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ABSTRACT

Although the effort to restructure the American high school is in high gear, little attention has been directed to how changes in high schools' organizational structures might affect the dynamic of equity in student learning--the ways that schooling outcomes reflect students' social background. This paper aims to identify organizational properties of schools that are simultaneously associated with both effectiveness and equity, with a focus on equity. The investigation addresses the ways that achievement gains in mathematics and science correspond to the social distribution of family socioeconomic status. Using data from the first three waves of the National Education Longitudinal Study (1988), researchers compared the equity of achievement between schools that follow restructured reform practices to those following more traditional practices. In addition to finding improved achievement and equity in restructuring schools, the study identified specific characteristics of these schools' academic and social organization that help explain their improved student performance. These include smaller school size; a restricted, unified academic curriculum; and a strong commitment to viewing learning resources as a public, rather than a private good. Included are several tables and 36 references. (Author/MLH)

High School Restructuring and the Equitable Distribution of Achievement

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ABSTRACT

Although the effort to restructure the American high school is in high gear in the educational policy arena, surprisingly little attention has been directed to how changes in high schools' organizational structures might affect the dynamic of *equity* in student learning -- the ways that schooling outcomes reflect students' social background. The purpose of this paper is to identify organizational properties of schools that are simultaneously associated with both effectiveness and equity, with a focus on the later. Our investigation focuses on achievement gains in mathematics and science, addressing the ways that achievement gains correspond to the social distribution of family socioeconomic status (SES). Using data from the first three waves of the National Educational Longitudinal Study of 1988 (NELS:88), we compare the equity of achievement between schools which follow restructured reform practices to those which follow more traditional practices. In addition to finding improved achievement and equity in restructured practice schools, we identified specific characteristics of these schools' academic and social organization which help explain their improved student performance.

Although the effort to restructure the American high school is in high gear in the educational policy arena, surprisingly little attention has been directed to how changes in high schools' organizational structures might affect the dynamic of *equity* in student learning -- the ways that schooling outcomes reflect students' social background. Much of the rhetoric underlying calls to reform schools focuses instead on increasing national competitiveness in economic and military terms (National Commission on Excellence in Education, 1983; National Governors' Association, Center for Policy Research and Analysis, 1991). Although the public remains quite conscious of a dire need to move our schools towards excellence (i.e., higher achievement), many appear to believe that efforts toward educational equity act in opposition to this aim. Weis (1988) writes, "Education plays a crucial role in both offering opportunities for individual mobility and at the same time legitimating large-scale structural inequalities." Short of massive early childhood programs to bring all children to a comparable level of experience with learning at the point they enter school, the major solution to this dilemma rests in the approximately 15,000 hours of schooling students receive in elementary and secondary school (Rutter, et al., 1979).

The purpose of this paper is to identify organizational properties of schools that are simultaneously associated with both effectiveness and equity, with a focus on the later. We locate our investigation of schools' organizational and structural properties within the current policy arena of school restructuring. To focus this complex topic somewhat, we limit our investigation to achievement gains in mathematics and science, as students most commonly learn these subjects in the classroom. Further, we focus on the social distribution of achievement gains relative to one student background characteristic: family socioeconomic status (SES), although we take other social characteristics into consideration. We use data from the first three waves of the National Educational Longitudinal Study of 1988 (NELS:88) to explore these issues.

BACKGROUND

The American class structure is built, at least in part, on the status and creditionals afforded by schooling (Collins, 1979). Some argue that unequal treatment of individuals in school, and the stratified learning that results from differential treatment, simply reflects a meritocratic (and desirable) society (Herrnstein & Murray, 1994; Wallace, 1995). Who receives what type of education has become part of a broader dynamic of inequality in the United States (Oakes, 1985; Powell, Farrar, & Cohen, 1985). But Americans also argue that education should serve as a central path to upward social mobility. Considering these somewhat conflicting ideologies, it becomes important to examine whether the structure of our schools might affect not only the overall level of achievement (excellence) but also the corresponding way that achievement is "distributed" within the society by social background (equity).

Defining the Social Distribution of Achievement

The idea that differences in students' school experiences could mediate the link between social background and academic achievement has been called the "social distribution of achievement" (Lee and Bryk, 1988). The concept includes characteristics measuring both the school's effectiveness in increasing student achievement and the equitable distribution of these performance indicators across students of differing backgrounds. A school's "effectiveness" in this definition would be captured by the school's average change (i.e., gain) in student achievement in a particular subject area. The "equity" parameter comes from the relationship between student gain and student background. Small (or no) differences in gains between students of different social status would be more equitable, while large differences would reflect socially stratified learning.

To clarify our meaning of effectiveness and equity, we present four hypothetical comparisons between two schools. Each comparison, displayed in Figure 1, depicts the relationship between student SES (on the horizontal axis) and gains in academic achievement (on the vertical axis) in two different schools.[1,2]

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Insert Figure 1 about here
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All four comparisons in Figure 1 start with the relationship between SES and achievement gains in an average school (School X, given by a solid line). For middle-class students in School X, gains in achievement are average (i.e., 0). For students in School X who are higher (or lower) on the socioeconomic ladder, their achievement gains reflect a 0.5 shift, or a one-half standard deviation in gain. Each comparison shows the contrast between School X with a different school (School Y, the dashed line), varying in both effectiveness and equity.

- In Condition A, students in School Y have a higher than average gain in achievement, which we have characterized as more "effective." However, the relationship between SES and gains in achievement in this school is much higher -- in this school, one's place on the socioeconomic ladder is more closely linked to academic learning in school. Because the separations between students in this school are larger than in School X, we characterize this relationship as <u>less</u> equitable.
- In Condition B, School Y is also more effective than School X. However, in this case School Y also provides a <u>more</u> equitable learning environment -- differences in students' social background are not as strongly linked to student gains in achievement as in School X.
- In Conditions C and D, School Y is less effective than School X -- the average gain for students in these two School Ys is below the overall average. However, in Condition C, School Y is a more equitable environment, while in Condition D School Y is both less effective and less equitable.

We argue that School Y in Condition B represents the most desirable combination of learning conditions. That is, in our definition a school must be both effective <u>and</u> equitable to qualify as a "good" school. In such a school, student gains in achievement are improved for all students, with particular advantage experienced by students from lower than average SES families. On the other hand, although students attending School Y in Condition A also have above-average gains in achievement, the major advantages in this school accrue to students from more advantaged families. We argue that a more equitable distribution of learning is meaningless if it does not occur in a more effective learning environment.

Although the conditions in Figure 1 are hypothetical, the contrasts underpin the meaning of the characteristics of high schools under scrutiny in this paper. Our investigation seeks to identify characteristics of schools which are simultaneously related to higher average achievement and to a more equitable social distribution of achievement among students -- those of School Y in Condition B.

Effects of Restructuring on the Social Distribution Of Achievement

Defining school structure. The structure of an organization refers to the type, character, and number of relationships between different members around its technical core (Mintzberg, 1979; Simon, 1957). In a high school, the technical core centers on educating students, and so its organizational structure is determined by relationships between teachers and students (to deliver that education), teachers and administrators (around resources needed for education), and administrators and students (around the management of student activity). In the abstract, one can characterize any organization by the functional task specificity and work conditions involved (Burns & Stalker, 1961). When work is highly predictable and routine (such as placing a cog in a machine), relationships among workers at different levels tend to be formal, impersonal, even automated. Conversely, when work is unpredictable or ill-defined (such as solving a crisis), relationships are typically more fluid and informal, shifting to meet the changing situations as needed (Rowan, 1990).

