with single-sex schools in this realm?

This category includes a range of outcomes that are not easily grouped together, and the results are mixed. More studies reporting positive effects of SS schools on self-concept and locus of control were found than those reporting positive effects of CE schools. However, results regarding self-esteem were indicative of the opposite as the majority of studies were pro-CE—at least for males—or reported no differences between SS and CE schools. For males, the single high school study favored CE schools, whereas for elementary school males, one study each favored either CE or SS schooling. Thus, it is difficult to draw any conclusions about this variable. It is also noteworthy that in a wide-ranging review of the self-esteem literature, Baumeister et al. (2003) concluded that self-esteem's relationship to school success, occupational success, better relationships, leadership, delinquent behavior, and other desirable outcomes is modest to nonexistent, and in each case the direction of causality is unclear. Although self-reported self-esteem is correlated with happiness, they found no evidence that efforts to boost self-esteem were successful. Thus, even if more studies were to show SS schooling to be associated with high or low self-esteem, the implications of that finding might be minimal, given that self-esteem is a relatively poor indicator of a type of school's efficacy.

A majority of studies supported the position that SS schooling resulted in higher academic aspirations, as evidenced by students showing more interest in and taking more difficult courses. The findings of a recent unpublished study by Spielhofer et al. (2002) with a large sample and excellent statistical controls were especially impressive. SS schools also resulted in higher educational and career aspirations for girls. A category called "attitudes toward school" showing mixed results was actually a combination of single studies using different outcome variables, thus reducing the meaningfulness of the category. In terms of actual behaviors, a few studies looked at delinquency. Although none found advantages for CE schools, any differences in favor of SS schools were moderated by individual developmental differences. This is one of a number of socioemotional outcome variables that can be measured by objective criteria and would benefit from additional studies. A single study showed SS females to have more positive attitudes toward working women (Riordan, 1990); however, the study was published 15 years ago and participation in the workplace for all women has increased so much that the data and the SS-CE differences may be dated. Generally, across this category, the preponderance of new studies and previous ones that Mael (1998) did not properly highlight support the view that SS schooling is associated with more positive attitudes toward and aspirations about education and careers.

What is lacking is a conceptual framework to tie together the myriad academic-attitude outcome measures used in this realm so that studies will be more directly comparable. The same can be said for the studies using the relatively amorphous "self-concept" as an outcome variable. In particular, the research is sketchy about how malleable self-concept and self-esteem are as a function of type of school, holding all other life influences constant.

Are SS schools more effective than CE schools in terms of long-term, quantifiable indicators of individual student adaptation and socioemotional development? Conversely, are any adverse effects associated with single-sex schools in this realm?

The outcomes in this domain generally do not appear in more than one or two studies that made it to Phase III review. Therefore, we must be cautious in generalizing from these results. Having said that, the results still suggest the potential that SS schooling could be associated with a number of post-high school, long-term positive outcomes. These include postsecondary success or participation in collegiate activities while maintaining full-time enrollment for a four-year period, reduced unemployment (males and females), reduced propensity to drop out of high school (males and females), the choice of a nontraditional college major (for females), and political activism (for females). The sole exception is eating disorders, in which one study found negative effects for SS schooling on eating disorders. However, Mensinger's relatively small Australian sample highlights the need for additional research.

Are single-sex schools more effective than coeducational schools in terms of addressing issues of procedural (e.g., classroom treatment) and outcome measures of gender inequity? Conversely, are any adverse effects associated with single-sex schools related to gender equity?

This question could not be addressed because we did not come across any quantitative studies that used gender equity as an outcome variable at the school level. Any studies that compared SS and CE classrooms within a CE school were outside the purview of this study and were not reviewed.

Are SS schools more effective than CE schools in terms of perceptual measures of the school climate or culture that may have an impact on performance? Conversely, are any adverse effects associated with single-sex schools in this realm?

School culture or climate refers to the informal rules, norms, and "ways things work" that create expectations for students and socialize students into certain modes of behavior. Culture and climate have the potential to increase aspiration levels and open new opportunities for students or, conversely, to teach students to stay within certain culturally mandated constraints deemed appropriate for persons like themselves (e.g., females, Hispanics). Advocates of SS schooling have argued that the cultures in SS schools foster greater academic aspirations and make it acceptable to be interested in academics more than in socializing. In addition, it has been argued that all-female schools allow women to pursue non-stereotypical courses and majors and hold leadership roles and that all-male schools for disadvantaged youths allow their students to pursue academic interests without peer censure. Evidence supporting claims that better culture leads to better organizational outcomes has been mixed, as is much research attempting to tie organizational culture to performance (Wilderom, Glunk, and Maslowski, 2000). This category includes a number of disparate, single-study results. The only study addressing leadership opportunities found more opportunities for both males and females in SS schools (Riordan, 1990); however, and the statistical significance of this finding depended on what other variables had been controlled for. Another study found that SS schools put more value on grades and

leadership and less on attractiveness and money for both males and females (Schneider and Coutts, 1982). However, there remains a dearth of high-quality empirical studies using this class of outcome variables as criteria.

A final category of outcomes examined as a subset of culture was the realm of subjective satisfaction of students, parents, and teachers with the school environment. Extensive research in the late 1960s and 1970s found that CE schools had friendlier and more relaxed atmospheres, with more opportunities for pleasure-centered social contact (Dale, 1971, 1974; Hyde, 1971). Although not formally part of the K-12 sample of this study, it is useful to note that at the college level, Astin (1977) and Smith (1990) also found that CE colleges were rated as having more enjoyable campus social life by males and females, respectively. Whether enjoyment of campus life should take priority over other academic and socioemotional criteria is debatable. The one study (Schneider and Coutts, 1982) in this review that found the social environment more appealing in CE schools is a good case in point because the same study found that SS students are more interested in grades and leadership and less interested in money and looks. Although some qualitative studies have looked at why certain parents prefer SS schooling, we did not review any empirical studies comparing current parental satisfaction in equivalent SS and CE schools. Studies in other cultures have found mixed results regarding teacher satisfaction with CE versus SS schooling (Marsh, Owens, Myers, and Smith, 1989; Payne and Newton, 1990). There remains a lack of research both on this class of criteria and on the relationship of subjective satisfaction to other more critical criteria.

