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ABSTRACT

Growth during the last 2 years of high school was examined in public and Catholic high schools using data from the High School and Beyond database--a large, nationally representative study. Earlier research was extended by considering: (1) affective variables (e.g., self-concept, locus of control), academic choices (e.g., course selection), and postsecondary activities as well as academic achievement outcomes; (2) Catholic single-sex and Catholic coeducational schools separately; and (3) academic self-concept, school policies related to discipline, and academic orientation as mediating variables. Data for 4,378 students from public schools, Catholic coeducational schools, Catholic boys schools, and Catholic girls schools were analyzed. A sample size of 4,000 was used to test statistical significance in all analyses. Results indicate that growth in the last 2 years of high school on a variety of outcomes was modestly larger for Catholic school students than for public school students. Effects favoring Catholic schools were relatively larger for the selection of academic courses, relatively smaller for achievement and university attendance, and almost zero for affective variables. Subsequent analyses suggest that Catholic schools encourage students to take more academically challenging coursework and that this difference explained other public/Catholic differences. Three tables contain study data. A 49-item list of references is included, and an appendix defines the variables considered. (Author/SLD)

Public, Catholic Single-Sex, and Catholic Coeducational High Schools: Their Effects on Achievement, Affect and Behaviors

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Public, Catholic Single-Sex, and Catholic Coeducational High Schools:

Their Effects on Achievement, Affect and Behaviors

ABSTRACT

Growth during the last two years of high school was examined in Public and Catholic high schools using the High School and Beyond data. Earlier research was extended by considering: (a) affective variables (e.g., self-concept, locus of control), academic choices (e.g., course selection), and post-secondary activities as well as academic achievement outcomes; (b) Catholic single-sex and Catholic coed schools separately; and (c) academic self-concept and school policies in relation to discipline and academic orientation as mediating variables. Effects favoring Catholic schools were relatively larger for the selection of academic courses, relatively smaller for achievement and university attendance, and almost zero for affective variables. Subsequent analyses suggested that Catholic schools encourage students to take more academically demanding coursework and that this difference explained other public/Catholic differences.

Educational researchers and the general public have debated extensively the effects of attending different types of high schools. The availability of the large, nationally representative High School and Beyond (HSB) data base in particular has stimulated interest in academic achievement differences attributed to public and Catholic high schools. Interest also continues to remain strong in the closely related field of school effectiveness research. Whereas researchers are typically able to identify between-school differences in unadjusted achievement scores, most of the between-school variance can be explained by family background and prior levels of achievement (e.g., Coleman, et al. 1966; Good & Brophy, 1986; Jencks, et al, 1972). Similarly, previous research with HSB data has shown that whereas senior Catholic high school students outperform public high school students on standardized achievement tests, much of this public/Catholic school difference can be explained by family background and prior achievement (e.g., Jencks, 1985). Public/Catholic school differences do, however, remain statistically significant for most of the HSB achievement tests even after controlling for pre-existing differences. Researchers continue to disagree on the importance of the apparently small amount of variance attributable to effective schools in general and to public/Catholic school differences in particular (Coleman & Hoffer, 1987; Good and Brophy, 1986; Jencks, 1985).

The bulk of HSB research on public/Catholic school differences has focused on the standardized achievement tests administered to students in their sophomore and again in the senior years of high school (Jencks, 1985). Good and Brophy (1986) argued that "information about school effects on narrow measures of student achievement is relevant and interesting but only one of many dimensions of effectiveness that would have to be considered in assessing the general concept of effectiveness in any real fashion" (p. 570). Brookover and Lezotte (1979), for example, argued for the consideration of three outcome variables: academic achievement, self-concept, and self-reliance. Hence, an important contribution of the present investigation is to examine public/Catholic school differences on a much broader array of outcome variables than have been considered in previous HSB studies (e.g., achievement tests, school grades, course selection, self-concept, locus of control, time spent on homework, getting into trouble, and subsequent university attendance; see Appendix).

Good and Brophy (1986) also argued that more attention in school effectiveness research needs to be placed on process variables. Similarly,

Hoffer, Greeley, and Coleman (1985; Coleman & Hoffer, 1987) and others have sought to determine which public/Catholic school differences in school policy are able to explain achievement differences. Coleman, Hoffer and Kilgore (1982a, 1982b; Coleman & Hoffer, 1987), for example, suggested that much of the Catholic/public differences in achievement may be explicable in terms of stronger discipline and academic orientation in Catholic schools. A broad consideration of process and context variables that may influence school effectiveness is beyond the scope of the present investigation, but the Catholic school organization appears to differ from that of public schools in three ways that are be considered here. First, unlike the public sector, there are many single-sex high schools in the Catholic sector. Coleman (1981) argued that coeducation may negatively influence both academic achievement and social adjustment. Riordan (1985) noted the inappropriateness of considering Catholic single-sex and coed schools as a single school type. He argued that Catholic single-sex schools were more effective than public or coed Catholic schools, and that this policy difference may account for much of the public/Catholic school differences. Second, Coleman (Coleman, et al. 1982a, 1982b; Hoffer, Greeley & Coleman, 1985; also see Morgan, 1983) found large public/Catholic school differences in discipline policy-related variables, and suggested that these differences affected achievements. Third, Coleman (Coleman, et al., 1982a, 1982b; Coleman & Hoffer, 1987; Hoffer, Greeley and Coleman, 1985; also see Kilgore, 1983) noted that Catholic schools are more academically oriented; requiring more homework, encouraging a greater percentage of students to take advanced coursework and placing them in academic tracks instead of general or vocational tracks. The first of these -- the comparison of single-sex and coeducation -- has apparently not been considered in relation to public/Catholic differences based on the HSB data. Whereas the other two policy issues have been considered in relation to public/Catholic differences in achievement they have apparently not been considered in relation to the broader array of outcome variables that are considered here.

Although not specifically examined in HSB studies of public and Catholic schools, recent research based largely on the HSB data indicates the importance of academic self-concept as both an outcome variable and as a mediating variable. Marsh demonstrated that prior academic self-concept effects subsequent school grades beyond what can be explained by prior school grades and performance on standardized achievement tests (Marsh, 1987, in press-a). Having part-time employment during the last two years of

high school has largely negative effects on a broad array of academic outcomes, and many of the negative effects are mediated by the negative effect that part-time employment has on academic self-concept (Marsh, in press-b). In contrast, participation in extracurricular activities -- particularly sports -- has largely positive effects, and these are substantially mediated by the positive effects of participation on academic self-concept (Marsh, 1990a). Attending a school where the average ability is high has largely negative effects on a broad array of academic outcomes (after controlling of initial ability and family background), and these effects are substantially mediated by the negative effect of attending a high-ability school on academic self-concept (Marsh, in press-c; also see Marsh, 1987, 1990b). A general theme underlying this research is that academic self-concept reflects in part an orientation or commitment to school; a student with a better academic self-concept is likely to achieve more positive academic outcomes than can be predicted by the student's ability and other background variables. In line with this research, an important contribution of the present investigation is to examine public/Catholic school differences in academic self-concept and whether these difference mediate public/Catholic differences in other outcomes.

The Differential Effects of Attending Public and Catholic High Schools

Standardized achievement test scores. For present purposes, consideration of public/Catholic school differences is limited primarily to HSB studies. This research is reviewed elsewhere (e.g., Coleman & Hoffer, 1987; Hoffer, Greeley & Coleman, 1985; Jencks, 1985; Wolfle, 1987) and so it is only summarized briefly. Using cross-sectional analyses based on just the first wave of HSB data (the 1980 cohorts of sophomores and seniors), Coleman, Hoffer and Kilgore (1981, 1982a, 1982b) concluded that Catholic school students learned more than public school students during their last two years of high school. This initiated heated debate (e.g., Goldberger & Cain, 1982), a flurry of reanalyses (Alexander & Pallas, 1983; Cain & Goldberger, 1983; Morgan, 1983) and rejoinders (e.g., Coleman & Hoffer, 1983). Whereas basic issues were unresolved, Jencks (1985) noted that: "All parties to this debate agreed, however, that the 1980 data were not ideal for estimating the effect of Catholic schooling, since there was no completely satisfactory way of knowing what seniors in 1980 were like when they were sophomores in 1978, or what sophomores in 1980 would be like when they became seniors in 1982" (p. 128).