The work done in schools challenges this contrast. Some tasks performed by teachers, administrators, and students fit the model suggested by the "routine" paradigm -- for example, grading papers, taking attendance, or finishing worksheets. However, other aspects of a school's work environment change constantly, requiring frequent revision to maintain even the most limited control, much less accomplish the highly complex tasks of teaching and learning complicated material. To further challenge classical organizational definitions, high school organizations also reflect some aspects of professional work. Instruction tends to be compartmentalized into different pieces or "subjects," each with its own set of specialists grouped into departments. In this regard, teachers function in the role of knowledge experts. Thus, high schools tend to combine a bureaucratically governed, mechanical task structure with a professional commitment to shared authority base resting on specialized knowledge and expertise over complex tasks. It is this combination of organizational structures with which we approach the problem of equity among students in their learning.

School reform and equity. Public opinion about what type of school organization best accomplishes the goal of increased equity for all students has come almost 180 degrees from the turn of the century. In the early 1900's, the provincialism of small communities tended to be viewed as a source of bias and bigotry which underpinned subsequent social differences in opportunity and access to limited resources (Conant, 1959; Taylor, 1911). As reformers worked to improve schools at the turn of the century, they argued that the "problem" to be solved was that schools were too deeply entrenched in tradition, and that authority was based more on personal charisma than on legitimate legal or rational grounds (Weber, 1924). To solve this problem, reforms aimed at depersonalizing authority, legitimizing formal or legal mechanisms in place of personal opinion and socially constructed values (Weber, 1924). With a legal-rational authority in place, it was believed that decisions about schooling for different types of students would be less influenced by personal prejudice or bias (Cremin, 1988). As a result, reforms leading schools out of the ninteenthth century shaped organizational structure in the direction of more hierarchical authority, and more formal and impersonal relations between teachers and students (including increasing the number of teachers a student saw per day). To better accomplish the goal of efficiency, an economy of scale argument supported increasing school enrollments, so that larger groups of students could be served within a more rigidly differentiated curriculum ((Conant, 1959). These changes became the "bureaucratic tradition" against which current efforts to reform the structure of schools are now directed.

In contrast, recent efforts to "restructure" schools turn away (at least in part) from impersonal hierarchical structures which emphasize autonomy and control. Instead, reformers favor lateral communication and collaborative work among teachers (Elmore, Peterson, & McCarthy, 1995). They also emphasize increased concern for common or "core" instructional experiences which all students share Newmann & Wehlage, 1995). For example, an influential research strand demonstrated weaker relationships between social background and academic achievement in Catholic than public schools -- i.e., that contemporary Catholic schools more closely resemble the American "common school" ideal (Coleman, Hoffer, and Kilgore, 1982; Greeley, 1982;

Jencks, 1985). Explanations for this effect have focused on three major structural distinctions between Catholic and public schools -- their academic, normative, and communal organizations (Bryk, Lee, and Holland, 1993; Lee and Bryk, 1988, 1989). This research suggests that equity in learning rests -- at least in part -- on informal personal relationships, in a school environment that emphasizes academic norms and values.

The research described in this paper builds on the organizational implications of that work. We begin by asking whether schools that have "restructured" in some way function more effectively and equitably for students. If so, we ask whether the curriculum, instruction, and/or normative characteristics of these restructured schools also show more equitable outcomes for students. Do the effects of restructuring increase when these organizational factors are taken into account, or do these factors account for overall differences between restructured and traditional schools?

METHOD

Research Structure

This research draws on results from two studies sponsored by the Center on Organization and Restructuring of Schools (CORS). Both studies estimate the effects of school restructuring on student learning (Lee and Smith, 1995; Lee, Smith, and Croninger, 1995). Study 1 (Lee and Smith, 1995) focused on the effects of school restructuring and size on student gains from 8th to 10th grade, as well as their effects on the social distribution of those gains across students of different social class backgrounds. Study 2 (Lee, Smith, and Croninger, 1995) extended this analysis to the effectiveness and equity in gains from 10th to 12th grade, and included "explanatory" aspects of school academic and social organization to explore whether these features contributed to, or explained away, the restructuring effects on student gains documented in Study 1. This paper expands on these results, drawing special attention to the findings concerning the social distribution of achievement in high schools.

Sample and Data

The sample for Study 1 was drawn from the first and second waves of the National Educational Longitudinal Study of 1988 (NELS:88), a general-purpose study of the educational status and progress of a large and nationally representative sample of 8th grade students in middle-grade schools sponsored by the National Center for Education Statistics in the U.S. Department of Education. About 25 eighth-grade students in each of about 1,000 American middle-grade schools were randomly drawn in the base year of 1988 (about 22,000 students). In 1990, a locator questionnaire completed by 8th graders helped trace the same students to high school. Despite obvious difficulties in locating students, response rates were reasonably high. These students were surveyed again in 1992.

The sample for Study 2 consisted of all 12th graders from the original sample with (a) full cognitive test-score data from both waves; (b) data from students' high schools and teachers; (c) only students enrolled in public, Catholic, or elite private secondary schools; and (d) only students attending high schools with at least 5 NELS:88 sampled students (Lee, Smith, & Croninger, 1995). The final sample included 9,449 sophomores in 773 high schools. The large majority (670) were public schools, with fewer Catholic (54) and independent (49) secondary schools. We constructed a set of "pseudo-design weights"[3] for the high schools attended by the NELS:88 students in our samples to at least partially adjust for the original design oversampling.

Measures[4]

Dependent measures. Study 1 had five dependent variables -- achievement gains in mathematics, reading, history, and science from 8th to 10th grade, as well as gains in academic engagement over that period. Of these, we focus on math and science gains for this study, to draw more complete comparisons to Sudy 2.[5] These curriculum areas were chosen for both theoretical and practical reasons. As stated earlier, gains in mathematics and science tend to be more directly linked to school instruction. In addition (from a practical standpoint), these two areas also had available information concerning the course content and instruction received by students during high school.

Test scores at all waves were scaled with Item Response Theory (IRT) methods to adjust for relative item difficulty and other psychometric properties of multiple choice tests. For Study 1, difference scores between 8th and 10th grade thus measure student growth on an interval scale which spans ability levels. Using this form of difference score eliminated the problem of spurious correlations among the standard error of measures estimated on the same persons over time. In Study 2, achievement data were available on all students at 8th, 10th, and 12th grades, allowing us to generate a growth trajectory using test-scores "nested" within students. This construction of achievement as a linear function of initial status varying by time established estimates of both 8-10th grade gains and 10-12th grade gains. We then examined both estimates as independent parameters net of measurement error. The initial status at 8th grade was held constant, taken into account as a student characteristic. For the analyses in Study 2, we used three-level hierarchical linear model (HLM) methods -- building from test scores to student differences to school effects. The equations used to estimate each of these models is provided in Appendix A.