General Trends

A few trends are apparent across all outcomes. The preponderance of studies in areas such as academic accomplishment (both concurrent and long term) and adaptation or socioemotional development (both concurrent and long term) yields results ranging from supporting SS schooling to no differences between SS and CE schooling. A limited number of studies throughout the review provide evidence favoring CE schooling. It is more common to come across studies that report no differences between SS and CE schooling than to find outcomes with support for the superiority of CE schooling. In terms of outcomes that may be of most interest to the primary stakeholders (students and their parents), such as academic achievement, self-concept, and long-term indicators of success, there is a degree of support for SS schooling. The one outcome variable that might be of most concern to parents of high school females is eating disorders; however, the single study suggesting greater problems in SS schools must be replicated in the United States with a larger, more diverse population of subjects. Special attention must be given to individual differences in this regard because conversely, Caspi's work suggests that for some girls, delinquency is a greater concern in CE schools.

The overwhelming majority of studies employed high school students, with a small minority using elementary school students. Not a single study in the quantitative review reported findings from a sample of middle school students. One possible explanation for this is that the preponderance of single-sex schooling research has been conducted in Catholic schools. In Catholic schools, students are separated by gender only when entering adolescence, which

coincides with the beginning of high school. Prior to high school, most Catholic students attend CE schools. Therefore, opportunities to study the phenomenon of SS schooling in either public or private schools have been limited. It is evident that studies comparing students from elementary and middle public schools are needed. This one-sidedness is also exhibited when considering studies that focused on one sex or another exclusively. The twenty findings drawn exclusively on girls were split evenly between support for SS schooling and no differences. Only two of these girls' findings resulted in pro-CE. No generalizations could be made for exclusive boys' studies as there were only three in the entire review.

There is a dearth of quality studies (i.e., randomized experiments or correlational studies with adequate statistical controls) across all outcomes. From the perspective of the What Works Clearinghouse (WWC), which requires randomized controlled trials, quasi-experimental designs with matching (QED), or regression discontinuity designs to build an evidence base, virtually no studies would inform this topic. Even using the more relaxed criterion of allowing correlational studies, each outcome has only limited candidate studies. Too few researchers report descriptive statistics or effect sizes. Providing such information would allow the aggregation of such effects and the correction of statistical artifacts. Of all the outcomes of interest, only mathematics achievement test scores and school track and subject preferences had more than 10 studies appropriate for our review.

Even within these categories, the studies differ in the criteria they use, the criterion measures they use, and the statistical controls they use to compare SS and CE schooling. This somewhat limits the arguments that can be built and extended from this quantitative review and render it nearly impossible to conduct meta-analysis on any outcome area. In fact, Hunter and Schmidt (1990), who have written extensively on meta-analysis and validity generalization, have advised against generalizing from any findings taken from meta-analyses using fewer than 15 studies, even with a homogeneous set of criteria and criterion measures. According to their rule of thumb, not one of the outcomes of interest would yield generalizable findings from a meta-analysis. Many of the remaining studies have other conceptual or interpretive flaws. These studies lacked well-developed hypotheses, and the hypotheses were often not linked directly to the outcomes being studied. Often, the availability of data was the driving force in using a specific outcome measure. Finally, the list of outcomes of interest needs to be expanded in future research and defined more clearly. Outcomes such as teenage pregnancy and bullying in school did not appear in a single study of sufficient quality to be reviewed. Other outcomes implicit in arguments for and against SS schooling need to be addressed explicitly. These include work-related long-term outcomes such as job performance, leadership performance, performance in mixed-sex work teams, performance and leadership in volunteer associations, job involvement, and organizational commitment. Expansion of this domain could prove useful in extending theory and changing practice.

These general implications of the review provide a stepping-stone for future research through the continuation of quality research on extant outcomes, the refinement of methodology,

better statistical reporting, and the expansion of the theoretical domain. If heeded, these implications can improve the generalizations made about single-sex schooling and coeducation.

The Difficulties in Doing Single-Sex Research

This review should not be interpreted as a condemnation of the work of the dedicated researchers who have chosen to study SS-CE differences. Unlike other interventions that can be studied in a controlled environment, such as educational techniques, a randomized experiment for this topic would take significant effort to design and implement. Randomized assignment to groups presumes that subjects (students) can be assigned to either treatment or control groups without their knowledge or permission. In actuality, for legal and other reasons, it is unlikely that students would be assigned to single-sex schools, other than voluntarily. As soon as parental preference is allowed to determine assignment to group, the possibility that the two parent bodies (and hence the students) will differ significantly is real. In principle, the administrations and staffs would have to be assigned randomly to each school, although in fact at least some of those working in SS schools do so because they believe in the concept. Moreover, the staff may embrace a particular view of women's education or the need for Afrocentric education that goes beyond the value associated with simply absenting the other sex. This would move the schools being compared even further from being randomized, matched groups. If the SS school is new or relatively new compared with the comparison CE school, one must question whether the relative immaturity of the SS school's culture and socialization processes is a cause for SS-CE disparities in outcomes. Moreover, if a previously CE school is split into a CE and SS school, or vice versa, the possibility of a Hawthorne effect, which can be manifested as an increase in student performance produced by the psychological stimulus of being singled out and made to feel important, in the new school cannot be discounted.

Thus, although, assuming that a randomized experiment could be performed practically, ethically, and consistent with the laws prohibiting sex discrimination, it could surely be worthwhile to conduct a randomized experiment, it would be unfair to criticize previous researchers who may not have had the resources to conduct a study requiring significant social engineering. Rather, we argue that instead of trying to conduct only all-or-nothing studies of whether SS schooling is better or worse, more careful specification of hypotheses and direct linkage of hypotheses to specific outcomes may show ways to conduct smaller studies that prove whether certain aspects of SS or CE schooling are beneficial.

