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ABSTRACT

Educators in District #2 in New York City have focused on school reform for more than a decade, shaping their efforts at district-wide instructional improvement through subject-matter initiatives. This study was conducted to explore the influence of a variety of factors on student achievement in District #2 with a particular interest in the role of teacher professional development. Between 1988 and 1998, the percentage of District #2 students achieving at or about grade level rose from 56% to 73% in reading and from 66% to 82% in mathematics, suggesting that the professional development strategy may have had some effects. Achievement and demographic data for District #2's students were obtained, as was information on teachers' backgrounds and professional development experience. Questionnaires completed by 37 teachers in grades 3 and 5 were used, and analyses of the link between achievement and professional development were based on the 848 students of these teachers. Many variables that the school district cannot control, poverty, ethnicity, and proficiency in English, exerted an influence on student performance in reading and mathematics. Socioeconomic status had a strong relationship with classroom level reading performance, but teachers' reported engagement in professional development made a difference in that the relationship between gender and reading achievement was weakened when teachers discussed their literacy instruction with colleagues and with their principals frequently. Some possible reasons professional development did not show more powerful effects in reducing the achievement gap are discussed. This study has provided a foundation for other studies that will measure the linkages between various aspects of District #2's theory of action and student outcome measures. Two appendixes contain a discussion of study methodology and the teacher survey. (Contains 24 references.) (SLD)

The Effects of Teachers' Professional Development on Student Achievement in Community School District #2

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America's urban districts are in distress. Supporting children's learning is more demanding and more essential than ever before, yet teachers who work in urban districts often find themselves engulfed by archaic rules, unbending regulations, and rigid bureaucratic structures. Moreover, because of the chronic underfunding and difficult working conditions, urban schools generally attract only the least experienced and often the most poorly trained teachers. Although there are examples of classrooms and even whole schools who serve urban children well, making high-quality education the rule rather than the exception in American cities is perhaps the biggest challenge facing public education today.

One response to this challenge has been increased attention to professional development for all teachers, but especially for those who work in inner city schools. Advocates of strong and continuous professional development suggest that, done well, it will improve teachers' skills, confidence and knowledge, thereby developing the capacity of schools to deliver quality instruction. Better instruction in turn will lead to more (ideally, *all*) students achieving high academic standards.

Despite consensus regarding the need for more and better professional development, there are few research findings that point unambiguously to the fact that professional development does indeed improve student achievement or to the kinds of professional development that are most likely to lift the achievement of all students. Indeed, only a small fraction of studies on teacher professional development even include measures of student learning (Kennedy, 1998). Those which do explore the impact on student achievement, however, present a strong case for attending more to the content of inservice teacher education and for "attending less to its structural and organizational features" (Kennedy, 1998, p. 16-15). In the studies reviewed by Kennedy, those professional development experiences which focused on teachers' knowledge of the subject, on the curriculum, or on how students learn the curriculum, demonstrated the largest influences on student learning.

The educators of Community School District #2 in New York City have based more than a decade of reform on assumptions such as these. They've shaped their efforts at district-wide instructional improvement through subject-matter initiatives. For example, after investing considerable time and energy researching how students learn to become literate, district professionals identified and adapted an elementary literacy program that, in their judgment, would support student learning in ways consonant with the research. Then they built a professional development system that would enable teachers to enact the program successfully. Although this professional development system can be described in terms of the wide array of structural and organizational forms that it encompasses,[1] we've argued elsewhere that its most important feature is the manner in which it parallels and supports the kinds of learning demanded of students in the classroom (Stein, D'Amico & Johnstone, 1999).

There is some indication that District #2's professional development strategy has been a successful one. Between 1988 and 1998, the percent of students achieving at or above grade level rose from 56% to 73% in reading and 66% to 82% in mathematics (HPLC Technical Report). (See Figure 1.)