Measuring school restructuring. The logic underlying our definition of the construct of restructuring combined two criteria: (1) a de-emphasis of hierarchical control and decision-making characteristic of bureaucratic organizations, and (2) a somewhat more practical definition of restructuring as a "substantial departure from conventional practice." We used school reports of their adherence to a set of reform practices. Those practices that moved high schools away from a bureaucratic tradition fell into three areas: (1) reorganized instruction toward more flexible and interactive teaching (mixed ability classes, cooperative learning, increased independent study, flexible class periods); (2) reorganized administrative and teacher authority toward more lateral and shared control (interdisciplinary team teaching, students evaluating teachers, staff solving school problems); and (3) increased informal contact among different constituencies (parent volunteers, teachers extending contact with students over several years, common planning time for teachers, schools-within schools). The remainder of the practices surveyed by NELS tended to increase hierarchical authority (i.e., increased use of department

divisions), kept teachers subordinate to administrators (i.e., increased use of formal rewards for teaching), or increased requirements for students (i.e., stricter discipline codes, more stringent graduation requirements). These reform practices were labeled "traditional."

High schools were then characterized according to their responses as to which of the reform practices they followed. A small group of schools (12%) reported they did not use any of the reform practices surveyed by NELS - traditional or restructured. These schools, referred to as "No Reform" schools[6] were kept in the analysis but are considered outside the primary contrast of traditional vs. restructured practice schools. Of the schools remaining, the critical contrast was between schools which had incorporated at least a few of the non-traditional practices into their organization to those which did not. A number of the schools (39%) reported engaging in at least three of the restructuring practices concerning instruction, authority, or communal relationships in the school.[7] These schools were identified as "restructured practice" schools. The other schools (49%) reported involvement only in those practices which follow more formal separation and hierarchical control structures in the school. These schools were identified as "traditional practice" schools.

School size. A movement away from large high schools is consistent with efforts to restructure schools along other dimensions. For example, increased personal attention and support tends to be easier to provide when teachers are more closely acquainted with fewer students (Newmann & Wehlage, 1995). In addition, when enrollment size is smaller, the academic curriculum tends to vary less between students (Monk & Haller, 1992). Thus, we also investigated the effects of high school size. Because the variable measuring total school enrollment was negatively skewed, we used a logarithmic transformation in multivariate analyses.

Academic organization. We included several measures of academic organization to possibly explain the impact of school restructuring on effectiveness and equity in student achievement.

- Students' average coursetaking in academic mathematics and science operates as a proxy measure for the level of *constrained academic curriculum*.

- We considered the standard deviation of academic coursetaking to measure the amount of *variability in students' academic experiences*.

From teacher surveys, we constructed two measures relating to instruction:

- Reports of math and science teachers' use of *authentic instruction in mathematics and science*, captures teachers' use of instruction requiring a greater level of student activity, direction, and critical thinking. This measure was aggregated to the school level.

- The standard deviation of this measure in each school taps the degree to which all teachers use this type of instruction: the *variability in instructional experiences* for students in the school.

Social organization. We also considered the possibility that schools with restructured practices could function under different normative cultures. To this end, we explored the impact of two measures of a school's social organization:

- An school average reflecting *collective responsibility for student learning*, taps teachers' willingness and feeling able to alter teaching methods to respond to the learning needs of their students.

- A composite of administrator reports concerning the *academic press* of the school, captures the normative stance taken toward students and teachers concerning the value of academic work in the school.

Control measures. Both studies employed the same sets of control measures for both students and schools. Student controls included minority status, gender, academic engagement, and ability at high-school entry. Student SES was the principal indicator of social status. School controls included average school SES, minority concentration, and sector (contrasting Catholic and independent private schools to public schools).[8]

Analytic Approach

We began by summarizing observed differences between the three groups of schools we established -- the actual average gains in different types of schools with different average SES (as hypothesized in Figure 1). As Studies 1 and 2 both explored the effects of schools on students, the appropriate method is multilevel -- i.e., one that takes into account two basic analytic problems: (1) that measurement of performance over time is idiosyncratic to individual students, and (2) that different students do not experience education in the same school uniformly. We used hierarchical linear modeling (HLM) to capture the variation both within-

and between- levels (performance within students, students within schools) in this complex structure.

RESULTS

Observed Differences Related to Restructuring

Differences between schools. A series of comparisons between schools characterized as "traditional" or "restructured" is displayed in Table 1. To simplify interpretation, we present only the statistical significance of these differences (tested with t-tests), in symbolic form. Effects designated with a "+" indicates that schools with restructuring practices are higher than traditional practice schools; those with a "-"are differences in which the restructuring practice schools are lower. A larger number of +'s or -'s indicates a stronger effect.

Insert Table 1 about here

Restructured practice schools tended to have higher average student SES and higher entering aptitude for students than traditional practice schools. Similarly, more of these schools were Catholic and independent (NAIS) schools. However, there were no significant differences in either minority enrollment or enroliment size. In addition, restructured practice schools were somewhat higher than traditional practice schools in measures of social organization described earlier, reporting a stronger level of collective responsibility for learning and a somewhat stronger academic press placed on students. Finally, restructured practice schools showed some different patterns than traditional schools in their academic organization -- higher average levels of academic coursetaking and authentic instruction with less variability among students in those practices.

The pattern of school differences consistently favored restructured practice schools in both the students who attend them and the organizational features that define them. These results lead to the next set of analyses, in that they show the importance of taking student differences into account when estimating the effects of restructuring on achievement *within* those schools. In our next analysis, we explore the effects of restructuring practice compared to traditional practice on

the students who attend those schools, after adjusting for other confounding factors contributing to student learning.

The Effect of Restructuring on the Social Distribution of Achievement in Schools.

Table 2 presents a summary of the effects of restructuring on (1) gains in achievement over the course of high school, and (2) on the relationship between SES and gains. These estimates take into account both student and school structural and demographic controls described earlier. Although the results are presented on two different types of outcomes -- average achievement gains (effectiveness) in the top panel, SES /gain slopes (equity) in the bottom panel, the effects on both gains and slopes were computed simultaneously in the same HLM model for each subject area. To simplify interpretation, we again present these effects in symbolic form, where effects designated with a "+" represent a positive effect, and those with a "-" a negative effect. A larger number of +'s or -'s indicates a stronger effect relative to its standard error.

The direction and magnitude of effects in Table 2 is directly tied to the models in Figure 1 that describe the interrelationship between effectiveness and equity parameters. Recall that School Y in Condition B is both more effective and more equitable than the standard (School X). Under those conditions, its intercept is higher and its slope flatter. Thus, school organizational characteristics that are simultaneously *positively* related to the intercept (the upper panel of Table 2) and *negatively* related to the SES/gain slopes (lower panel of Table 2) are most favorable. These characteristics describe a school that is both more effective and also more equitable for students -- i.e., more like School Y in Condition B.

Insert Table 2 about here

Table 2 shows that restructured practice schools fit these two criteria. Students in those schools learned significantly more than those in schools with traditional practices only. In addition, achievement gains were more equitably distributed in restructured practice schools -- the amount of math and science learning did not depend as much on a student's SES.