Moderators and Individual Differences

In his 1998 review, Mael noted that with few exceptions (described below), the possibility that either SS or CE schooling might be more beneficial for some students and harmful to others has not been considered. Moderator variables (Baron and Kenny, 1986) may change or limit the relationship between type of school and one or more outcomes in important ways. Using moderator variables may show that SS schools are effective or are especially effective only in some situations or for some groups of students. The most obvious moderator is the sex of the student. In a number of studies in this review, SS schools are associated with

different outcomes for girls and boys. This is understandable, considering that some proposed reasons for valuing SS schooling are unique to either males or females. Another common moderator is the age of the student, reflected in differentiating between effects at elementary and high school levels. This is also understandable, given that some explanations for the value of SS schools are relevant only at the elementary or high school level.

A number of authors have also proposed that SS schools are particularly effective for students of lower socioeconomic status and perhaps specifically for those who are members of minority or disadvantaged communities (Riordan, 1994, 2002; Salomone, 2002). This is another important moderator variable to consider. Unfortunately, an insufficient number of studies in this review focused on race or ethnicity as a moderator. Only three studies addressed this moderator.

Another type of moderator does not deal with group characteristics, but rather with specific personality or developmental characteristics of boys and girls that might moderate the effects of SS schooling. An example is Caspi's finding that SS schooling has differential effects on girls depending on the onset of menarche (Caspi, 1995). Although this and myriad other observations are of interest, their implications for policy are more limited. Additional research on individual differences and other moderators may help parents make more informed decisions.

The Limits of a Systematic Review on This Topic

The purpose of a systematic review in the model of the Campbell Collaboration and the What Works Clearinghouse is to demonstrate whether evidence exists for the efficacy of an intervention. When the desired intervention has a single, unambiguous criterion of success (e.g., retention of learned material or scores on tests), evidence of efficacy can also be relatively unambiguous. However, when an intervention is being judged by multiple criteria, and all stakeholders do not share the hierarchy of these criteria, then the real limits of resolving debate through systematic review are evident.

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APPENDIX 1: QUANTITATIVE STUDY CODING GUIDE

Background

What is the Study ID number? _____

On what date was data extraction completed? _____

Primary reviewer: _____

Secondary reviewer: _____

Sample Characteristics

1.	Were subjects individually randomly assigned?	Yes ___ No ___
2.	Were subjects drawn from the same local area (such as school district, high school pyramid, town or named area in city)?	Yes ___ No ___
3.	Were subjects matched by demographics or other stated similarity?	Yes ___ No ___

Psychometric Properties

	For 4 through 7: Acceptable psychometric properties will be assumed to exist for studies employing large national NCES data sets such as NLS, HSB, and NELS or for those using data gathered using published tests, even if not described in the paper. Student achievement data is acceptable as is. Survey data is not assumed to be valid unless individual evidences are reported.	Yes ___ No ___
4.	Were temporal stability/test-retest reliability statistics or an outside source such as a standardization study reported, or was reliability stated to be acceptable? (Temporal stability or test-retest reliability statistics can be reported as a correlation (r) between test scores at time 1 and test scores on the same test at time 2. Acceptable levels are correlations greater than .40.)	Yes ___ No ___
5.	Was inter-rater reliability assessed and considered to be acceptable? (Inter-rater reliability is often reported as a correlation amongst raters but can also be reported as an intraclass correlation (ICC) or within-group r (rwg). A good example of inter-rater reliability would be if the authors mention a measure of agreement (r , ICC, or rwg) between two teachers who rate students on their academic orientation.)	Yes ___ No ___
6.	Was internal consistency assessed and considered to be acceptable? (Internal consistency estimates include Cronbach's alpha, coefficient alpha, item-total correlations, inter-item correlations, or the KR-20. Acceptable internal consistency estimates are greater than .70.)	Yes ___ No ___

7.	Was evidence presented that the operationalized measure reflects the construct of interest? (This can be evidence it predicts future measures, distinguishes groups otherwise identified or yields outcomes similar to those of other instruments.)	Yes ___ No ___
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Controlling Variables

	For 8 through 12: Evidence for this will include authors indicating that they have controlled for preexisting differences between students by accounting for the variance in the outcomes that can be attributed to these extraneous variables. Accounting for variance in the outcomes attributable to preexisting differences can be accomplished by treating these variables as covariates (e.g., dummy or binary coded vectors) in statistical procedures such as regression, structural equation modeling and/or ANOVA. These variables can include the four listed below or any variables that are uncommon but extraneous. If there is no evidence of having controlled for preexisting differences, the study should not be coded. The coder should note in the notes section of the coding form (bottom of last page) that study was not coded because authors did not control for preexisting variables.	
8.	Language	Yes ___ No ___
9.	Ethnic/racial minority status	Yes ___ No ___
10.	Socioeconomic status	Yes ___ No ___
11.	Grade level or age. [Here all subjects must be of same age or grade level. "Fifth and Sixth Graders," for instance, is not acceptable.]	Yes ___ No ___
12.	Did the authors equate the subjects on or control for other variables such as preexisting academic ability, curriculum, parental aspirations, etc? [Here, the goal is to ensure that researchers who have applied statistical control or accounted for preexisting differences other than the common ones receive credit for doing so.]	Yes ___ No ___

Issues of Internal Validity

13.	Was the study free of evidence that the equating procedure produced differential statistical regression? (Note: For example, you would answer "no" to this question if students in the SS group were chosen from poorly-performing students within a high-achieving school and comparison students were chosen from high-achieving students within a poorly-performing school.)	Yes ___ No ___
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14.	Was the outcome measure adequately aligned to the intervention? (Note: An example of under-alignment would be when students are taught math but tested on reading. An example of over-alignment would be when, in a study of reading comprehension, the intervention students were exposed to reading passages during the intervention that were on the posttest, but comparison students did not receive this exposure.)	Yes ___ No ___
15.	Was the unit of assignment or selection the same as the unit of statistical analysis? (Note: For example, if each student was individually selected, statistical analyses should be conducted using the student as the unit of analysis. If entire classrooms were selected for the SS or CE condition, statistical analyses should be conducted using the classroom as the unit of analysis.)	Yes ___ No ___
16.	Was SS or CE assignment implemented as defined? (An example of a “no” response would be inclusion of some of opposite sex in some single-sex classes or other non-uniform assignment of students.)	Yes ___ No ___
17.	Was the study free from evidence that one group might also have experienced a changed expectancy, novelty and/or disruption effect that was not also experienced by the other group?	Yes ___ No ___
18.	Was the study free from attrition or change in composition effects?	Yes ___ No ___
19.	Was the study free from local history events? (A local history event is an event that (a) occurred during the study period (b) affected one of two comparison groups, but not both, and (c) could have produced the observed outcome in the absence of the intervention.)	Yes ___ No ___