The availability of the second wave of (1982) data provided a much

stronger basis for subsequent analyses. Jencks (1985, provided a summary and review of the subsequent analyses (Alexander & Pallas, 1985; Hoffer, Greeley & Coleman, 1985; Willms, 1985) based on sophomore and senior responses by the 1980 sophomore cohort. Jencks noted that all three follow-up studies agreed that public/Catholic school differences favored Catholics students for sophomore achievement tests (reading, vocabulary, mathematics, writing, science and civics), for unadjusted sophomore-to-senior gains on 5 of 6 tests (all but civics), and for sophomore-to-senior gains adjusted for various pre-existing differences on 4 of 6 tests (all but civics and science). Whereas the public/Catholic differences varied somewhat depending on the particular content area and methodological details of the the analysis, sophomore-to-senior gains adjusted for pre-existing differences were approximately .1 SD for for Catholic school students in mathematics, reading, writing, vocabulary and close to zero for science and civics.

Whereas the authors disagreed on some methodological details, all agreed that there was no satisfactory way of estimating school type effects except by using both background variables and 1980 scores to correct 1982 scores. As noted by Jencks (1985, p. 128): "One major purpose of the High School and Beyond (HSB) study was to assess the impact of different kinds of schooling on how much students learned in the last two years of schooling." All these studies corrected 1982 scores for background variables and the matching 1980 score. Jencks noted, however, that for both theoretical and practical reasons a model correcting for a whole range of 1980 outcomes as Willms (1985) used is better than one correcting for just the matching outcome. As noted by Jencks any given outcome is likely to reflect many different characteristics -- knowledge, attitudes, behaviors, etc. -- and so it is better to use a composite measure that more accurately reflects these different domains. Jencks also noted the possibility that matching 1980 and 1982 outcomes might not be substantially correlated, but that a composite of optimally weighted 1980 outcomes including, perhaps, the matching outcome might be able to predict the 1982 outcome. Also, this approach enables researchers to consider results for 1982 and post-secondary outcomes that do not have a matching 1980 outcome variable. Finally, the reliability and, perhaps, the validity of a broadly based composite is likely to be higher than that of a single variable that is part of the composite.

Interactions between public/Catholic differences and other background characteristics. Researchers have typically focused on public/Catholic differences averaged across all students. They have, however, also

considered whether the sizes of these effects vary for different types of students within each school. In the language of ANOVA, the question is whether the public/Catholic effects interact with other background characteristics. This empirical question has been complicated by the different approaches used to test the interaction effects.

Willms (1985) estimated a single regression equation from the total group covariance matrix and inferred public/Catholic differences from a dummy (dichotomous) variable representing school-type. He tested for interactions between the public/Catholic grouping variable and background characteristics by including appropriately defined cross-products in his regression equation. Because these interaction terms added little to variance explained and were rarely significant, his results suggested that public/Catholic effects did not interact with the background characteristics that he tested.

Hoffer, et al. (1985) used a two-equation approach in which separate regression equations were estimated for public and Catholic school samples. In this two-equation approach, tests of interactions were made by comparing the unstandardized regression coefficients in each equation. For example, Hoffer, et al. (1985) reported that SES, dummy variables for being black and being Hispanic, and initial achievement had more impact on subsequent achievement in public schools than in Catholic schools. They interpreted this to mean that initially disadvantaged students were less disadvantaged in Catholic schools than in public school. However, few of the coefficients in their public school equation differed significantly from the corresponding coefficients in the Catholic school equation. Assuming a design effect of 1.5 used in most HSB studies (see Jencks, 1985), only one of 24 interactions presented by Hoffer, et al. (1985, Table 2.4) was statistically significant.

In summary, neither the single-equation nor the two-equation approach provides support for the interaction of public/Catholic effects and background characteristics. In his review of this research, Jencks (1985) also concluded that there was little convincing evidence for the existence of interaction effects but he also noted that the tests of these interactions were not sufficiently powerful to conclude that they did not exist. It is also important to reiterate that neither the single-equation nor the two-equation approach is inherently superior. Both approaches provide tests of interaction effects and under special circumstances the approaches are mathematically equivalent. If interactions do not occur the

single-equation approach is more parsimonious, but even when there are interactions the single-equation approach is appropriate so long as the interaction terms are included in the regression equation. Whereas tests of interaction effects may lack statistical power as suggested by Jencks (1985), this is true for both approaches.

The effects of mediating variables. HSB studies of public/Catholic differences (e.g., Coleman & Hoffer, 1987; Hoffer, et al., 1985) have considered many variables besides test scores and these additional variables could have been considered as outcomes in their own right (e.g., college plans, academic track, coursework selection, time spent on homework, discipline and parental involvement). These additional variables were generally viewed as either background variables that needed to be controlled in making comparisons of test scores or mediating variables reflecting different school policies that may explain public/Catholic differences in test scores. Public/Catholic school differences in background variables were not assumed to represent school-type effects.

When variables were posited as mediating variables, however, there was an implicit assumption that school-type differences on these mediating variables represented true school-type effects. If so called mediating variables actually reflect pre-existing differences, then it is wrong to consider them as mediating variables. Tests of this implicit assumption, however, were rarely tested as rigorously as interpretations of test scores. For example, public/Catholic differences in test scores were inferred on the basis of gain scores (senior outcomes corrected for sophomore outcomes) that had been corrected for background variables. In contrast, public/Catholic differences in mediating variables were typically inferred on the basis either sophomore variables corrected for background variables or senior variables corrected for background variables but not sophomore outcome variables. Thus, whereas HSB studies of public/Catholic school differences have implicitly considered outcome variables other than test scores, the observed differences may reflect school-type differences instead of school-type effects. An important contribution of the present investigation is to test more rigorously the implicit assumption that public/Catholic differences in mediating variables represent school-type effects rather than just school-type differences.

Post-secondary outcomes: College attendance. Most previous studies of public/Catholic school differences based on the HSB data have considered only the first two waves of data for the Sophomore cohort. Thus, there has

been little research on the public/Catholic school differences in post-secondary activities. Coleman and Hoffer (1987) review some of the difficulties inherent in establishing criteria of success beyond high school. They argue, however, that "some paths, if successfully pursued, will lead to greater success in the directions that school prepares for than others. With few exceptions, a successful pursuit of a bachelor's degree in college will result in an occupation that brings higher income, higher status, and more chance for advancement." Based on this rationale they examined public/Catholic school differences in subsequent college attendance.

Coleman and Hoffer (1987) concluded that there were large differences in the percentages of public and Catholic school students who attended college in the first two years after high school graduation. About half of the difference could be explained in terms of family background differences, but they argued that a large part of the remaining difference was explained by what goes on in the schools. In particular, Catholic school students were more likely than public school students to be in the academic track, to select academic courses, and to spend more time on homework. Furthermore, these differences explained much of the public/Catholic differences in subsequent college attendance.

An important limitation of Coleman and Hoffers' analyses, however, is that they are based on data for the HSB senior cohort collected during their senior year in high school and two years after their normal graduation from high school. As already noted in examination of achievement test scores, it is difficult to determine whether school-type differences are due to selection effects that are not eliminated by controlling for background differences or true school-type effects (i.e., effects of schools that are not due to pre-existing differences). Whereas Coleman and Hoffer recognized this problem and introduced additional controls, their design is inherently weak for purposes of differentiating between school-type differences and school-type effects. If the three waves of data for the sophomore cohort had been available when they conducted their analyses, a stronger design would have been to consider school-type differences after controlling for both background variables and sophomore outcomes. The rationale for this stronger design is based on the same logic as the earlier analyses of public/Catholic differences in achievement test scores. Early findings about public/Catholic differences on academic achievement test scores based on an inherently weak design were largely substantiated by subsequent research using a stronger

design when additional HSB data became available, but it was still critically important to provide stronger tests of the initial claims. Similarly, an important contribution of the present investigation is to apply this stronger design, using the three waves of data for the sophomore cohort that are now available, in order to evaluate Coleman and Hoffer's (1987) claims about public/Catholic school differences in college attendance.