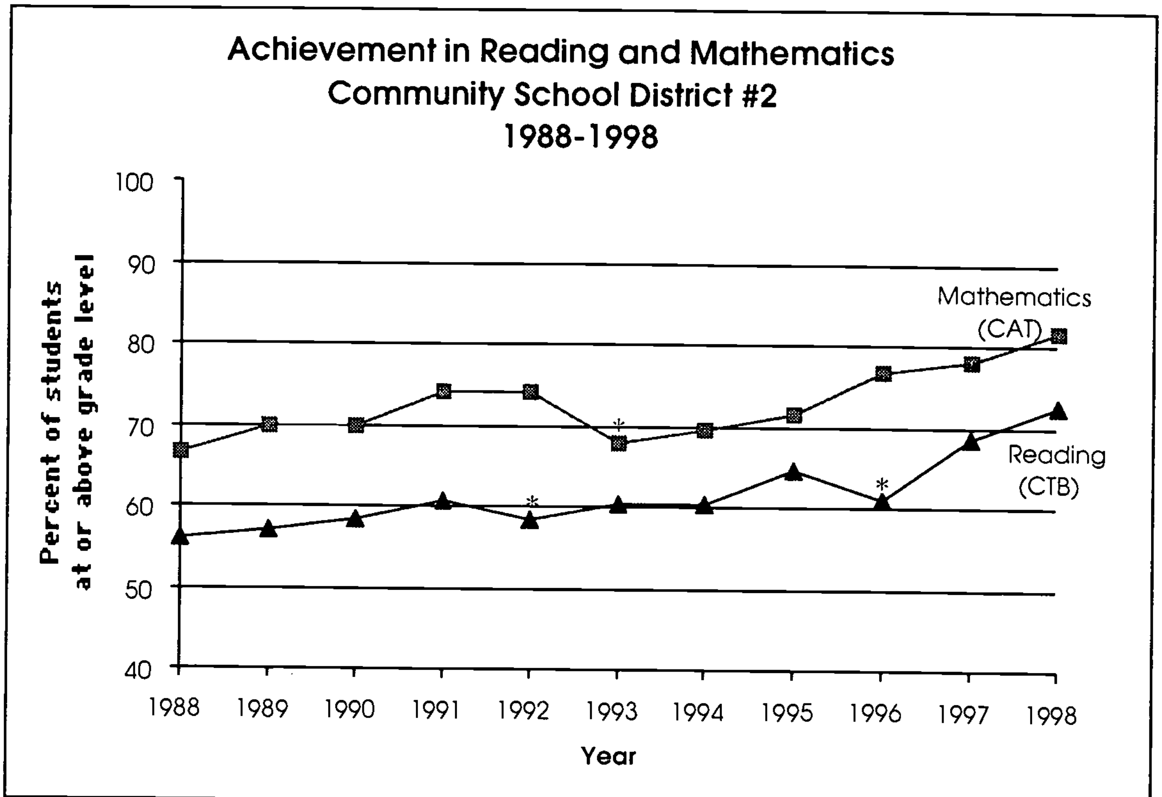

Figure 1: Reading and mathematics achievement in District #2 between 1988 and 1998 as measured by the Comprehensive Test for Basic Skills (CTB) and the California Achievement Test (CAT). (*) Indicates a test renorming.[2]

Nevertheless, it is difficult to empirically tease out the factors that theoretically could be responsible for this rise in student achievement. Over the years, District #2 has leveraged a variety of tools and resources to help underachieving schools and students. For example, the

[1] The forms range from workshops to staff developers observing and co-teaching with individual teachers in their classrooms to various kinds of intervisitation and co-teaching between teachers (Elmore & Burney, 1996).
[2] Data obtained from District #2 archives. According to the notes made on these records, the scores are based on all students in 1988 and General Education and Reading Resource rooms for 1989-'96. The reading scores were renormed in 1992 and 1996 and the mathematics scores were renormed in 1993.

district maintains high standards for hiring teachers and principals; they are also vigilant about maintaining high standards of practice. In addition, District #2 carefully targets its resources at those students who need the most attention (see Stein, Harwell, & D'Amico, 1999). They provide extended day and extended year programs for students that attend schools with a history of low achievement, reading recovery teachers for at-risk readers, and "push-in" teachers for classrooms with a high proportion of children reading below grade level. Finally, high poverty schools in the district maintain school lunch and breakfast programs, as well as medical and social services that help support the basic needs of children without which learning is difficult at best. All of these forms of assistance, a subset of them, or additional unidentified factors may be responsible for the persistent rise in student achievement scores.

The purpose of this study is to better understand the influence of a variety of factors on student achievement in District #2 with a particular interest in the role of teacher professional development. Previous attempts to understand the role of professional development in District #2 have been conducted using indirect measures and with the school as the unit of analysis. One study (Resnick & Harwell, 1998) suggested that the quality of professional development in schools (as judged by the Deputy Superintendent and the Director of Professional Development) was positively related to the achievement of students in those schools. In this study, we use self-reports of teachers' engagement in various kinds of professional development as our measure of teacher professional development and we measure student achievement at multiple levels including at the level of the individual student. We measure student achievement by individual student performance on the Comprehensive Test of Basic Skills (CTB) in both reading and mathematics.

We begin by describing the characteristics of students in District #2 in terms of their socio-economic status, ethnicity, English proficiency, gender, and their achievement in mathematics and reading. We then describe the challenges that the district faces in closing the achievement gap between advantaged students and those who come to school poorly prepared to learn. In the final section we ask the question, "Are teachers with strong professional development participation patterns more likely to have closed the achievement gaps?"