Effect

20.	Was a mean and standard deviation or variance available for both comparison groups?	Yes ___ No ___
21.	For this study, could effect sizes be generated?	Yes ___ No ___
22.	Could the direction of the effect be identified for this outcome measure? (The direction of the effect can be determined by using r, t, z, or d. Any directionality in these indicators can be viewed as indicating the direction of the effect.)	Yes ___ No ___

Issues of Bias

23.	Was the study published in a peer-refereed journal? (For example, you would answer yes if the paper is published in a journal reviewed by peers but no if the study is a conference paper.)	Yes ___ No ___
24.	Did the authors test properly operationalized hypotheses? (For example, if the authors of the study test hypotheses or a model that clearly depicts the relationship amongst clearly defined variables, you would answer "Yes." On the other hand, if they claim the goal was to examine certain relationships because of trends or controversy over the existence of single-sex schooling, you would answer "no" because no clear hypotheses are provided.)	Yes ___ No ___

Total ___

Describe the Result of Study

a. Concurrent, quantifiable academic accomplishment

a1. Academic Achievement: (Name of Study) in comparing ss versus coed schools (level: HS, Elementary; Public/Private/Catholic) found (significant/non-significant) differences for males (score: mean, sd, t, or F) and (significant/non-significant) differences for females (score: mean, sd, t or F). (n = XXX). [Then, any moderators. An example of a moderator would be finding that single-sex schooling has an impact on academic achievement only for girls who reach menarche early, but not for those who reach menarche on time or late. Time of menarcheal development serves as a moderator.]

a2. Mathematics Achievement Test Scores:

a3. Science Achievement Test Scores:

a4. Verbal/English Achievement Test Scores:

a5. Other outcome in this category:

b. Long-term, quantifiable academic accomplishment

b1. Postsecondary test scores:

b2. College Graduation:

b3. Graduate School Attendance:

b4. Other outcome in this category:

c. Concurrent, quantifiable indicators of individual student adaptation and socioemotional development

c1. Self-concept:

c2. Self-esteem:

- c3. Locus of control:
- c4. School Track/Subject Preference:
- c5. Career Aspirations:
- c6. Peer Delinquency:
- c7. Self-Reported Delinquency:
- c8. Other outcome in this category:

d. Long-term, quantifiable indicators of individual student adaptation and socioemotional development

- d1. Teenage pregnancy:
- d2. Dropouts:
- d3. Delinquency:
- d4. Eating disorders:
- d5. Other outcome in this category:

e. Indicators of process and outcome measures of gender inequity

- e1. Gender inequity:
- e2. Differential treatment by teachers:
- d3. Other outcome in this category:

f. Perceptual measures of the school climate or culture that may impact performance

- f1. Climate for learning:
- f2. Quality of teacher-student interactions:
- f3. Opportunities for leadership roles:
- f4. Perceived bullying in school
- f5. Other outcome in this category:

g. Subjective satisfaction with the school experience by students, parents, and/or teachers

- g1. Satisfaction with learning environment:
- g2. Other outcome in this category:

APPENDIX 2: QUALITATIVE STUDY CODING GUIDE

Background

What is the Study ID number? _____

What was the first author's last name and year of publication of the article? _____

On what date was data extraction completed? _____

What is the name of the primary reviewer?

Primary reviewer _____

What studies are linked to this one? _____

Literature Review

1.	The study question was sufficiently described. ("Thick, rich description")	Yes ___ No ___
2.	The investigators have no documented predispositions. ("Clarifying researcher bias")	Yes ___ No ___
3.	Subject characteristics were adequately reported. (Adequately means that a reader could identify a similar set of subjects for comparison with little ambiguity. "Thick, rich description," "Dense description of participants")	Yes ___ No ___

Methods

5.	Sample was compared to demographic data. ("Dense description of participants")	Yes ___ No ___
6.	Circumstances under which evidence was collected are indicated (times, places, etc.; "Chain of evidence," "Audit trail")	Yes ___ No ___
7.	Initial study questions and the methods of data collection are linked conceptually.	Yes ___ No ___
8.	Methods were reported in a way that was transparent to the reader. ("Thick, rich description")	Yes ___ No ___
9.	Validity evidence for measures is presented (Such as, that the operationalized measure predicts future measures, distinguishes groups otherwise identified or yields outcomes similar to those of other instruments).	Yes ___ No ___
10.	An outside control group was used to which the study population was compared.	Yes ___ No ___

11.	Comparisons were made between groups within the study population.	Yes ___ No ___
12.	Was the study free of evidence that the study population (or part of the study population) experienced a change during the study period that could have affected interpretation of the data?	Yes ___ No ___
13.	Use of a database was stated. (“Audit Trail”)	Yes ___ No ___
14.	Use of a field journal was reported. (“Reflexivity”)	Yes ___ No ___
15.	The investigator field experience is documented. (“Prolonged field experience”)	Yes ___ No ___

Analyses

16.	A peer review was performed. (Here is a sample statement indicating peer review was conducted: “Draft copies of this report were shared with study participants and we wish to thank them for their feedback.” “Peer examination.”)	Yes ___ No ___
17.	A code-recode procedure was used. (Data was coded, then recoded after an interval of time; “Code-recode”)	Yes ___ No ___
18.	Analysis was conducted at the subgroup level (below assignment to male-female contingents).	Yes ___ No ___
19.	A protocol for the study was described.	Yes ___ No ___
20.	Specific documents, interviews, observations, etc. were consistently cited. (“Chain of evidence.”)	Yes ___ No ___