The Differential Effects of Attending Single-sex and Coed High Schools

Coeducational high schools, it is frequently argued, provide a more natural social environment to prepare adolescents to take their place in society than do single-sex schools (e.g., Dale, 1974). Based in part on this contention, public single-sex schools are becoming rare in most western societies. Coleman, however, challenged this contention and suggested that coeducation "may be inimical to both academic achievement and social adjustment" (1961, p. 51; also see Goodlad, 1985). More recently, other researchers have proposed that coeducation may be detrimental to the academic or social development of girls in particular (see Bone, 1983; Lee & Bryk, 1986; Spender & Sarah, 1980; Willis & Kenway, 1986).

Interpretations of single-sex/coed comparisons are hampered by the typical nonequivalent group comparisons used in most research. Because single-sex schools are more likely to be private selective schools, their students are typically brighter, come from higher socioeconomic backgrounds, may be more highly motivated and differ from coed students on a variety of other pre-existing variables that probably invalidate the interpretation of single-sex/coed comparisons (e.g., Dale, 1974; Steedman, 1984; Willis & Kenway, 1986). Studies that do not control for such pre-existing influences cannot be given great weight, and even those that do must be interpreted cautiously because of difficulties inherent in using statistical procedures to equate nonequivalent groups.

Historically, the most important research on single-sex/coed differences is Dale's extensive research program conducted in England and Wales. A detailed review of Dale's research is beyond the scope of this article (see Bone, 1983; Marsh, Smith, Marsh & Owens, 1988), but his major conclusions in relation to affective and achievement outcomes respectively were:

1. "It has been demonstrated that the average coeducational grammar school is a happier community for both staff and pupils than the average single-sex school" (Dale, 1974, p. 273). Dale also found that anxiety was

slightly lower for students from coed schools than for those from single-sex schools, that neuroticism tended to be lower in coed schools than single-sex schools for boys, though there was no difference for girls, and that there were no significant differences on introversion-extroversion.

2. "A cautious summing up would be that the progress of boys is probably improved by co-education while that of girls is not harmed" (Dale, 1974, p. 267). Thus, according to Dale, the social and affective benefits of coeducation were not at the expense of academic progress (1974, p. 273).

Recent comparisons of achievement levels in single-sex and coed schools (e.g., Bone, 1983; Finn, 1980; Riordan, 1985; Steedman, 1984; Willis and Kenway, 1986) typically show that academic achievement is substantially higher in single-sex schools than in coed schools. Once pre-existing characteristics such as intelligence, prior academic achievement, motivation, and social class are controlled, however, the differences tend to be much smaller or nonsignificant. The differences, therefore, are largely explicable in terms of the characteristics of students who attend single-sex and coed schools rather than school-type effects. Steedman (1984), for example, examined the academic achievements of a large representative sample of 16 year old boys and girls in single-sex and coed schools after correcting for achievement at ages 7 and 11 and for family background variables. Whereas single-sex students had higher levels of achievement than coed students, most of this difference could be accounted for on the basis of pre-existing variables. Steedman (1984, p.98) concluded that "very little in these examination results is explained by whether schools are mixed or single-sex once allowance has been made for differences at intake."

In a study particularly relevant to the present investigation, Riordan (1985) argued that the effects of Catholic schooling may differ in single-sex and coed schools, and that such differences may alter interpretations of public/Catholic school comparisons. He compared public coed students to Catholic single-sex and coed students using the National Longitudinal Study of the High School Class of 1972. After controlling for SES, single-sex girls had higher verbal scores whereas single-sex boys had higher math scores and educational attainment. Riordan, however, had available only data collected in the senior year or later. Due to the lack of control for pre-existing differences in ability, achievement or motivation noted by Riordan, the school-type differences should not be interpreted as school-type effects.

Other researchers (e.g., Feather, 1974; Jones, Shallcross & Dennis, 1972; Schneider & Coutts, 1982) have compared high school students from single-sex and coed schools on social and affective variables. Jones et al., found that single-sex students are more academically oriented whereas coed students are more socially oriented, but that the two did not differ in overall self-regard. They suggested that their research generally supported Coleman's (1961) claim of the negative effects of coeducation. Feather found little difference in the values of students in single-sex and coed schools, though at least boys in coed schools were more satisfied with their classmates and teachers than boys in single-sex schools. He concluded that "there was no support for Coleman's hypothesis concerning the possible adverse effect of coeducation and limited support for Dale's suggestion that single-sex schools may be seen as more concerned with control and discipline" (Feather, 1974, p.14). Schneider et al. found no difference between single-sex and coed students in terms of emphasis on scholarship and achievement, but found that coeducational schools were perceived as more pleasant atmospheres, more conducive to the development of self-confidence, and reflecting less prejudiced and irrational thinking. They concluded that their findings did not support Coleman's suggestion but noted that "it remains for further research to ascertain whether or not the apparent advantage enjoyed by coeducational students occurs at the expense of academic achievement" (Schneider, et al., 1982, p. 906). Despite the varying conclusions, the authors all cautioned that observed differences may have reflected pre-existing differences instead the school-type effects. In none of these studies was any attempt made to test or control such differences, and so conclusions must be viewed cautiously.

Marsh, Smith, et al (1988; Marsh, Owens, Marsh & Smith, 1989) conducted a five-year longitudinal study of a boys' school and a girls' school serving the same suburb that subsequently formed two coed high schools. Teachers at both schools favored the transition and indicated that students overwhelmingly preferred coed to single-sex schools. English and mathematics achievement scores were similar in the single-sex and coed settings for both boys and girls. During the five year period spanning the single-sex/coed transition girls performed substantially better than boys in English and marginally poorer in mathematics, but the sizes of these differences were similar in the single-sex and coed settings. There was, however, an increase in multiple dimensions of self-concept for both boys and girls. Sex differences in specific areas of self-concept -- those favoring girls and

those favoring boys -- were unaffected by the transition. The authors concluded that the benefits of the transition on self-concept were not at the expense of academic achievement.

Achievements, attitudes and behaviors of students attending single-sex and coed Catholic high schools in the HSB study have been examined in a series of analyses, reanalyses and critiques (Lee & Bryk, 1986, 1989; Marsh, 1989a, 1989b) that resembles in some ways the controversial analyses of public/Catholic differences in the HSB data. As with the public/Catholic studies of the HSB data, the single-sex/coed comparisons are summarized only briefly and the reader if referred to the original studies. Lee and Bryk (1986) initially examined single-sex/coed differences in sophomore and senior outcomes after correcting for a variety of background differences. They found that single-sex students tended to have higher scores than coed students for a number of sophomore outcomes and senior outcomes that were not corrected for sophomore outcomes. Marsh (1989a, 1989b) countered that tests of sophomore outcomes and tests of senior outcomes that did not control at least the matching sophomore outcomes proviced insufficient control for pre-existing differences, and also noted an apparently inappropriate use of one-tailed tests of statistical significance by Lee and Bryk (1986). In a reanalysis, Marsh (1989a) examined sophomore-to-senior gains that were corrected for background variables, using a design like those considered in public/Catholic comparisons discussed earlier. Based on these analyses Marsh (1989a, 1989b) concluded that changes during the critical sophomore-to-senior period were similar in Catholic single-sex and coed schools and that this lack of single-sex/coeducation difference was similar for boys and for girls.

A Comparison Between Studies of Public/Catholic School Effects and Single-Sex/Coed Effects

A brief comparison of public/Catholic studies and single-sex/coed studies is informative. Two major differences are immediately apparent: (a) the methodological rigor applied in attempting to distinguish between school-type differences and school-type effects and (b) the variety of outcome variables that have been considered. Studies of public/Catholic school differences, particularly the recent research based on the HSB data reviewed here, have used methodologically sophisticated approaches to correct school-type differences for pre-existing differences in students attending these schools that might otherwise invalidate interpretations. In marked contrast, there has been a surprising disregard for this issue in

most single-sex/coed comparisons. In this respect, single-sex/coed studies may benefit from the models established by public/Catholic school studies. In contrast, the public/Catholic comparisons reviewed here have focused primarily on achievement test scores as outcome measures, whereas single-sex/coed comparisons have considered a wider variety of outcomes. The typical disregard for distinguishing between school-type differences and school-type effects in single-sex/coed comparisons, however, may undermine this advantage.