The pattern of findings relating to school size is equally clear: larger schools were both less effective and less equitable. The amount of math and science learned in high school was less in schools with more students (i.e., large negative effects on the average gains), and student SES had a stronger relationship with learning in larger schools (i.e., positive effects on the SES-gain slopes). These findings provide important evidence that learningis both more effective and more equitably distributed in smaller schools.

Organizational explanations of restructuring effects. Although Table 2 demonstrates that schools with restructured practices fit the criteria we have defined for effective and equitable learning environments, it is not clear what these effects actually mean. While the classifications capture the presence or absence of particular practices, there may be other aspects of the school organization that are related both to the likelihood of a school engaging in these practices and to a school's organizational capacity for enhancing student learning. Table 3 displays the results of a further set of HLM analyses, in which we have added the organizational features (shown in Table 1) to the models (shown in Table 2) Our purpose here is twofold: (a) to identify organizational characteristics of schools that themselves influence effectiveness and equity in science and mathematics learning, and (b) to determine whether these characteristics alter the comparison of schools with reform practices classified as traditional or restructured.

Insert Table 3 about here

A major finding from Table 3 is that the organizational characteristics with which we have defined schools meets the criteria established for School Y, Condition B in Figure 1. These conditions are coincident with more student learning and a reduced link between learning and SES in a given school. In this sample, a school which emphasized more *collective responsibility for learning* and had a stronger *academic press* also had, on average, more learning (as indicated by the +'s in the top panel) and did so with less regard for student SES (as indicated by the -'s in the lower panel). In addition, schools in which students took more academic courses in mathematics and science and were exposed to more authentic instruction in these subjects had

higher average learning gains. These characteristics, however, had few effects on the SES/gain slopes (as indicated by small or 0 effects in bottom panel). Conversely, the degree of *variability* between students -- in both the *number of academic math and science courses taken* and their exposure to *authentic instruction* -- showed the opposite pattern. While increased variation between students did not influence average gains, more variability in these schools was associated with larger differences in gains by SES (as indicated by the ++ in the bottom panel). These findings suggest that, to generate greater equity among students, the critical feature of the academic organization is not the amount but the pervasiveness in coursework and type of instruction available to students.

Another important finding from Table 3 concerns the restructuring effects. The combination of academic and social organization characteristics in these analyses explains away most of the differences between schools shown in Table 2. In other words, while these schools differed in the types of reform practices they had in place, it appears largely the *content* of these practices -- the academic and social norms associated with these reforms -- rather than the label (restructured or traditional) which was associated with effective and equitable schooling. On the other hand, the effects observed in Table 2 for school size persisted (although somewhat reduced in magnitude). This finding suggests that enrollment differences among schools may be coincident with or characteristic of other conditions critical to student learning not otherwise captured in this model.

DISCUSSION

Historically, most discussions of the purposes of secondary education in the United States have assumed that excellence is sacrificed when social equity aims predominate -- that equity and excellence are in conflict with one another. An idea underpinning such an assumption is the impossibility of selecting school reform strategies that target both goals with equal vigor. Our findings undercut that assumption. Our results show that the goals of improved equity and excellence can be accomplished simultaneously in high schools that are characterized by certain critical features. Our definition of the social distribution of achievement, in fact, includes both

effectiveness and equity. But what are schools that show this effective and equitable distribution of achievement like? Our discussion explores this question.

Restructuring Practices

Locating our work in contemporary discussions of educational policy, we conclude that the "school restructuring" movement appears to push schools in the right direction. Those schools which have adopted even a modest number of practices that alter traditional authority hierarchies and isolation among teachers are also places where all students learn more. These differences persist for learning both early and later in high school. Although it could be argued that very few of the high schools in this analysis were fundamentally restructured, those which moved in the direction of reorganizing curriculum toward collaboration in learning, teaching, and decision-making do have measurable differences in student learning.

Enrollment Size

Our results provide strong support for the advantages to students of attending smaller high schools. Even after taking into account a multitude of covariates commonly associated with enrollment size -- sector, demographic composition, curriculum structure, and social organization -- strong negative effects for large school size remain. Within the currently constrained fiscal environment, it would be folly to recommend that localities build a number of new and smaller high schools. Rather, a reform initiative suggested by our results would aim to create smaller administrative and instructional units, such as schools-within-schools. Smaller and simpler high school organizations have the potential to be more supportive and attentive to student learning. The caveat in such a response would be to avoid the potential of creating smaller units that were more specialized and differentiated, as increased variability in students' experience appears strongly linked to decreased equity.

Academic Organization

Our results also expand on the findings reported elsewhere that explain the positive effects of Catholic schools: that those schools offer a restricted set of courses with mostly academic content

that almost all students take (Bryk, Lee, and Holland, 1993; Lee and Bryk, 1988). High schools where students enroll in more of such courses are places where students learn more. In addition, when teachers required more authentic learning from students -- more disciplined inquiry, more use of higher-order thinking skills, and more interconnection between subjects and their value beyond school -- gains in learning are higher. Finally, high schools where there is little variation among students in the courses taken or the type of instruction received are places where learning is less closely tied to social class -- i.e., they are more equitable. These results indicate that an academic organization that is focused on academic learning for everyone does not result in stratified learning opportunities for students -- quite the contrary.

Social Organization

The two measures we used to capture the social organization of schools reflect the content of and the commitment to the goals of the school. Academic press captures the content of a school's normative environment -- one that pushes all students into a specific type of coursework and emphasizes the importance of academic learning. It has been argued that pressing all students toward this end may disadvantage less able students, who may not be able to succeed in such courses. Our results suggest that this is not the case. High schools which have this agenda show a more equitable distribution in learning. It may be the case that, in such schools, extra steps are taken to ensure that no student is left behind. These effects may in fact be linked to the results concerning the amount and availability of academic coursework for students (although they are independent of them). The fact that this measure shows an effect beyond the quantified indicators of student coursetaking and reports on instruction implies that there may be a larger normative press at work.

The measure of collective responsibility for student learning reflects the commitment experienced by members of the school to accomplish academic goals for learning. It is one thing to say, "All students can learn." It is quite another to maintain, "And if they don't, *I as the teacher* need to do something differently." This dynamic of teacher responsibility goes beyond simply feeling competent to teach -- it also addresses the problem of how to respond when and if

a student has not learned. If the fault is seen to lie with the student, a functional response would be to remove the student from the class (or to lay blame on a deficient home). If the focus is directed toward instruction, something can be done in the classroom to address the difficulty. In addition, it is possible that such an instructional response benefits more students than the one targeted -- responding to one student's confusion could clarify the lesson for any number of others. Those schools which are characterized by a shared sense of responsibility for all students' learning are places in which all students learn more (Lee & Smith, 1996).

Important Lessons about Equity

We conclude that there is a dense and consistent web of organizational characteristics associated with learning for all students. The "binding glue" of these factors, in our opinion, is their affinity with ideas about shifting toward viewing resources for learning as a public, rather than a private good. The defining features of a private good rest in the limits placed on access and use (Samuelson, 1954), while a public good can be made equally available to all without losing value for any one person (Head, 1974). The manner in which resources for learning -- for example, instructional skill, challenging curriculum, or authentic pedagogy -- are distributed inside a school is central to how learning is distributed in schools. When opportunities for valued resources are limited, sociologists argue that the functional response is to increase stratification through access to that resource (Parsons, 1964). When access to resources is equally available to all, *in a manner which does not reduce the value of that resource to any one person*, stratification is no longer a social dynamic in the situation.