Findings and Conclusions

21.	Conclusions are supported by more than one piece of evidence. (Evidence must be specifically stated with conclusion; there must be two or more pieces of evidence; “Triangulation”)	Yes ___ No ___
22.	Evidence cited was collected in ways consistent with the method described in the protocol. (“Chain of evidence”)	Yes ___ No ___
23.	Key informants reviewed the draft report. (If no review documented, mark “no.” “Member checking”)	Yes ___ No ___
24.	Data gathered matches previous findings (“Pattern matching”).	Yes ___ No ___

25.	Plausible post hoc explanation for observation is advanced. (“Explanation building”)	Yes ___ No ___
26.	No alternative explanation is plausible. (“Explanation building”)	Yes ___ No ___
27.	Data gathered is consistent with theoretical expectations. (Survey papers with no cited expectations receive a “Yes,” “Explanation building”)	Yes ___ No ___
28.	There is evidence for generalizability to other populations. (“Rich, thick description”)	Yes ___ No ___
29.	Literature review is linked to the study question.	Yes ___ No ___

Total ____

APPENDIX 3: LIST OF QUANTITATIVE STUDIES EXCLUDED DURING PHASE III

Excluded Studies	
Study Authors	Reason for Exclusion
1) Armstrong and Price (1982)	Did not use elementary or high school students
2) Bastick (2000)	No statistical controls
3) Bornholt (2001)	No statistical controls
4) Bornholt (1988)	No statistical controls
5) Brody, Fuller, Gosetti, Moscato, Nagel, Pace, and Schmuck (1998)	No statistical controls
6) Broyles (1992)	Not a proper operationalization of single-sex schools
7) Doorman and Queensland (1997)	No statistical controls
8) Fennema and Sherman (1978)	Did not use elementary or high school students
9) Flanders (1992)	Not a proper operationalization of single-sex schools
10) Fox (1993)	No statistical controls
11) Fritz (1996)	No statistical controls
12) Gilroy (1990)	No statistical controls
13) Gilson (1999)	No statistical controls
14) Hyde and Linn (1988)	Did not compare single-sex and coeducational schools
15) Holz-Ebeling, Gratz-Tummers, and Schwarz (2000)	Written in German (not codable by researchers)

16) Holz-Ebeling and Hansel (1993)	Written in German (not codable by researchers)
17) Jacklin and Maccoby (1978)	Did not compare single-sex and coeducational schools but rather dyads
18) James (2001)	No statistical controls
19) Katsurada and Sugihara (2002)	No statistical controls
20) Kleinfeld (1999)	Review article
21) Kysor (1993)	No statistical controls
22) Lawrie and Brown (1992)	No statistical controls
23) LePore and Warren (1996)	Original manuscript of subsequently published paper
24) Lockheed (1985)	Review article
25) Marsh (1992)	Review of other research; same data explored
26) McDonald (1996)	Did not compare single-sex and coeducational schools
27) Mensinger (2003)	Did not compare single-sex and coeducational schools
28) Moore, Piper, and Schaefer (1993)	Review of other research
29) Norfleet and Richards (?)	No statistical controls
30) Richardson (1990)	No statistical controls
31) Riordan (1999)	Not a quantitative study; article published in weekly periodical
32) Riordan (2000)	Did not compare single-sex and coeducational schools
33) Rost and Pruisken (2000)	Written in German (not codable by researchers)

34) Robinson and Smithers (1999)	No statistical controls
35) Schlosberg (1998)	No statistical controls
36) Schneider, Coutts, and Starr (1988)	No statistical controls
37) Shapka and Keating (2003)	Did not compare single-sex and coeducational schools
38) Shields (1991)	No statistical controls
39) Shmurak (1993)	No statistical controls
40) Steinbrecher (1991)	No statistical controls
41) Tartre and Fennema (1995)	Did not compare single-sex and coeducational schools
42) Taylor (2002)	No statistical controls
43) Tiggermann (2001)	No statistical controls
44) Trickett, Trickett, Castro, and Schaffler (1982)	No statistical controls
45) U.S. Department of Education (1993)	Not a quantitative study
46) U.S. Department of Education (1993)	Not a quantitative study
47) Walter (1997)	No statistical controls
48) Yin and Ryska (1999)	Study about single-sex classes, not schools

APPENDIX 4: QUANTITATIVE CODING GUIDE FOR ALL STUDIES

<i>Criterion</i>	<i>Study</i>	Ainley and Daly (2002)	Baker, Riordan, and Schaub (1995)	Bornholt and Moeller (2003)	Brutsaert and Bracke (1994)	Carpenter and Hayden (1987)	Caspi (1995)	Caspi, Lynam, Moffitt, and Silva (1993)	Cipriani-Sklar (1996)	Conway (1996)	Cuddy (2000)	Daly (1995)	Daly (1996)	Daly and Ainley (Unknown Date)
Sample Characteristics														
1) Were subjects individually randomly assigned?		N	N	N	N	N	N	N	N	N	N	N	N	N
2) Were subjects drawn from the same local area?		N	N	Y	N	N	N	N	Y	Y	N	N	N	N
3) Were subjects matched by demographics or other stated similarity?		N	Y	Y	N	N	N	Y	Y	Y	Y	N	N	N
Psychometric Properties														
4) Were temporal stability/test-retest reliability statistics or an outside source such as a standardization study reported, or was reliability stated to be acceptable?		Y	Y	N	N	N	Y	Y	Y	N	N	N	Y	N
5) Was inter-rater reliability assessed and considered to be acceptable?		Y	N	Y	N	N	N	Y	N	N	Y	N	Y	N
6) Was internal consistency assessed and considered to be acceptable?		Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	N	N
7) Was evidence presented that the operationalized measure reflects the construct of interest?		Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N
Controlling Variables														
8) Did the author(s) control for Language?		Y	N	Y	N	N	N	N	N	N	N	N	Y	Y
9) Did the author(s) control for Ethnic/racial minority status?		N	N	N	N	N	N	Y	Y	N	Y	Y	Y	N
10) Did the author(s) control for Socioeconomic status?		Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y
11) Did the author(s) control for Grade level or age?		Y	Y	N	N	Y	Y	N	Y	Y	Y	N	Y	Y
12) Did the authors equate the subjects on or control for other variables such as preexisting academic ability, curriculum, parental aspirations, etc?		Y	Y	Y	N	N	N	N	Y	Y	Y	Y	N	Y
Threats to Internal Validity														
13) Was the study free of evidence that the equating procedure produced differential statistical regression?		Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y