Riordan's (1985) study demonstrates the need to consider public, Catholic coed, and Catholic single-sex schools in the same study. He argued that it is wrong to consider Catholic single-sex and coed schools as a single school type. If, as claimed by Riordan, public/Catholic differences are limited primarily to single-sex Catholic schools, then it may be wrong to conclude that there are benefits associated with attending Catholic schools. Instead, the appropriate conclusion would be that are benefits in attending single-sex schools or, perhaps, that there are benefits in attending single-sex Catholic schools. Because of limitations in the data used by Riordan, his design was inherently weak and provided a poor basis for testing his claims. Hence it is imperative to test more adequately the validity of his claims. For this reason, comparisons in the present investigation are based on three school types -- public, single-sex Catholic, and coed Catholic -- instead of just two.

Methods

The Present Investigation

The present investigation is a further analysis of public/Catholic differences and of single-sex/coed differences within the Catholic sector using the HSB study. This investigation differs from public/Catholic comparisons reviewed earlier in that: (a) academic choice, affective and post-secondary outcomes are considered as well as standardized test scores and (b) effects of single-sex and coed Catholic schools are considered separately rather than assuming that public/Catholic differences generalize across this potentially important school-type difference.

Sample

Data for the present investigation are based on the commercially available data file for the sophomore cohort of the HSB study. A detailed description of this data base is available in the user's manual produced by the National Center for Educational Statistics (NCES, 1986). The data file includes variables collected in 1980 when respondents were sophomores, in

1982 when respondents were seniors, and in 1984 two years after the normal time of high school graduation. The sophomore cohort initially involved a two-stage probability sample of 1,015 high schools and approximately 36 sophomores within each of these schools. The second follow-up consisted of a probability sample of 14,825 of the original sample. For present purposes, students were selected from the second follow-up who: (a) attended a public or Catholic high school (private school students were excluded) and (b) attended the same school in 1980 and 1982 (students who had the same school identification number both years, had not dropped out, had not transferred to another school, and had not already graduated). This left a total of 10,507 students from 853 public schools, 33 Catholic coed schools, 21 Catholic boys schools, and 26 Catholic girls schools.

Responses in the present analysis were weighted so as to hold constant the total sample size but to take into account the disproportionate sampling of specified subgroups -- particularly the over-sampling of Catholic high school students -- in the HSB design (NCES, 1986, Table 3.5-1). The original unweighted and subsequently weighted sample sizes for different groups were: 8175 and 9744 (public school); 957 and 380 (Catholic coed school); 629 and 165 (Catholic boys school); and 746 and 216 (Catholic girls school). Because of the cluster sampling in the HSB study, standard errors based on the assumption of simple random sampling substantially underestimate the sampling variability in summary statistics and distort tests of statistical significance. In order to compensate for this bias, the weight for each respondent was divided by the estimated design effect of 2.40 (NCES, 1986, Table 3.6-5), reducing the nominal sample size from 10,507 to 10,507/2.4=4,378. (This reduction in nominal sample size has no effect at all on cell means and parameter estimates; it only affects the df used in tests of statistical significance.) All analyses were based on a single correlation matrix based on variables described below that was constructed with pair-wise deletion for missing data. The weighted number of cases for each variable varied from 3656 to the maximum of 4,378, and the minimum pairwise number of cases was 3232. A sample size of 4,000 was used for purposes of testing statistical significance in all analyses.

Design and Analysis

The study consists of a three group design in which the main effects of school-type (public, Catholic single-sex, and Catholic coed) were examined. The main effects were represented by two single-degree-of-freedom contrasts: public vs. Catholic (in which public, single-sex Catholic and coed Catholic

were coded +.279, -3.574 and -3.574 respectively), and single-sex Catholic vs. coed Catholic (in which public, single-sex Catholic and coed Catholic were coded 0, +1 and -1 respectively). For the weighted sample size these contrasts were orthogonal so that the variables representing them were uncorrelated (see Cohen & Cohen, 1983).

Other variables selected for consideration (see Appendix and Table 1) were classified as background variables, sophomore, senior, and post-secondary outcome variables, and discipline policy-related variables. Background variables were selected to represent potentially important pre-existing influences. These included 7 individual level variables (e.g., sex, SES, ethnicity) and 5 school-level variables (e.g., school-average SES, ethnic composition). A total of 40 outcome variables were selected to represent potentially important influences of school-type; 34 (17 pairs) were matching measures collected in both sophomore and senior years, 4 were senior outcomes that had no matching sophomore outcomes, and 2 reflected post-secondary activities. These outcome measures included standardized achievement tests, course selection, homework, affective and attitudinal variables measured in the sophomore and senior years, and post-secondary activities measured two years after the normal graduation from high school. Seven discipline policy variables (e.g., number of rules, effectiveness of discipline policy) were based on school-average responses by students.

Insert Table 1 About Here

School-average variables (school-average background variables and discipline policy variables) were based on responses from approximately 30,000 students who constituted the original sophomore cohort of the HSB instead of the subsample of 14,825 students selected for the second follow-up. Thus, school-average responses were based an average of about 30 students per school instead of the average of about 15 students per school included in the second follow-up. These school-average values were merged with the second follow-up data so that all students from the same school were assigned the same school-average scores.

Most of the senior outcomes were paired with matching sophomore outcomes that were either strictly parallel or very similar. The only senior outcomes that could not be readily matched to sophomore outcome variables were some course selection variables (see Table 1). In both sophomore and senior years students reported their track-program (academic, general or vocational) and the number of advanced courses they had taken in mathematics and English. Based on high school transcripts obtained from the schools

during the senior year, patterns of course selection by each student in mathematics, in science, and in vocational studies were subjectively evaluated by HSB staff in terms of their number, difficulty, and continuity. For these three content areas the pattern of courses completed by each student was classified along a four-point scale varying from limited or non-participation in the area to a major concentration in the area. Also based on the transcripts, the HSB staff compiled the total number of credits completed by each student in six academically oriented content areas.

The initial analyses consisted of a series of multiple regressions in which the school-type variables, background variables, and sophomore outcome variables were related to each senior and post-secondary outcome. Two different analytic approaches were considered. In the first, called the weak control model, each senior outcome was corrected for sex, family SES, race, and its matching sophomore outcome in assessing school-type effects. In the second, called the strong control model, senior and post-secondary outcomes were corrected for all background variables and all sophomore outcomes in assessing school-type effects.

In further analyses, the possibility of interaction effects and the impact of school-type policy differences were explored. Interaction effects were used to determine whether any school-type effects varied with sex, race, SES, college expectations, and overall achievement levels. This was tested with a set of cross-products formed by multiplying the two school-type variables times the standardized (Mn=0, SD=1) scores representing sex, SES, total achievement (the sum of the five sophomore achievement test scores in Table 1 after each was standardized), and the two variables representing race (see Table 1). The impact of school-type differences were also examined in relation to policy differences in discipline and academic orientation. Discipline policies were inferred on the basis of the 7 discipline variables and academic orientation was inferred on the basis of the senior course selection and the senior homework outcomes. The impact of each set of policy-related variables was tested by controlling school-type differences in senior and post-secondary outcomes for these policy-related variables. The rationale and interpretation of these various analyses are described in more detail as part of the presentation of the results.

RESULTS

School-type Effects With Weak and Strong Control Models

As noted previously, a major purpose of the HSB study was to assess the impact of different kinds of schooling on student growth during the last two

years of high school. Previous HSB studies of Catholic/public school differences typically corrected senior achievement test scores for selected background variables and at least the matching sophomore test score. In the present investigation, two different approaches are considered. In the weak control model, school-type effects in each senior outcome were tested after controlling for just the matching sophomore outcome and a small number of background variables (sex, SES, and race). In the strong control model, school-type effects were tested after controlling for all sophomore outcomes and a larger number of background variables. The weak control model is like the approach used in some HSB studies of public/Catholic differences (Jencks, 1985), whereas the strong control model -- because of the wide range of sophomore outcome variables -- is stronger than those typically used. Because the weak control model is based on a subset of the variables included in the strong control model, the strong control model must necessarily be able to explain at least as much outcome variance as the weak control model for every outcome variable (See Table 2). It does not follow, however, that school-type effects are necessarily smaller in the strong control model. The results show (Table 2) that school-type effects are similar for both models, though the effects are slightly smaller for the strong control model.