For example, if only one class in Calculus is offered, students who manage to secure a place in that class have access to a resource which others do not -- it is a private good. The value of "having taken Calculus" in that situation is derived both from the learning available in the curriculum and the subsequent status attained by students who took the course, relative to those who were unable to do so. But if all students take Calculus, the resources for learning that material are made equally available to all students, and the opportunity given to one student does not restrict that of another. In that context, the value of learning Calculus is not accorded to

differential status of the "haves" compared to the "have-nots." It is a public good.[9] Along these lines, the combination of academic press and collective responsibility for learning emphasizes the importance of academic learning for all students. An academic organization in which students take mostly academic courses, where most students are actively engaged in critical thinking and discovery, and where all students have access to such experiences reflects the practical application of this commitment. These features characterize high schools where learning is both effective and equitable by the definition we laid out in Figure 1.

How do American high schools become places like this? In the past, when reform efforts have targeted the classroom, the organizational structure of American high schools resisted lasting change (e.g., Sarason, 1990). Attempts to promote instructional change have commonly been met with strong resistance from a rigid and unresponsive authority hierarchy, better designed to buffer teachers than to influence them. On the other hand, recent research exploring the impact of restructuring schools suggests that structural shifts *in themselves* also tend to avoid altering what takes place in the classroom (Cohen, 1995; Elmore, 1995; Rowan, 1990). It is not enough to superficially change the authority and professional collaboration of teachers and administrators. Elmore concludes, "... the relationship between structural changes in schools and changes in teaching and learning are mediated by relatively powerful factors, such as the shared norms, knowledge, and skill of teachers...(Elmore, 1995, p. 26)" If a school's norms and expectations are based on an assumption of highly differentiated outcomes for students, one is likely to find unequitable learning in that school, regardless of its structural form

How do American high schools become more effective and more equitable? We are less sanguine about how to accomplish such transformations than to identify their direction. We certainly recognize that inducing this kind of organizational change is unlikely to come from top-down directives. Rather, it must be developed and supported by the leadership of both principals and teachers who believe in the value of these ideas and are willing (and able) to commit personal and fiscal resources to their development. Other than school size (a policy-level determination that generally comes from school districts or states), the genesis of reforms in the

direction suggested by our findings most reasonably comes from individual school members -- administrators, teachers, students, and parents. Though our aim here has been to identify the direction of reform, we are less successful in specifying the means by which individual schools can become both equitable and effective places, other than to identify the organizational aims toward which they might aspire. If Americans really want both excellence and equity, we believe the major changes must be generated and supported locally. At the very least, our research indicates that this aim is a reasonable one.

References

Bryk, A.S., V.E. Lee, and P.B. Holland (1993). Catholic schools and the common good. Cambridge, MA: Harvard University Press.

Burns, T. & Stalker, G.M. (1961). The management of innovation. London: Tavistock Publications.

Cohen, D.K. (1995). What is the system in systemic reform? Educational Researcher, 24(9), 11-19.

Coleman, J.S., Hoffer, T. & Kilgore, S. (1982). High school achievement: Public, Catholic, and private schools compared. New York: Basic Books.

Collins, R. (1979). The credential society: An historical sociology of education and stratification. New York: Academic Press.

Conant, J.B. (1959). The American high school today. New York: McGraw Hill.

Cremin, L.A. (1988). American education: The metropolitan experience 1876-1980. New York: Harper & Row.

Elmore, R.F. (1995). Structural reform in educational practice. Educational Researcher, 24(9), 23-26.

Elmore, R.F., Peterson, P., & McCarthy, S. (1995). Restructuring in the classroom: Teaching, learning, and school organization. San Francisco: Jossey-Bass.

Fraser, S. (Ed.). The bell curve wars : Race, intelligence, and the future of America. New York: BasicBooks.

Greeley, A.M. (1982). Catholic high schools and minority students. New Brunswick, NJ: Transaction Books.

Head, J.G. (1974). Public goods and public welfare. Durham, NC: Duke University Press.

Herrnstein, R. J. & Murray, C. (1994). The bell curve : Intelligence and class structure in American life. New York: Free Press.

Jacoby, R. & Glauberman, N. (Eds.) (1995). The bell curve debate : History, documents, opinions . New York: Times Books.

Jencks, C. (1985). Inequality: A reassessment of the effect of family and schooling in America. New York: Harper.

Lee, V.E. & Bryk, A.S. (1988). Curriculum tracking as mediating thesocial distribution of high school achievement. Sociology ofEducation, 61(2):78-94.

Lee, V.E. & Bryk, A.S. (1989). A multilevel model of the social distribution of highschool achievement. Sociology of Education, 62(3):172-192.

Lee, V.E. & Smith, J.B. (1995). Effects of school restructuring and size on gains in achievement and engagement for early secondary school students. Sociology of Education, 68(4), 241-270.

Lee, V.E. & Smith, J.B. (1996). Collective responsibility for learning and its effects on gains in achievement and engagement for early secondary school students. American Journal of Education.

Lee, V.E., Smith, J.B. & Croninger, R. (1995). Another look at high school restructuring. in Issues in Restructuring Schools, No. 9. Madison WI: Center on Organization and Restructuring of Schools.

Mintzberg, H. (1979). The structuring of organizations. Englewood Cliffs, NJ: Prentice-Hall.

National Commission on Excellence in Education. (1983). A nation at risk: The imparative for educational reform. Washington, D.C.: U.S. Government Printing Office.

National Governors' Association, Center for Policy Research and Analysis (1991). Time for results: The Governors' 1991 report on education. Washington, D.C.: National Governors' Association.

Newmann, F.M. & Wehlage, G.G. (1995). Successful school restructuring: A report to the public and educators. Madison WI: Center on Organization and Restructuring of Schools.

Oakes, J. (1985). Keeping track: How schools structure inequality. NewHaven: Yale Univ. Press.

Parsons, T. (1964). Essays in sociological theory. New York: Free Press.

Powell, A.G., Farrar, E., & Cohen, D.K. (1985). The shopping mall high school. Boston, MA: Houghton Mifflin.

Rowan, B. (1990) Applying conceptions of teaching to organizational reform. In R.E. Elmore (Ed). Restructuring schools: The next generation of educational reform. San Francisco: Jossey-Bass.

Rutter, M., Maughan, B., Mortimore, P., Ouston, J., & Smith, A. (1979). Fifteen thousand hours: Secondary schools and their effects on children. Cambridge: Harvard Univ. Press.

Samuelson, P.A. (1954). The pure theory of public expenditure. Review of Economics and Statistics, pp. 350-389.

Sarason, S.B. (1990). The predictable failure of school reform: Can we change course before it's too late? San Francisco: Jossey-Bass.

Simon, H. (1957). Administrative Behavior. New York: MacMillan.

Taylor, F.W. (1911). Principles of scientific management. New York: Harper.