Continued on next page

Quantitative Coding Guide for All Studies (cont'd)

Criterion	Study													
	Ainley and Daly (2002)	Baker, Riordan, and Schaub (1995)	Bornholt and Moeller (2003)	Brutsaert and Bracke (1994)	Carpenter and Hayden (1987)	Caspi (1995)	Caspi, Lynam, Moffitt, and Silva (1993)	Cipriani-Sklar (1996)	Conway (1996)	Cuddy (2000)	Daly (1995)	Daly (1996)	Daly and Ainley (Unknown Date)	
14) Was the outcome measure adequately aligned to the intervention?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
15) Was the unit of assignment or selection the same as the unit of statistical analysis?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
16) Was SS or CE assignment implemented as defined?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
17) Was the study free from evidence that one group might also have experienced a changed expectancy, novelty and/or disruption effect that was not also experienced by the other group?	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	
18) Was the study free from attrition or change in composition effects?	N	Y	Y	Y	Y	Y	N	Y	N	N	Y	Y	Y	
19) Was the study free from local history events?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Effect Size														
20) Was a mean and standard deviation or variance available for both comparison groups?	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	N	
21) For this study, could effect sizes be generated?	N	Y	Y	Y	Y	N	Y	Y	Y	Y	N	N	Y	
22) Could the direction of the effect be identified for this outcome measure?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	
Issues of Bias														
23) Was the study published in a peer-refereed journal?	N	Y	Y	Y	Y	N	Y	N	N	N	Y	Y	N	
24) Did the authors test properly operationalized hypotheses?	Y	N	Y	Y	Y	N	Y	Y	N	N	N	Y	N	
Totals	16	18	19	15	15	13	15	20	15	15	15	16	13	
Percent of Criteria Met in Study	67%	75%	79%	63%	63%	54%	63%	83%	63%	63%	63%	67%	54%	
Percent of Criteria NOT Met in Study	33%	25%	21%	38%	38%	46%	38%	17%	38%	38%	38%	33%	46%	

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Quantitative Coding Guide for All Studies (cont'd)

Criterion	Study	Daly, Ainley, and Robinson (1996)	Daly and Shuttleworth (1996)	Garcia (1998)	Harker and Nash (1987)	Harker (2000)	Lambert (1998)	Lee and Bryk (1986)	Lee and Lockheed (1990)	Lee and Marks (1990)	LePore and Warren (1997)	Marsh (1989)	Marsh (1991)	Marsh et al. (1988)
Sample Characteristics														
1) Were subjects individually matched (randomly assigned)?		N	N	N	N	N	N	N	N	N	N	N	N	N
2) Were subjects drawn from the same local area?		N	N	Y	N	N	Y	N	N	N	N	N	N	Y
3) Were subjects matched by demographics or other stated similarity?		N	N	Y	N	N	N	N	N	Y	Y	Y	N	N
Psychometric Properties														
4) Were temporal stability/test-retest reliability statistics or an outside source such as a standardization study reported, or was reliability stated to be acceptable?		Y	N	N	N	N	Y	Y	N	Y	Y	Y	Y	N
5) Was inter-rater reliability assessed and considered to be acceptable?		Y	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N
6) Was internal consistency assessed and considered to be acceptable?		Y	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y
7) Was evidence presented that the operationalized measure reflects the construct of interest?		N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controlling Variables														
8) Did the author(s) control for Language?		Y	N	N	N	N	N	N	N	N	N	N	N	Y
9) Did the author(s) control for Ethnic/racial minority status?		Y	N	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y
10) Did the author(s) control for Socioeconomic status?		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
11) Did the author(s) control for Grade level or age?		Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
12) Did the authors equate the subjects on or control for other variables such as preexisting academic ability, curriculum, parental aspirations, etc?		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N

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Threats to Internal Validity													
13) Was the study free of evidence that the equating procedure produced differential statistical regression?	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
14) Was the outcome measure adequately aligned to the intervention?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
15) Was the unit of assignment or selection the same as the unit of statistical analysis?	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
16) Was SS or CE assignment implemented as defined?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
17) Was the study free from evidence that one group might also have experienced a changed expectancy, novelty and/or disruption effect that was not also experienced by the other group?	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N
18) Was the study free from attrition or change in composition effects?	N	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y	N
19) Was the study free from local history events?	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N
Effect Size													
20) Was a mean and standard deviation or variance available for both comparison groups?	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
21) For this study, could effect sizes be generated?	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
22) Could the direction of the effect be identified for this outcome measure?	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Issues of Bias													
23) Was the study published in a peer-refereed journal?	N	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	Y
24) Did the authors test properly operationalized hypotheses?	Y	Y	N	Y	N	N	Y	N	N	Y	Y	Y	Y
Totals	15	16	16	12	15	14	20	15	20	21	20	20	16
Percent of Criteria Met in Study	63%	67%	67%	50%	63%	58%	83%	63%	83%	88%	83%	83%	67%
Percent of Criteria NOT Met in Study	38%	33%	33%	50%	38%	42%	17%	38%	17%	13%	17%	17%	33%

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Quantitative Coding Guide for All Studies (cont'd)