Insert Table 2 About Here

For the strong control model (Table 2) public/Catholic differences are small but typically favor Catholic school students (the negative coefficients indicate higher scores for students from Catholic schools -- see Note in Table 2). The largest public/Catholic differences occur for course selection variables. Students in Catholic schools are more likely to earn credits in academically oriented courses, to select a concentration of math and science courses, to be in the academic track, and to take honors or advanced courses, but are less likely to select a concentration of vocational courses and to be in the vocational track. Students in Catholic schools are also more likely to do better on the standardized achievement tests, though the sizes of these effects are smaller than for the course selection variables. (The public/Catholic differences on standardized achievement tests observed here are similar to those reported in earlier studies.1) Catholic school students also tend to spend more time on homework and are more likely to pursue a post-secondary education. Catholic/public differences on the affective and attitudinal variables are typically small or nonsignificant, but those effects that are statistically significant

(involvement with parents and staying out of trouble) also favor Catholic school students. Public/Catholic differences tend to favor Catholic school students slightly more for the weak control model than for the strong control model. These results suggest that Catholic students demonstrate modestly greater growth during the last two years of high school on a variety of outcome variables than public school students. Further analyses described later (see discussion of Interaction Effects) indicates that this pattern of results generalizes across students differing on a wide variety of background variables.

In contrast to the public/Catholic differences, Catholic single-sex/coed differences are not statistically significant for any outcomes for either the weak or strong control models. These results contradict Riordan's 1985 claim that public/Catholic differences are larger for single-sex Catholic schools than for coed Catholic schools. The results also contradict Lee and Bryk's 1986 claim that the single-sex Catholic schools in the HSB study produce better outcomes than do the coed Catholic schools. The discrepant claims are apparently due to the different models used to control for pre-existing differences. Except for the gain scores considered by Lee and Bryk that were typically not statistically significant, the two earlier studies did not control senior outcomes for even the corresponding sophomore outcome so that their controls were not even as strong as in the weak control model considered here (see Marsh, 1989a, 1989b, for further discussion). These results suggest that students from Catholic single-sex and Catholic coed schools demonstrate a similar pattern of growth during the last two years of high school on a variety of outcome variables. Further analyses described later (see discussion of Interaction Effects) indicate that this lack of difference between single-sex and coed schools is similar for boys and for girls.

Interaction Effects

Whereas the search for potential interaction effects was not a primary purpose of the present investigation, the existence of interaction effects might complicate interpretations of the results. For example, the apparent advantages due to Catholic schools may not generalize across different groups of students whereas the lack of differences due to Catholic single-sex and Catholic coed schools may reflect counterbalancing effects for boys and for girls. In order to test such possibilities, a set of 12 interaction terms was added to the set of multiple regressions used in the strong control model. Six of these represented the interaction of public/Catholic

differences with sex, SES, race--black, race--Hispanic, college expectations and the average of the sophomore achievement tests. A corresponding set of six interaction terms was based on the Catholic single-sex/coed differences. These 12 interactions were tested for each of the 22 senior and post-secondary outcomes -- a total of 264 (12 x 22) interaction terms.

Two approaches were used in assessing the statistical significance of the 12 interactions for each outcome. First, the overall increase in multiple R due to the inclusion of all 12 interactions was assessed. Using this approach, however, the set of 12 interactions did not contribute significantly to any of the 22 senior and post-secondary outcomes. Second, the effect of each of the 264 interactions was tested separately (i.e., 264 one-df tests that did not take into account the effect of other interaction terms). Using this approach, 4 of 264 interactions were statistically significant (see Table 2), but the interactions were very weak. Using the more conservative approach, the set of 12 interactions did not contribute significantly to any of the 22 senior and post-secondary outcomes. Using the less conservative approach, 4 of 264 tests were statistically significant at the $p < .05$ level. Since the number of statistically significant differences is far less than would be expected by chance alone, the interpretation of these few interactions may be dubious.[2] These results suggest that neither public/Catholic differences nor single-sex/coed differences interact with any the background variables considered. Since sex was one of the background variables that was considered, the findings also imply that the lack of single-sex/coed differences was consistent across boys and girls (see Marsh, 1989c, for a general discussion of sex differences based on all the NSB data).

The Influence of School-type Differences in Policy-related Variables

Previous research suggested that public/Catholic differences in achievement may be due to stronger discipline policies and to stronger academic orientations in Catholic schools. The unadjusted means of the seven school-average discipline variables (Table 1) support the suggestion that discipline is stronger in Catholic schools. These public/Catholic differences are very large, accounting for as much as 25% of the variance in some school-average discipline variables, and were shown to be relatively independent of background variables in unreported analyses. To the extent that the selection of academically oriented courses and spending more time on homework reflect academic orientation, the results in Table 2 demonstrate that Catholic schools are more academically oriented than public schools.

The impact of these two sets of variables representing discipline and academic orientation were examined in additional multiple regressions summarized in Table 3. In addition, it was posited that public/Catholic school differences in academic self-concept would mediate public/Catholic school differences in other outcomes. The results summarized in Table 2, however, indicate that there were no public/Catholic differences in academic self-concept (beta = 0.00) and so academic self-concept is not able to mediate the public/Catholic school differences in other variables.

Insert Table 3 About Here

The major focus of the analysis of discipline variables is to determine whether the discipline variables mediate the public/Catholic differences observed in earlier analyses. To the extent that public/Catholic differences are eliminated or substantially reduced by controlling discipline variables, there may be support for the contention that public/Catholic differences are mediated by discipline differences. Whereas there are large public/Catholic school differences in the discipline variables, correcting for discipline variables has little effect on public/Catholic differences in the set of 22 outcome variables (Table 3). Although not the primary focus of this study, it is interesting to note that the set of discipline variables does not contribute significantly to a majority of the senior and post-secondary outcomes (as indicated by the change in R^2 due to these variables; see Table 3). Furthermore, the sizes of the contributions that are statistically significant are typically very small. These findings suggest that discipline policy has little effect on public/Catholic school differences in growth for the outcomes considered here.

The set of eight senior outcomes used to infer academic orientation contribute significantly to all the remaining outcome variables (as indicated by the change in R^2 due to these variables shown in Table 3). The sizes of this contribution, though still modest in absolute size, are substantially larger than those observed with the discipline variables. More importantly for purposes of this study, there are no statistically significant public/Catholic school differences for any remaining outcomes after controlling for this set of variables used to infer academic orientation. The results support earlier claims that much of the public/Catholic school differences in outcomes is because Catholic schools are more academically oriented than are public schools. It is important to reiterate that these analyses imply that this greater academic orientation in Catholic schools is not a characteristic that is exogenous to the school

but represents a policy difference between public and Catholic schools. Gain scores used to infer academic orientation in Table 3 are systematically larger in Catholic schools than in public schools. Thus, the inferred public/Catholic differences in academic orientation in the final year of high school are in addition to differences that can be explained by background variables, academic orientation in the sophomore year, and other sophomore outcomes.

SUMMARY AND CONCLUSIONS

The results of the present investigation show that growth during the last two years of high school on a variety of outcomes is modestly larger for Catholic school students than for public school students. The pattern of achievement test results is similar to previous studies of public/Catholic differences based on the HSB data. This study expands on previous research, however, in that a much broader array of outcomes is considered. Whereas significant differences in growth consistently favored Catholic school students for all outcomes, the sizes of these differences were not uniform across the different outcome variables. The largest differences were for course selection outcomes. Catholic school students were more likely to take academically oriented courses and somewhat less likely to take vocationally oriented courses. Catholic school students showed modestly larger growth in academic achievement measured by standardized examination and were more likely to continue their education after graduation from high school, but these differences were smaller than for the course selection variables. In contrast to course selection and achievement outcomes, public/Catholic school differences in growth were typically not statistically significant for affective variables such as esteem, locus of control, academic self-concept, and educational aspirations. This pattern of result implies that public/Catholic school differences in achievement and course selection are not mediated by differences in the affective variables. Whereas school-type apparently did not affect growth in these affective areas, the larger growth experienced by Catholic school students in many other outcomes was not at the expense of growth in these affective variables.

Public/Catholic school differences and single-sex/coed differences in growth were reasonably consistent across sex, SES, race, college expectations, and ability level for all senior and post-secondary outcomes. In this respect, the results appear to be generalizable.