Wallace, B(1995). Poisoned apple : The bell curve crisis and how our schools create mediocrity, and failure. New York: St. Martin's Press.

Weber, M. (1924). The theory of social and economic organization. In A.M. Henderson & Talcott Parsons (Eds). Glencoe, IL: Free Press (translated in 1947).

Weis, L. (Ed.) (1988). Class, race, and gender in American education. Albany, NY: State University of New York Press.

Table 1: *Differences in School Demographics, Structure, and Organization between Restructuring and Traditional Practice Schools*

	Restructured compared to Traditional Practice Schools
Demographics	
Average SES	++
High percent minority	0
Average aptitude at high school entry	++
Structure	
Catholic	++
Independent private	++
Enrollment size	0
Social Organization	
Collective responsibility for learning	++
Academic press	+
Academic Organization	
Average number of academic-level math and science courses taken	++
Variability in number of academic math and science courses taken	-
Average level of authentic instruction in math and science courses	++
Variability in use of authentic instruction in math & science courses	-

a. Effects presented here represent the difference between restructured practice and traditional practice schools, as determined by simple t-test. + indicates that the restructuring practice schools are higher, - indicates that the restructuring practice schools are lower. Symbolic representations are as follows:

0 difference not significant

+,- $p < .10$

++, -- $p < .05$

Table 2: *Effects of High School Restructuring on the Social Distribution of Achievement During the High School*[a]

	Effectiveness Measures			
	Gain in math Grade 8-10	Gain in science Grade 8-10	Gain in math Grade 10-12	Gain in science Grade 10-12
Independent Variables[bc]				
Restructured v. Traditional Schools	++++	++++	++	++
No Reform v. Traditional Schools	-	-	-	-
Enrollment Size	----	----	---	----

	Equity Measures			
	SES effect on Mathematics Gain Grade 8-10	SES effect on Science Gain Grade 8-10	SES effect on Mathematics Gain Grade 10-12	SES effect on Science Gain Grade 10-12
Independent Variables[bc]				
Restructured v. Traditional Schools	---	---	-	---
No Reform v. Traditional Schools	++	++	++	+
Enrollment Size	++	+++	+++	++

a. These results come from three-level HLMs on 9,449 students in 773 schools

b. Effects are estimated in HLM models that include statistical controls for students (minority status, gender, engagement, and ability) and for schools (average SES, minority concentration, and school sector)

c. Effects presented here represent the direction and levels of statistical significance of the HLM gamma coefficients. Symbolic representations are as follows:

+,- $p < .10$
++, -- $p < .05$
+++, --- $p < .01$
++++,---- $p < .001$

Table 3: *Effects of High School Restructuring, Social Organization, and Academic Organization on the Social Distribution of Achievement During the High School*[a]

Independent Variables[bc]	Gain in math Grade 8-10	Gain in science Grade 8-10	Gain in math Grade 10-12	Gain in science Grade 10-12
	Effectiveness Measures			
Restructuring effects				
Restructured v. Traditional Schools	0	0	0	0
No Reform v. Traditional Schools	0	0	0	-
Enrollment Size	–	–	–	---
Social Organization effects				
Collective responsibility for learning	++	++	++	++
Academic press	+	++	++	++
Academic Organization effects				
Average number of academic-level math and science courses taken	++	++	++++	++
Variability in number of academic math and science courses taken	0	0	0	0
Average level of authentic instruction in math and science courses	+++	++	++	++
Variability in use of authentic instruction in math & science courses	-	0	-	0
	Equity Measures			
Independent Variables[bc]	SES effect on Mathematics Gain Grade 8-10	SES effect on Science Gain Grade 8-10	SES effect on Mathematics Gain Grade 10-12	SES effect on Science Gain Grade 10-12
Restructuring effects				
Restructured v. Traditional Schools	0	-	0	0
No Reform v. Traditional Schools	0	+	0	+
Enrollment Size	++	++	++	+
Social Organization effects				
Collective responsibility for learning	–	-	–	–
Academic press	---	–	–	–
Academic Organization effects				
Average number of academic-level math and science courses taken	0	0	-	-
Variability in number of academic math and science courses taken	++	++	++	++
Average level of authentic instruction in math and science courses	0	0	0	-
Variability in use of authentic instruction in math & science courses	++	++	++	++

a. These results come from three-level HLMs on 9,449 students in 773 schools
b. Effects are estimated in HLM models that include statistical controls for students (minority status, gender, engagement, and ability) and for schools (average SES, minority concentration, and school sector)
c. Effects presented here represent the direction and levels of statistical significance of the HLM gamma coefficients. Symbolic representations are as follows:
0 effect not significant +,- $p < .10$ ++, -- $p < .05$ +++, --- $p < .01$ ++++,---- $p < .001$

[1]Both the independent and dependent variables are shown in standardized z-score metric (mean [M]=0, standard deviation [SD]=1). As such, one can interpret an SES value of 0 as middle class, +1 upper-middle class, -1 lower-middle class, and so forth. Similarly, a value of 0 for achievement would be "average gain" (rather than NO gain), +1 somewhat high gain, -1 somewhat low gain, and so forth.

[2] In analytic terms, these characteristics have a positive effect on the "intercept" (raising the level of the overall average gains), and a negative effect on the SES-Gain "slope" (flattening out the relationship between SES and gains in achievement among students).

[3]The base-year NELS:88 sampling procedure, which oversampled private schools and schools with high minority concentrations, necessitated using student- and school-level design weights in all analyses. However, the NELS:88 follow-up data files included design weights only for students. This lack of school-level design weights created a serious dilemma, as the study's research questions requires the use of hierarchical statistical methods. The construction of the weights used for these analyses can be found in Lee & Smith (1995).

[4]Appendix 1 provides full descriptions of the procedures, methods, and measures used to construct all measures used in these analyses.

[5]Results for reading and history did not differ substantially from those in mathematics and science on the simple restructuring comparisons. The only differences occurred in smaller effects for restructuring on the SES-reading gain relationship -- suggesting support for the argument that reading gains occur over more contexts than school settings.

[6]The wording of the questionnaire item stem states, "Please indicate whether the following programs are part of your school's current program." Thus, while school administrators who said "No" to all 30 items probably have some other program in place, the school reports they do not currently offer any of the programs indicated in the list.

[7]For further information and support for the cut-point of three practices to define a "restructured practice" high school, see Lee and Smith, 1995.

[8]Average SES of the school is an aggregate of the individual measure used in the same analysis. In this way, it functions as a context measure rather than an overall characteristic of the school. However, minority concentration is reported by the school administrator, and can be taken to be a true school measure.

[9]Of course, such a philosophy also requires that all students are trained to qualify for this high-level content.