Criterion	Study													
	Mensingher (2001)	Proach (2000)	Riordan (1985)	Riordan (1990)	Riordan (1994)	Sanders (1992)	Schneider and Coutts (1982)	Speilhofer et al. (2002)	Stables (1990)	Steinback and Gwizdala (1995)	Thompson (2003)	Watson, Quatman, and Edler (2002)	Woodward et al. (1999)	Young, Fraser, and Western (1992)
Sample Characteristics														
1) Were subjects individually matched?	N	N	N	N	N	N	N	N	N	N	N	N	N	N
2) Were subjects drawn from the same local area?	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	N	N
3) Were subjects matched by demographics or other stated similarity?	N	Y	Y	N	Y	Y	N	N	N	Y	N	N	N	N
Psychometric Properties														
4) Were temporal stability/test-retest reliability statistics or an outside source such as a standardization study reported, or was reliability stated to be acceptable?	N	N	Y	N	Y	Y	N	N	N	N	Y	N	N	Y
5) Was inter-rater reliability assessed and considered to be acceptable?	N	N	N	N	Y	N	N	N	N	N	N	Y	N	N
6) Was internal consistency assessed and considered to be acceptable?	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y
7) Was evidence presented that the operationalized measure reflects the construct of interest?	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y
Controlling Variables														
8) Did the author(s) control for Language?	N	N	N	N	N	N	N	N	N	Y	N	N	N	N
9) Did the author(s) control for Ethnic/racial minority status?	N	N	Y	Y	Y	N	N	N	N	Y	Y	N	N	N
10) Did the author(s) control for Socioeconomic status?	Y	N	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
11) Did the author(s) control for Grade level or age?	N	Y	Y	N	Y	Y	Y	Y	N	N	Y	N	Y	Y
12) Did the authors equate the subjects on or control for other variables?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Threats to Internal Validity														
13) Was the study free of evidence that the equating procedure produced differential statistical regression?	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

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Quantitative Coding Guide for All Studies (cont'd)

Criterion	Study														
	Mensingher (2001)	Proach (2000)	Riordan (1985)	Riordan (1990)	Riordan (1994)	Sanders (1992)	Schneider and Coutts (1982)	Speilhofer et al. (2002)	Stables (1990)	Steinback and Gwizdala (1995)	Thompson (2003)	Watson, Quatman, and Edler (2002)	Woodward et al. (1999)	Young, Fraser, and Western (1992)	
14) Was the outcome measure adequately aligned to the intervention?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
15) Was the unit of assignment or selection the same as the unit of statistical analysis?	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	
16) Was SS or CE assignment implemented as defined?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	
17) Was the study free from evidence that one group might also have experienced a changed expectancy, novelty and/or disruption effect that was not also experienced by the other group?	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	
18) Was the study free from attrition or change in composition effects?	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	
19) Was the study free from local history events?	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	
Effect Size															
20) Was a mean and sd or variance available for both comparison groups?	N	Y	N	N	N	N	N	N	Y	N	Y	Y	Y	N	
21) Could effect sizes be generated?	N	Y	Y	N	Y	N	N	Y	Y	N	Y	Y	Y	Y	
22) Could the direction of the effect be identified for this outcome measure?	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	
Issues of Bias															
23) Was the study published in a peer-refereed journal?	Y	N	Y	N	Y	N	Y	N	Y	Y	Y	Y	Y	N	
24) Did the authors test properly operationalized hypotheses?	Y	Y	Y	N	Y	Y	Y	N	N	N	Y	Y	Y	Y	
Totals	14%	15%	19%	12%	20%	15%	13%	14%	13%	12%	19%	15%	15%	16%	
Percent of Criteria Met in Study	58%	63%	79%	50%	83%	63%	54%	58%	54%	50%	79%	63%	63%	67%	
Percent of Criteria NOT Met in Study	42%	38%	21%	50%	17%	38%	46%	42%	46%	50%	21%	38%	38%	33%	

Quantitative Coding Guide for All Studies (Percentage of Studies Meeting/Not Meeting Criterion)

<i>Criterion</i>	<i>Total</i>	<i>Meets Criterion</i>	<i>Doesn't Meet Criterion</i>
Sample Characteristics			
1) Were subjects individually randomly assigned?	0	0%	100%
2) Were subjects drawn from the same local area (such as school district, high school pyramid, town or named area in city)?	11	28%	73%
3) Were subjects matched by demographics or other stated similarity?	15	38%	63%
Psychometric Properties			
4) Were temporal stability/test-retest reliability statistics or an outside source such as a standardization study reported, or was reliability stated to be acceptable?	18	45%	55%
5) Was inter-rater reliability assessed and considered to be acceptable?	14	35%	65%
6) Was internal consistency assessed and considered to be acceptable?	27	68%	33%
7) Was evidence presented that the operationalized measure reflects the construct of interest?	33	83%	18%
Controlling Variables			
8) Did the author(s) control for Language to ensure that the language of instruction was English?	7	18%	83%
9) Did the author(s) control for Ethnic/racial minority status?	20	50%	50%
10) Did the author(s) control for Socioeconomic status?	35	88%	13%
11) Did the author(s) control for Grade level or age?	30	75%	25%
12) Did the authors equate the subjects on or control for other variables such as preexisting academic ability, curriculum, parental aspirations, etc?	33	83%	18%
Threats to Internal Validity			
13) Was the study free of evidence that the equating procedure produced differential statistical regression?	36	90%	10%
14) Was the outcome measure adequately aligned to the intervention?	40	100%	0%
15) Was the unit of assignment or selection the same as the unit of statistical analysis?	36	90%	10%
16) Was SS or CE assignment implemented as defined?	39	98%	3%
17) Was the study free from evidence that one group might also have experienced a changed expectancy, novelty and/or disruption effect that was not also experienced by the other group?	35	88%	13%
18) Was the study free from attrition or change in composition effects?	31	78%	23%
19) Was the study free from local history events?	35	88%	13%
Effect Size			
20) Was a mean and standard deviation or variance available for both comparison groups?	23	58%	43%
21) For this study, could effect sizes be generated?	29	73%	28%
22) Could the direction of the effect be identified for this outcome measure?	36	90%	10%
Issues of Bias			
23) Was the study published in a peer-refereed journal?	25	63%	38%
24) Did the authors test properly operationalized hypotheses?	25	63%	38%