Public/Catholic outcome differences were examined in relation to four process or policy-related differences. First, the Catholic sector contains a

large number of single-sex schools whereas the public sector does not. Public/Catholic school differences in growth were very similar for Catholic single-sex and Catholic coed schools, and these results were consistent for boys and for girls. Hence, this policy difference is apparently unable to explain public/Catholic differences in growth. Second, public and Catholic schools differed substantially in terms of discipline policy-related variables. Controlling for the discipline variables, however, had little effect on public/Catholic differences in the outcomes considered here. Hence, discipline policy differences are apparently unable to explain observed differences in growth. Third, there were no public/Catholic school differences on growth in academic self-concept. Hence, academic self-concept was unable to explain public/Catholic school differences in other outcomes. Fourth, Catholic school students were more likely to select academically oriented courses and to spend more time on homework than were public school students, suggesting that Catholic schools were more academically oriented. These academic orientation variables contributed significantly to growth in all remaining senior and post-secondary outcomes. Furthermore, controlling for these academic orientation variables eliminated statistically significant public/Catholic differences in growth on all the remaining outcomes. These results suggest that Catholic schools encourage students to take more academically demanding coursework and that this may be responsible for the public/Catholic differences in growth in other outcomes.

Other researchers have considered the effects of controlling for variables like those used here to infer academic orientation, but the present results are stronger in a variety of ways. First, for at least some of these variables (e.g., academic track), measures for sophomore and senior years were considered separately. This procedure demonstrated not only differences between public and Catholic schools, but also showed that the sophomore-to-senior gains were larger in Catholic schools than in public schools. That is, the academic orientation was stronger in Catholic schools in both the sophomore and senior years, and the public/Catholic differences were still statistically significant for senior year variables even after controlling for the academic orientation in the sophomore year. Because the variables used to infer academic orientation were corrected for both background characteristics and sophomore outcomes, this public/Catholic school difference apparently represents a legitimate school-type effect. This provides stronger support for the contention that public/Catholic school differences in academic orientation cannot be explained by pre-

existing differences than does previous research. Second, the largest public/Catholic school differences occurred for course selection variables constructed by HSB staff on the basis of the actual high school transcripts for each student (e.g., number of credits in academic courses and the concentration of mathematics courses). These variables were not readily available to researchers who conducted analyses on the second wave of data and previous research typically relied on self-report surrogates of these more objective measures. Hence, the stronger findings apparently also reflect the better quality of some variables used here.

The HSB study is ideally suited for evaluating the effects of different types of schooling during the last two years of high school. Particularly once the second wave of data became available, apparently all HSB studies of public/Catholic school differences have been limited to this perspective. Using this perspective, public/Catholic differences in sophomore outcomes are treated as selection effects to be controlled in evaluating senior outcomes, even if they are legitimate school-type effects that occurred prior to collection of HSB data in the spring of the sophomore year. Alexander and Pallas (1985), as have others, noted this limitation in the HSB data, but added that "it would be a peculiar type of effective school that exhausted its impact after the first year or two" (p. 119). Lee and Bryk (1986), in their comparison of Catholic single-sex and coed schools, were even more concerned by this limitation and argued that sophomore outcomes should not be treated as covariates that are adjusted away. In support of their contention they noted that "for certain outcomes, such as attitudes towards academics or amount of homework, it was reasonable to hypothesize that these attitudes and behaviors are formed early in high school experience and remain relatively constant throughout the secondary years" (p. 385). If this does happen, then growth during the last two years of high school may underestimate true school-type effects. The problem, at least with the HSB data, is that for the sophomore variables there is no adequate basis for differentiating between true school-type effects and school-type differences that are due to pre-existing differences. This problem can, however, be addressed with the subsequent National Longitudinal Study that began in 1988, because data in this study were first collected in 8th grade prior to the typically beginning of high school.

Footnote.

1 -- The use of standardized beta weights to summarize public/Catholic differences in Tables 2 and 3 facilitates the comparison of differences across the different outcome variables. These standardized beta weights are not, however, directly comparable to effect sizes for achievement scores from other research (see Jencks, 1985, Table 2, columns 3 and 6). In the present study the public/Catholic variable was dummy-coded (Catholic = -3.574, Public=+0.279) so that the resulting dummy-coded variable was standardized (M=0, SD=1). Hence, public and Catholic students differed by 3.853 (3.574 + 0.279) standard deviations on this dummy coded variable. Multiplying the standardized beta weights in Tables 2 and 3 by 3.853 provides an estimate of public/Catholic differences in standard deviation units. These differences reflect growth during the last two years of high school so that dividing the values by 2 provides values comparable to differences in annual growth presented by Jencks (1985). For the academic achievement variables considered in both studies, public/Catholic differences based on the strong controls in Table 2 are similar to results presented by Jencks.

2 -- The four significant interactions suggested that: (a) public/Catholic differences in honors courses favoring Catholic schools were more likely for higher-ability students; (b) public/Catholic differences in the concentration of math courses favoring Catholic schools were larger for boys; (c) public/Catholic differences in the concentration of vocational courses favoring public schools were larger for girls; and (d) for boys but not girls there was a stronger concentration of math courses in single-sex Catholic than coed Catholic schools.

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Table 1

Public, Catholic Coed and Catholic Single-sex Means (unadjusted) and SDs

Variables	Public		Catholic Single-sex		Catholic Coeducational		Statistically Significant
	Mean	SD	Mean	SD	Mean	SD	Contrasts
Background Variables -- measured at individual level							
Sex	1.50	0.50	1.56	0.50	1.53	0.50	(none)
SES	-.05	0.71	0.36	0.68	0.33	0.65	(1,2,4)
Race--Black	0.12	0.33	0.05	0.22	0.04	0.19	(1,2,4)
Race--Hispanic	0.12	0.33	0.10	0.31	0.07	0.26	(1,4)
Single Parent	0.17	0.37	0.11	0.32	0.14	0.35	(1,2)
Repeated Grade	1.87	0.34	1.93	0.26	1.92	0.27	(1,2,4)
College Expect	2.31	0.81	2.67	0.62	2.58	0.69	(1,2,4)
Background Variables -- measured at the school level							
Mean SES	-.07	0.35	0.35	0.39	0.32	0.28	(1,2,4)
% Black	0.12	0.20	0.05	0.13	0.04	0.08	(1,2,4)
% Hispanic	0.12	0.14	0.11	0.14	0.08	0.09	(1,2,4)
Mean Coll Expct	2.28	0.29	2.68	0.18	2.58	0.23	(1,2,3,4)
% Single Parent	0.18	0.10	0.11	0.08	0.14	0.06	(1,2,3,4)
Achievement Outcome Scores (paired scores, 1980 and 1982)							
MathAch-yr10	22.05	13.34	27.41	11.56	26.59	11.54	(1,2,4)
MathAch-yr12	24.16	14.37	31.94	12.55	30.67	12.49	(1,2,4)
ReadAch-yr10	6.95	4.78	9.13	4.36	8.22	4.52	(1,2,4)
ReadAch-yr12	8.04	5.10	10.83	4.53	9.92	4.71	(1,2,4)
SciAch-yr10	9.12	4.57	10.04	4.06	10.24	3.95	(1,2,4)
SciAch-yr12	9.88	4.67	11.40	4.01	11.17	4.01	(1,2,4)
WriteAch-yr10	8.55	5.04	10.89	4.24	10.33	4.58	(1,2,4)
WriteAch-yr12	10.03	5.07	12.77	3.82	12.16	4.16	(1,2,4)
VocabAch-yr10	8.76	5.27	11.65	4.76	8.95	5.28	(1,2,4)
VocabAch-yr12	10.69	5.65	14.28	.41	13.46	4.74	(1,2,4)
Grades-yr10	5.51	1.56	5.95	1.42	5.88	1.44	(1,2,4)
Grades-yr12	5.61	1.45	6.11	1.32	6.01	1.34	(1,2,4)
Academic Orientation -- Course Selection and Homework							
MathPat-yr12	2.46	0.70	3.10	0.67	2.96	0.72	(1,2,4)
SciPat-yr12	2.30	0.85	2.79	0.80	2.68	0.80	(1,2,4)
VocatPat-yr12	2.80	0.88	2.18	0.76	2.25	0.73	(1,2,4)
AcadCrd-yr12	11.22	3.69	14.89	3.20	14.43	4.29	(1,2,4)
AcdTrack-yr10	0.32	0.47	0.69	0.46	0.57	0.50	(1,2,3,4)
AcdTrack-yr12	0.36	0.48	0.74	0.44	0.69	0.46	(1,2,4)
VocTrack-yr10	0.22	0.41	0.05	0.22	0.06	0.24	(1,2,4)