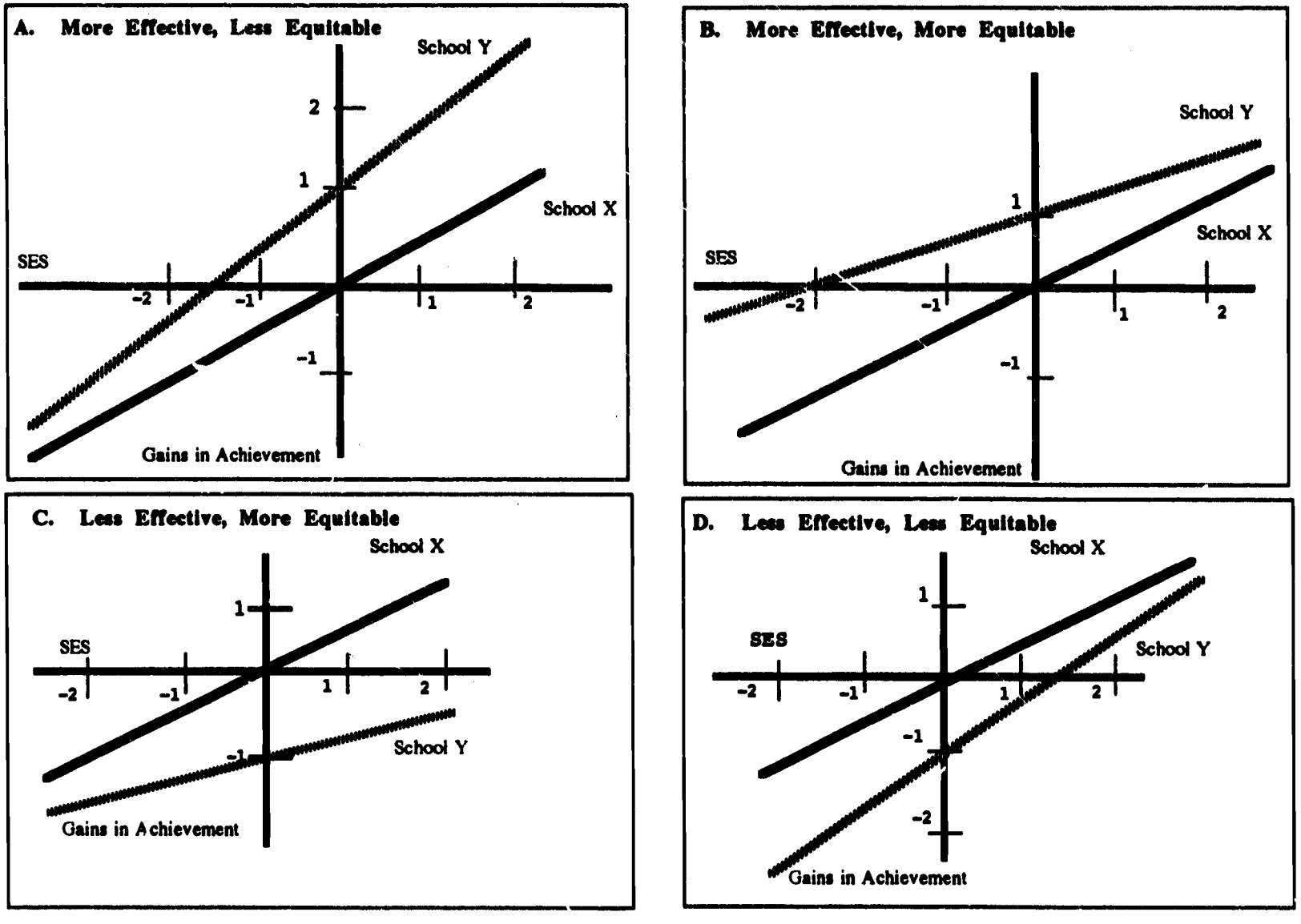

Figure 1: School Effectiveness and Equity: Four Different Comparisons of the Relationship Between Social Class and Gains in Achievement.

Appendix 1

Formal HLM Models Used to Estimate Results for Comparison between Restructured Practice Schools and Traditional Practice Schools

1. The figures below specifies the actual three-level models used in each analysis. Figures A1 and A2 provide the model parameter structures for Study 1, while Figures A3 and A4 do the same for the extended analysis conducted for Study 2. In each figure, the variables used have been labeled to correspond to those labels provided in the text (see Tables 2 and 3).

Figure A1: *Variables used to estimate the comparison between restructured practice schools and traditional practice schools (Study 1).*

Level-1 Coefficients	Level-2 Predictors	Level-3 Predictors
INTRCPT1, P0	INTRCPT2, B00[A]	INTRCPT3, G000
		INTRCPT3, G100
Gain from 8-10th grade, P1	INTRCPT2, B10	Schl ave social class, G101[C]
		Over 40% minority, G102
		Enrollment size, G103[C]
		Catholic HS, G104
		Ind. private HS, G105
		Restructured practice HS, G106
		No reforms reported, G107
	Effect of SES on gain 8-10, B11[B]	INTRCPT3, G110
		Schl ave social class, G111[C]
		Over 40% minority, G112
		Enrollment size, G113[C]
		Catholic HS, G114
		Ind. private HS, G115
		Restructured practice HS, G116
		No reforms reported, G117
	# Math&sci crses taken 9th-10th grade, B12[A,C]	INTRCPT3, G120
	8th grade engagement, B13[A,C]	INTRCPT3, G130
	8th grade ability, B14[A,C]	INTRCPT3, G140
	Std is minority, B15[A]	INTRCPT3, G150
	Std is female, B16[A]	INTRCPT3, G160
Gain from 8-10th grade,, P2	INTRCPT2, B20	INTRCPT3, G200
		Schl ave social class, G201[C]
		Over 40% minority, G202
		Enrollment size, G203[C]
		Catholic HS, G204
		Ind. private HS, G205
		Restructured practice HS, G206
		No reforms reported, G207
	Effect of SES on gain 10-12, B21[B]	INTRCPT3, G210
		Schl ave social class, G211[C]
		Over 40% minority, G212
		Enrollment size, G213[C]
		Catholic HS, G214
		Ind. private HS, G215
		Restructured practice HS, G216
		No reforms reported, G217
	# Math&sci crses taken 10-12th grade, B22[A,C]	INTRCPT3, G220
	8th grade engagement, B23[A,C]	INTRCPT3, G230
	8th grade ability, B24[A,C]	INTRCPT3, G240
	Std is minority, B25[A]	INTRCPT3, G250
	Std is female, B26[A]	INTRCPT3, G260

'A' - The residual parameter variance for the parameter has been set to zero
'B' - This variable has been centered around its group mean
'C' - This variable has been centered around its grand mean

Figure A2: *Formal equations used to model the comparison between restructured practice schools and traditional practice schools (Study 1).*

Level-1 Model

Y = P0 + P1*(Gain from 8th-10th) + P2*(Gain from 10th-12th) + E

Level-2 Model

P0 = B00 + R0
P1 = B10 + B11*(Std SES) + B12*(# Math&sci crses 9-10th) + B13*(8th grade engagement)
+ B14*(8th grade ability) + B15*(Std is minority) + B16*(Std is female) + R1
P2 = B20 + B21*(SES) + B22*(# Math&sci crses taken) + B23*(8th grade engagement)
+ B24*(8th grade ability) + B25*(Std is minority) + B26*(Std is female) + R2