APPENDIX 5: TABLE OF STUDY OUTCOMES FOR BOYS

<i>Outcome</i>	<i>Total</i>	<i>Pro-SS</i>		<i>Pro-CE</i>		<i>Null</i>		<i>Mixed</i>	
		<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>
Concurrent Academic Accomplishment									
1) All-Subject Achievement Test Scores	4	3	75%	0	0%	1	25%	0	0%
2) Mathematics Achievement Test Scores	9	3	33%	2	23%	4	44%	0	0%
3) Science Achievement Test Scores	3	1	33%	0	0%	2	67%	0	0%
4) Verbal/English Achievement Test Scores	6	2	33%	0	0%	3	50%	1	17%
5) Grades	0	0	0%	0	0%	0	0%	0	0%
6) Social Studies Achievement Test Scores	1	0	0%	0	0%	1	100%	0	0%
Long-Term Academic Accomplishment									
7) Postsecondary Test Scores	1	1	100%	0	0%	0	0%	0	0%
8) College Graduation	0	0	0%	0	0%	0	0%	0	0%
9) Graduate School Attendance	0	0	0%	0	0%	0	0%	0	0%
Concurrent Adaptation and Socioemotional Development									
10) Self-Concept	3	1	33%	0	0%	2	67%	0	0%
11) Self-Esteem	3	1	33%	2	67%	0	0%	0	0%
12) Locus of Control	3	2	67%	0	0%	1	33%	0	0%
13) School Track and Subject Preference	7	2	29%	2	29%	3	43%	0	0%
14) Educational Aspirations	2	0	0%	0	0%	2	100%	0	0%
15) Career Aspirations	1	1	100%	0	0%	0	0%	0	0%
16) Delinquency	1	0	0%	0	0%	1	100%	0	0%
17) Attitudes Toward School	3	2	67%	0	0%	1	33%	0	0%
18) Time Spent per Week on Homework	1	1	100%	0	0%	0	0%	0	0%
19) Attitudes Toward Working Women	1	0	0%	0	0%	1	100%	0	0%
Long-Term Adaptation and Socioemotional Development									
20) School Completion	1	1	100%	0	0%	0	0%	0	0%
21) Postsecondary Success	0	0	0%	0	0%	0	0%	0	0%
22) Postsecondary Unemployment	1	1	100%	0	0%	0	0%	0	0%
23) Eating Disorders	0	0	0%	0	0%	0	0%	0	0%

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Table of Study Outcomes for Boys (cont'd)

<i>Outcome</i>	<i>Total</i>	<i>Pro-SS</i>		<i>Pro-CE</i>		<i>Null</i>		<i>Mixed</i>	
		<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>
24) Choice of College Major	0	0	0%	0	0%	0	0%	0	0%
25) Sex-Role Stereotyping	1	0	0%	0	0%	1	100%	0	0%
26) Political Involvement	0	0	0%	0	0%	0	0%	0	0%
27) Percent Married to First Spouse	1	0	0%	0	0%	1	100%	0	0%
Perceived School Culture									
28) Climate for Learning	1	1	100%	0	0%	0	0%	0	0%
29) Opportunities for Leadership Roles	1	1	100%	0	0%	0	0%	0	0%
30) School Environment	0	0	0%	0	0%	0	0%	0	0%
Subjective Satisfaction									
31) Satisfaction with School Environment	0	0	0%	0	0%	0	0%	0	0%
32) College Satisfaction	0	0	0%	0	0%	0	0%	0	0%

APPENDIX 6: TABLE OF STUDY OUTCOMES FOR GIRLS

Outcomes	Total	Pro-SS		Pro-CE		Null		Mixed	
		N	Percent	N	Percent	N	Percent	N	Percent
Concurrent Academic Accomplishment									
1) All-Subject Achievement Test Scores	8	5	63%	2	25%	1	13%	0	0%
2) Mathematics Achievement Test Scores	11	3	27%	0	0%	8	73%	0	0%
3) Science Achievement Test Scores	5	2	40%	0	0%	3	60%	0	0%
4) Verbal/English Achievement Test Scores	8	1	12.5%	0	0%	6	75%	1	12.5%
5) Grades	0	0	0%	0	0%	0	0%	0	0%
6) Social Studies Achievement Test Scores	1	1	100%	0	0%	0	0%	0	0%
Long-Term Academic Accomplishment									
7) Postsecondary Test Scores	1	1	100%	0	0%	0	0%	0	0%
8) College Graduation	0	0	0%	0	0%	0	0%	0	0%
9) Graduate School Attendance	0	0	0%	0	0%	0	0%	0	0%
Concurrent Adaptation and Socioemotional Development									
10) Self-Concept	4	3	75%	0	0%	1	25%	0	0%
11) Self-Esteem	3	0	0%	0	0%	3	100%	0	0%
12) Locus of Control	3	3	100%	0	0%	0	0%	0	0%
13) School Track and Subject Preference	8	5	63%	1	13%	2	25%	0	0%
14) Educational Aspirations	2	2	100%	0	0%	0	0%	0	0%
15) Career Aspirations	2	2	100%	0	0%	0	0%	0	0%
16) Delinquency	3	2	67%	0	0%	1	33%	0	0%
17) Attitudes Toward School	3	2	67%	1	33%	0	0%	0	0%
18) Time Spent per Week on Homework	1	1	100%	0	0%	0	0%	0	0%
19) Attitudes Toward Working Women	1	1	100%	0	0%	0	0%	0	0%
Long-Term Adaptation and Socioemotional Development									
20) School Completion	1	1	100%	0	0%	0	0%	0	0%
21) Postsecondary Success	0	0	0%	0	0%	0	0%	0	0%
22) Postsecondary Unemployment	1	1	100%	0	0%	0	0%	0	0%
23) Eating Disorders	1	0	0%	1	100%	0	0%	0	0%

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Table of Study Outcomes for Girls (cont'd)

<i>Outcome</i>	<i>Total</i>	<i>Pro-SS</i>		<i>Pro-CE</i>		<i>Null</i>		<i>Mixed</i>	
		<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>
24) Choice of College Major	1	1	100%	0	0%	0	0%	0	0%
25) Sex-Role Stereotyping	2	1	50%	1	50%	0	0%	0	0%
26) Political Involvement	1	1	100%	0	0%	0	0%	0	0%
27) Percent Married to First Spouse	1	0	0%	0	0%	1	100%	0	0%
Perceived School Culture									
28) Climate for Learning	1	1	100%	0	0%	0	0%	0	0%
29) Opportunities for Leadership Roles	2	1	50%	0	0%	1	50%	0	0%
30) School Environment	0	0	0%	0	0%	0	0%	0	0%
Subjective Satisfaction									
31) Satisfaction with School Environment	0	0	0%	0	0%	0	0%	0	0%
32) College Satisfaction	1	1	100%	0	0%	0	0%	0	0%