Table 1 Continued [b]

Variables	Public		Catholic Single-sex		Catholic Coeducational		Statistically Significant Tests
	Mean	SD	Mean	SD	Mean	SD	
VocTrack-yr12	0.30	0.46	0.10	0.30	0.11	0.31	(1,2,4)
Honors-yr10	1.25	0.38	1.31	0.41	1.26	0.38	(none)
Honors-yr12	1.24	0.36	1.34	0.41	1.32	0.40	(1,2,4)
Homework-yr10[a]	4.60	1.28	5.43	1.15	5.05	1.21	(1,2,3,4)
Homework-yr12	4.56	1.41	5.39	1.45	5.09	1.39	(1,2,4)
Affective and Attitudinal Outcomes							
Esteem-yr10	3.61	0.56	3.69	0.52	3.63	0.51	(none)
Esteem-yr12	3.76	0.52	3.82	0.54	3.78	0.49	(none)
Locus-yr10[a]	0.02	0.64	0.19	0.59	0.12	0.57	(1,2,4)
Locus-yr12	0.02	0.67	0.19	0.59	0.14	0.58	(1,2,4)
AcadSC-yr10[a]	0.03	0.59	0.14	0.55	0.08	0.55	(1,2)
AcadSC-yr12	-.02	0.74	0.13	0.68	0.08	0.71	(1,2)
Educ Aspir-yr10[a]	0.01	0.85	0.52	0.73	0.30	0.80	(1,2,3,4)
Educ Aspir-yr12	0.04	0.86	0.58	0.73	0.42	0.77	(1,2,4)
Parent Inv-yr10[a]	0.02	0.64	0.13	0.56	0.11	0.58	(1,2)
Parent Inv-yr12	-.01	0.67	0.15	0.56	0.15	0.53	(1,2,4)
Trouble-yr10[a]	-.05	0.59	-.16	0.49	-.14	0.49	(1,2,4)
Trouble-yr12	0.02	0.62	-.08	0.56	-.10	0.58	(1,2,4)
Post-Secondary Outcome Variables (based on 1984 data)							
Post-Secondary	3.35	3.50	5.53	3.24	5.23	3.29	(1,2,4)
Unemployed	0.08	0.35	0.02	0.18	0.02	0.16	(1,2,4)
Discipline-Policy Related Variables (school-average responses)							
Trouble	0.04	0.49	-.32	0.44	-.28	0.28	(1,2,4)
No. of Rules	0.57	0.12	0.67	0.12	0.75	0.09	(1,2,3,4)
Problems	1.94	0.15	2.42	0.17	2.38	0.14	(1,2,3,4)
Safety	1.91	0.06	1.95	0.04	1.94	0.03	(1,2,3,4)
Effectiveness	2.43	0.24	3.10	0.30	2.91	0.27	(1,2,3,4)
Fairness	2.30	0.23	2.55	0.23	2.38	0.27	(1,2,3,4)
Strictness	2.51	0.29	3.09	0.38	2.99	0.31	(1,2,3,4)

Note. See Appendix for a description of the variables. All values are based on the weighted sample sizes with no adjustments for other variables.

[a] Sophomore (yr10) and senior (yr12) are not directly comparable because of differences in the response scale or because the responses were standardized separately in each year.

[b] Four contrasts were used to compare unadjusted group means: (1) Public vs. Catholic, (2) public vs. SS Catholic, (3) Public vs. Coed Catholic, and (4) Coed Catholic vs. SS Catholic. Those comparisons that were statistically significant ($p < 0.05$) are indicated by number under the column labeled statistically significant contrasts.

Table 2

Standardized Beta Weights Relating School Type Contrasts and Selected Interaction Terms to Senior and Post-secondary Outcome Variables.

Senior/ Post-Second Outcome	Group Comparisons with Weak Controls			Group Comparisons with Strong Controls			Inclusion of 12 Interaction terms to Strong Controls Model [a]	
	Pub/ Cath	SS/ Coed	Mult R SQ	Pub/ Cath	SS/ Coed	Mult R SQ	Change in R Sq for all 12 terms	Statistically Significant Terms
Achievement Scores								
Math	-04##	-01	737	-02##	00	771	000	none
Read	-04##	-01	568	-03#	-01	648	000	none
Science	-02#	-01	566	00	00	627	000	none
Writing	-04##	-01	564	-03#	00	629	001	none
Vocab	-04##	-01	655	-03##	-01	709	001	none
Grades	-03#	-01	551	-04##	00	581	000	none
Academic Orientation -- Course Selection and Homework								
MathPat[b]	-12##	-01	279	-12##	-01	450	002	Pub-Sex SS-Sex
SciPat[b]	-05##	-01	236	-05##	00	386	002	none
VocatP[b]	10##	00	211	08##	-01	270	002	Pub-Sex
AcadCrd[b]	-15##	00	290	-13##	00	426	002	none
AcdTrk	-09##	00	313	-08##	01	415	001	none
VocTrk	06##	00	149	03#	-01	211	001	none
Honors	-04##	00	210	-03#	01	299	003	Pub-Ach
Homework	-05##	-01	283	-04##	-01	320	001	none
Attitudes and Behaviors								
Esteem	-01	00	156	-01	00	179	000	none
Locus	-01	00	242	00	00	306	000	none
AcadSC	-02	00	284	00	00	392	000	none
EdAspir	-04##	00	467	-02	00	517	001	none
PrntInv	-03	00	186	-03#	01	229	001	none
Trouble	03#	-01	237	03#	-01	261	001	none
Post Secondary Outcomes								
PostSec	--	--	--	-04##	00	390	001	none
Unemploy	--	--	--	01	00	052	001	none

Table 2 Continued on Next Page

Table 2 Continued

Note. See Appendix for a description of the variables. All coefficients are presented without decimal points. Public/Catholic (Pub/Cath) and Single-sex/coed (SS/coed) effects are standardized beta weights resulting from a series of multiple regressions. Positive coefficients represent higher scores in public schools than Catholic schools and higher scores in coed schools than single-sex schools respectively. Each senior and post-secondary outcome was related to school-type contrast variables (i.e., orthogonal group comparisons), the matching sophomore outcome, sex, SES, and race (Weak Controls), and to all sophomore outcomes and all background variables (Strong Controls).

* $p < 0.05$; ** $p < 0.01$.

[a] The inclusion of all 12 interaction terms did not result in a statistically significant change in R^2 for any of the outcomes. For a few outcomes, sex interacted with the Public/Catholic contrast (Pub-Pub) or the Catholic single-sex/coed contrast (Sex-SS) and overall achievement interacted with the public/Catholic contrast (Ach-Pub) as indicated.
[b] These senior outcomes had no matching sophomore outcome and so the three sophomore course selection variables (academic track, vocational track, and honors) were used for purposes of the weak control.

Table 3

Standardized Beta Weights Relating Group Comparisons to Senior and Post-secondary Outcome Variables After Controlling for All Background and Sophomore Outcomes (Strong Controls) and Two Sets of Policy-related Variables

Senior & Post Secondary Outcome	Strong Controls and Discipline Policy Variables			Strong Controls and Academic Orientation Policy Variable		
	Pub/ Cath	SS/ Coed	Chng in R2	Pub/ Cath	SS/ Coed	Chng in R2
Achievement Scores						
Math	-02$	00	001$	00	00	017$$
Read	-03$$	-01	000	-01	-01	004$$
Science	00	-01	001$	01	00	006$$
Writing	-02	00	001	-02	00	007$$
Vocab	-04$$	00	001	-02	-01	003$$
Grades	-02	-01	002$	-02	00	014$$
Academic Orientation -- Course Selection and Homework						
MathPat	-10$$	-01	002	--[a]	--	--
SciPat	-05$$	00	003$	--	--	--
VocatP	08$$	-01	002	--	--	--
AcadCrd	-08$$	00	007$$	--	--	--
AcdTrk	-06$$	01	002$	--	--	--
VocTrack	02	-01	002	--	--	--
Honors	-02	01	001	--	--	--
Homewrk	-03	00	002	--	--	--
Attitudes and Behaviors						
Esteem	01	-01	001	-01	-01	004$$
Locus	01	00	002	00	00	004$$
AcadSC	01	01	000	01	00	032$$
EdAspir	-03$	00	001	01	00	037$$
PrntInv	-01	00	002	-02	01	009$$
Trouble	02	-01	019$$	02	-01	015$$
Post Secondary Outcomes						
PostSec	-04$	00	002	-01	00	044$$
Unemploy	-01	00	003	00	-01	004$

Note. See Appendix for a description of the variables. All coefficients are presented without decimal points. Public/Catholic (Pub/Cath) and Single-sex/coed (SS/coed) effects are standardized beta weights resulting from a series of multiple regressions. Each senior and post-secondary outcome was related to the two school-type variables with all sophomore outcomes and all background variables (Strong Controls) and one of two sets of policy related variables. For purposes of these analyses, senior outcome variables consisting of the course selection variables and the academic effort variables were considered to be policy related variables reflecting academic orientation.