Level-3 Model

B00 = G000
B10 = G100 + G101(Schl ave social class) + G102(Over 40% minority)
+ G103(Enrollment size) + G104(Catholic HS) + G105(Ind. private HS)
+ G106(Restructured practice HS) + G107(No reforms reported) + U0
B11 = G110 + G111(Schl ave social class) + G112(Over 40% minority)
+ G113(Enrollment size) + G114(Catholic HS) + G115(Ind. private HS)
+ G116(Restructured practice HS) + G117(No reforms reported) + U1
B12 = G120
B13 = G130
B14 = G140
B15 = G150
B16 = G160
B20 = G200 + G201(Schl ave social class) + G202(Over 40% minority)
+ G203(Enrollment size) + G204(Catholic HS) + G205(Ind. private HS)
+ G206(Restructured practice HS) + G207(No reforms reported) + U2
B21 = G210 + G211(Schl ave social class) + G212(Over 40% minority)
+ G213(Enrollment size) + G214(Catholic HS) + G215(Ind. private HS)
+ G216(Restructured practice HS) + G217(No reforms reported) + U3
B22 = G220
B23 = G230
B24 = G240
B25 = G250
B26 = G260

Figure A3: *Variables used to estimate the effects of school organisational characteristics on the comparison between restructured practice schools and traditional practice schools (Study 2).*

Level-1 Coefficients	Level-2 Predictors	Level-3 Predictors
INTRCPT1, P0	INTRCPT2, B00[A]	INTRCPT3, G000
Gain from 8-10th grade, P1	INTRCPT2, B10	INTRCPT3, G100
		Schl ave social class, G101[C]
		Over 40% minority, G102
		Enrollment size, G103[C]
		Catholic HS, G104
		Ind. private HS, G105
		Restructured practice HS, G106
		No reforms reported, G107
		Collective respon. for lrng, G108
		Academic press, G109
		Ave # math, sci crses, G1010
		Var. in # math, sci crses, G1011
		Ave lvl authentic instr math,sci, G1012
		Var. in authentic instr math,sci, G1013
	Effect of SES on gain 8-10, B11[B]	INTRCPT3, G110
		Schl ave social class, G111[C]
		Over 40% minority, G112
		Enrollment size, G113[C]
		Catholic HS, G114
		Ind. private HS, G115
		Restructured practice HS, G116
		No reforms reported, G117
		Collective respon. for lrng, G118[C]
		Academic press, G119[C]
		Ave # math, sci crses, G1110[C]
		Var. in # math, sci crses, G1111[C]
		Ave lvl authentic instr math,sci, G1112[C]
		Var. in authentic instr math,sci, G1113[C]
	# Mathsci crses taken 9th-10th grade, B12[A,C]	INTRCPT3, G120
	8th grade engagement, B13[A,C]	INTRCPT3, G130
	8th grade ability, B14[A,C]	INTRCPT3, G140
	Std is minority, B15[A]	INTRCPT3, G150
	Std is female, B16[A]	INTRCPT3, G160
Gain from 8-10th grade, P2	INTRCPT2, B20	INTRCPT3, G200
		Schl ave social class, G201[C]
		Over 40% minority, G202
		Enrollment size, G203[C]
		Catholic HS, G204
		Ind. private HS, G205
		Restructured practice HS, G206
		No reforms reported, G207
		Collective respon. for lrng, G208[C]
		Academic press, G209[C]
		Ave # math, sci crses, G2010[C]
		Var. in # math, sci crses, G2011[C]
		Ave lvl authentic instr math,sci, G2012[C]
		Var. in auther ↓ instr math,sci, G2013[C]
	Effect of SES on gain 10-12, B11[B]	INTRCPT3, G210
		Schl ave social class, G211[C]
		Over 40% minority, G212
		Enrollment size, G213[C]
		Catholic HS, G214
		Ind. private HS, G215
		Restructured practice HS, G216
		No reforms reported, G217
		Collective respon. for lrng, G218[C]
		Academic press, G219[C]
		Ave # math, sci crses, G2110[C]
		Var. in # math, sci crses, G2111[C]
		Ave lvl authentic instr math,sci, G2112[C]
		Var. in authentic instr math sci, G2113[C]
	# Mathsci crses taken 10-12th grade, B22[A,C]	INTRCPT3, G220
	8th grade engagement, B23[A,C]	INTRCPT3, G230
	8th grade ability, B24[A,C]	INTRCPT3, G240
	Std is minority, B25[A]	INTRCPT3, G250
	Std is female, B26[A]	INTRCPT3, G260

'A' - The residual parameter variance for the parameter has been set to zero
'B' - This variable has been centered around its group mean
'C' - This variable has been centered around its grand mean

Figure A4: *Formal equations used to model the effects of school organizational characteristics on the comparison between restructured practice schools and traditional practice schools (Study 2).*

Level-1 Model

Y = P0 + P1*(Gain from 8th-10th) + P2*(Gain from 10th-12th) + E

Level-2 Model

P0 = B00 + R0
P1 = B10 + B11*(Std SES) + B12*(# Math&sci crses 9-10th) + B13*(8th grade engagement)
+ B14*(8th grade ability) + B15*(Std is minority) + B16*(Std is female) + R1
P2 = B20 + B21*(SSES) + B22*(# Math&sci crses taken) + B23*(8th grade engagement)
+ B24*(8th grade ability) + B25*(Std is minority) + B26*(Std is female) + R2

Level-3 Model

B00 = G000
B10 = G100 + G101(Schl ave social class) + G102(Over 40% minority)
+ G103(Enrollment size) + G104(Catholic HS) + G105(Ind. private HS)
+ G106(Restructured practice HS) + G107(No reforms reported)
+ G108(Collective respon for std lrng) + G109(Academic press)
+ G1010(Ave # math, sci crses taken) + G1011(Var in # math sci crses)
+ G1012(Ave lvl auth. instr) + G1013(Var in auth instr) + U0
B11 = G110 + G111(Schl ave social class) + G112(Over 40% minority)
+ G113(Enrollment size) + G114(Catholic HS) + G115(Ind. private HS)
+ G116(Restructured practice HS) + G117(No reforms reported)
+ G118(Collective respon for std lrng) + G119(Academic press)
+ G1110(Ave # math, sci crses taken) + G1111(Var in # math sci crses)
+ G1112(Ave lvl auth. instr) + G1113(Var in auth instr) + U1
B12 = G120
B13 = G130
B14 = G140
B15 = G150
B16 = G160
B20 = G200 + G201(Schl ave social class) + G202(Over 40% minority)
+ G203(Enrollment size) + G204(Catholic HS) + G205(Ind. private HS)
+ G206(Restructured practice HS) + G207(No reforms reported) + U2
+ G208(Collective respon for std lrng) + G209(Academic press)
+ G2010(Ave # math, sci crses taken) + G2011(Var in # math sci crses)
+ G2012(Ave lvl auth. instr) + G2013(Var in auth instr) + U2
B21 = G210 + G211(Schl ave social class) + G212(Over 40% minority)
+ G213(Enrollment size) + G214(Catholic HS) + G215(Ind. private HS)
+ G216(Restructured practice HS) + G217(No reforms reported) + U3
+ G208(Collective respon for std lrng) + G209(Academic press)
+ G2010(Ave # math, sci crses taken) + G2011(Var in # math sci crses)
+ G2012(Ave lvl auth. instr) + G2013(Var in auth instr) + U3
B22 = G220
B23 = G230
B24 = G240
B25 = G250
B26 = G260