[a] For this analysis these senior outcomes were used as policy-related variables reflecting academic orientation instead of outcomes variables.

$ p <0.05; $$ p <0.01.

Appendix

Definition of Variables Considered

Variables	Description
School-type Variables	
Pub/Cath	[HSTYPE] 1=public school, -1=Catholic single-sex school, -1=Catholic coed school (after standardization to Mn=0, SD=1, values were .279, -.3574 and -.3574 respectively).
SS/Coed	0=public school, -1=Catholic single-sex school, +1=Catholic coed school.
Background Variables -- measured at individual level	
Sex	[SEX] 1=male, 2=female
SES	[BYSES] 1980 Composite socioeconomic status based on father's occupation, father's education, mother's education, family income, and material possessions in the home (higher values reflect higher SES).
Race--Black	[Race2] Ethnicity is Black. (1=yes, 0=no)
Race--Hispanic	[Race2] Ethnicity is Mexican, Cuban, Puerto Rican, or other Hispanic. (1=yes, 0=no)
Single Parent	[BB036B, BB036C, BB036D, BB036E] Respondent did not live with either father (or stepfather or other male guardian) or mother (or stepmother of other female guardian). (1=yes, 0=no)
Repeated Grade	[FY59] Ever held back or repeated a grade. (1=yes, 2=no)
College Expect	[YB068A] College expectations in 8th grade (1=no, 2=not sure, had not thought about it, 3=yes).
Background Variables -- measured at the school level	
Mean SES	school average of SES composite (see above)
% Black	school average of Race-Black (see above)
% Hispanic	school average of Race-Hispanic (see above)
Mean College Expectation	school average of college expectations (see above)
% Single Parent	school average of Single Parent (see above)
Achievement Outcome Scores (paired scores, 1980 and 1982)	
MathAch	[YBMTH1FS, YBMTH1FS; FYMTH1FS, FYMTH1FS] sum of formula scores for part 1 and 2 of the math tests
ReadAch	[YBREADFS; FYREADFS] reading test formula score
SciAch	[YBSCINFS; FYSCINFS] science test formula score
WriteAch	[YBWRITFS; FYWRITFS] writing test formula score
VocabAch	[YBVOCBFS; FYVOCBFS] vocabulary test formula score
Grades	[BB007; FY7] Self-reported high school grades so far (8=mostly A's, 7=half A's, half B's, 6=mostly B's..,1=mostly D's)

Academic Orientation -- Course Selection and Homework

MathPat	[MATHPATN] In 1982 the math course-taking pattern (4=concentration, 3=college-bound, 2=general studies, 1=limited or non-participant)
SciPat	[SCIPATN] In 1982 the math course-taking pattern (4=concentration, 3=college-bound, 2=general studies, 1=limited or non-participant)
VocatPat	[VCONPATN] In 1982 the math course-taking pattern (4=concentration, 3=limited concentration, 2=sampler, 1=non-participant)
AcadCrd	[NEWBASE] In 1982 number of credits in six academic areas.
AcdTrack	[BB002; FY2] In 1980 and 1982 participated in academic track (1=yes, 0=no)
VocTrack	[BB002; FY2] In 1980 and 1982 participated in vocational track (1=yes, 0=no)
Honors	[BB011C,BB011D; FY9C, FY9D] In 1980 and 1982, the mean of affirmative responses to taking advanced or honors courses in English and mathematics (1=none, 1.5=one only, 2=both).
Homework	[BB015; FY15] Time per week spent on homework. (2=none, 3=less than 3 hours,...,8=15 hours a week or more)

Affective and Attitudinal Outcomes

Esteem	[BB058A, BB058B, BB058D, BB058H, BB058L; FY75A, FY75B, FY75D, FY75H, FY75L] A composite variable consisting of the mean of 6 items similar to those on the Rosenberg's (1965) self-esteem scale. (higher values reflect more positive scores)
Locus	[BBLOCUS, FYLOCUS] composite locus of control (higher values reflect a more internal locus)
AcadSC	A composite variable constructed from responses to one cluster of 8 dichotomous items that refer to attitudes toward English [YB035A-YB035D] and mathematics [YB035E-YB035H] (e.g., I dread English (mathematics) classes; English (mathematics) class does not scare me at all), and 3 items asking if respondent is interested in school [BB059C], is seen by others as a good student [YB053D], and has the ability to complete college [BB069]. The standardized mean of the first eight items was averaged with the standardized means of the other three items in 1980. Because the first cluster of 8 items was not included in 1982, only the mean of ths standardized responses to the other three items was used (higher scores reflect more positive academic self-concepts).
Educat Aspir	[BB061G, BB065, BB067; FY76G, FY80, FY82] Mean of z-score responses asking whether disappointed if do not graduate from college, expected level of schooling and lowest level of schooling satisfied with (higher scores reflect higher educational aspirations).
Parent Invol	[BB046A-BB046C, BB047G; FY57A-FY57C, FY60G] Mean of z-score responses asking if mother and father monitor school work, if parents know what I'm doing, and if I spend time talking to my parents (higher scores reflect greater parental involvement).
Homework	[BB015; FY15] Time per week spent on homework. (2=none, 3=less than 3 hours,...,8=15 hours a week or more)
Trouble	[YB053F, BB059B, BB059D, BB059F, BB061A; FY74F, FY66B, FY66E, FY66F, FY76A] Mean of z-score responses asking if others see you as a trouble maker, if had disciplinary problems in school, if suspended from school, if cut classes, and if had serious trouble with the law. (higher values reflect more trouble).

Post-Secondary Outcome Variables (based on 1984 data)

Post-Secondary	[PSESOC82, PSESFE82,PSESOC83, PSESFE84] Sum of activity variables indicating student was not a student (0), was a part-time student (1), or was a full-time student (2) at some form of post-secondary institution at each of four points in time.
Unemployed	[JOBSOC82, JOBSFE82, JOBSOC83, JOBSFE84] Sum of activity variables indicating student was neither employed (full or part-time) nor a student (full or part-time) at each of four points.

Discipline-policy Related Variables -- measured at the school average level

Trouble	Mean of school-average sophomore and senior responses to Trouble composite (see above)
No. of Rules	Mean of school-average sophomore (YB020A-YB020F) and senior (FY20A-FY20I) responses to items asking if various rules (e.g., rules about hall passes, smoking, dress, leaving school at lunch) are enforced. (higher values reflect more rules)
Problems	Mean of school-average sophomore (YB019A-YB019F) and senior (FY20A-FY20F) responses to items asking the extent to which various discipline problems (e.g., students not attending classes, cutting classes, fighting among students) exist (1=often,...,4=rarely or never)
Safety	Mean of school-average sophomore (BB059F) and senior (FY66G) responses to item: I don't feel safe at this school. (1=true, 2=false)
Effectiveness	Mean of school-average sophomore (BB053F) and senior (FY67FG) responses to item: rate effectiveness of discipline at this school (1=poor,...,4=good)
Fairness	Mean of school-average sophomore (BB536) and senior (FY67FH) responses to item: rate fairness of discipline at this school (1=poor,...,4=good)
Strictness	School-average senior (FY67FG) responses to item: rate strictness of discipline at this school (1=poor,...,4=good)

Note. Values in brackets refer to variables names used on the HSB data file. Those starting with BB or YB come from the 1980 (sophomore) survey, and those starting with FY come from the 1982 (senior) survey. Most outcome variables for the sophomore and senior years are paired, and unless otherwise noted, are defined with parallel variables from the two surveys. For all composite variables consisting of the mean of specific indicators, the mean of all non-missing values was computed and a missing value was assigned only if all the variables were missing.