METHODS

Student data

The study was conducted during the 1998-99 school year. Achievement and demographic data for individual students in District #2 was made available through the Division of Assessment and Accountability of the Office of the Deputy Chancellor of Instruction of the New York City Board of Education. The information obtained included the ethnicity and gender for every student, their eligibility for a free or reduced priced lunch, their English proficiency status, their attendance rates, their CTB achievement scores in reading and mathematics, and their enrollment status for three years (1996-97, 1997-98 and 1998-99).

Students in District #2 take a number of tests mandated either by the district, New York City Board of Education, or the State of New York. Many of these are given to students in specific grades. In the Spring of 1999, the CTB reading and mathematics tests were taken by students in grades 3,5,6, and 7.

District #2 is one of New York's Community School Districts and thus services primarily elementary and middle school students. Of the approximately 22,700 students enrolled in the 1998-99 school year 14,054 (62%) were in kindergarten through fifth grade, and 6,483 (27%) where in grades six through eight. The schools are configured in a variety of ways, the most common of which are PK/K-5 (20), 6-8 (8), PK/K-8 (4), and 6-12 (4). The size of these schools varies rather dramatically, from less than 100 students in some of the specialty option schools, to more than 1000 in comprehensive middle schools. Our study is limited to the 4,566 students enrolled in grades three and five because only elementary students could be linked to teachers in mathematics and literacy instruction and fourth grade students did not take the CTB exams in 1999.

Teacher data

Information on teachers' backgrounds and professional development experience was obtained through a questionnaire sent to District #2 teachers in June of 1999. (See Appendix B.) The questionnaire had several sections, including: education and certification; gender and ethnicity; teaching experience (number of years, which grades, etc.); engagement in the professional community of their school (e.g. "How often in the past academic year did you have detailed discussions about instructional practice in mathematics with other teachers in your school?"); engagement in the professional community of District #2 (e.g. "In the past academic year did you serve as a mathematics lead teacher?"); and engagement in the professional community beyond District #2 (e.g., "In the last two years did you attend a workshop or conference outside your district?").

The limitations of self-report measures are well known (e.g. Gay, 1996; Stein & Henningsen, 1992). Those most pertinent to this study are the possibility that teachers will respond in socially desirable ways (e.g., some teachers may not feel comfortable indicating they *never* have substantive conversations about instruction with their colleagues), or have difficulty accurately estimating the frequency with which they engage in the various professional development activities described.

The questionnaires were sent to school principals about two weeks before the end of school with the request that they be distributed. 99 completed questionnaires were received by September 1999, but 62 were unusable because they came from teachers in grades other than three or five. The remaining sample of 37 questionnaires represent approximately 21% of District #2's third and fifth grade teachers. These teachers had a total of 848 students, or 19% of the students in grades three and five. Some of the initial data analyses on the achievement patterns of students from different socio-economic, ethnic and linguistic backgrounds are done for all students in grades three and five (N = 4,566). Those analyses that link achievement to professional development, however, are restricted to this smaller sample of 848.

Analyses

A shortcoming shared by previous research done on the effectiveness of District #2's professional development system (Resnick & Harwell, 1998; Stein, Harwell & D'Amico, 1999) was that the units of analysis used in these studies were schools. As a result, variation among students' performance and teachers' experiences *within* schools was ignored. A defining feature of American public education is that educational organizations have a hierarchical structure. For example, students are nested within classrooms run by particular teachers, who are nested within schools. Incorporating this multi-level structure into the data analysis permits a more realistic approach to understanding the predictors of student achievement. Multilevel data-analytic models provide a mechanism for statistically modeling the effects of this hierarchical structure that avoids the problems of aggregation bias and misestimation of standard errors of parameter estimates that have plagued educational research (Bryk & Raudenbush, 1992). The need for multilevel models in school-based research is now widely acknowledged, and numerous examples of these models can be found in the educational research literature (e.g. Grolnick, Benjet, Kurowski & Apostoleris, 1997; Lee & Bryk, 1989; Newmann & Associates, 1997; Raudenbush, Rowan & Cheong, 1993; Rumberger, 1995; Sui-chu & Williams, 1997).

Harwell and Gatti (1999) addressed the units of analysis shortcoming of the Resnick and Harwell and Stein, et al. studies by performing a multilevel analysis that examined variation in student achievement within and between schools in the district. However, there was no information available at that time to connect student performance to particular classrooms and/or teachers and the effect of teachers' engagement in professional development on achievement was not studied.

For the current study, we describe the characteristics of the District #2 student population overall in grades three and five and the sample of 848 students and their achievement patterns in reading and mathematics. We then use regression models/hierarchical linear models (HLM) (Bryk & Raudenbush, 1992) to explore the extent to which teacher engagement in professional development activities affects achievement gaps between students of different socio-economic, linguistic and ethnic backgrounds. We also review the extent to which student participation in District #2 classrooms (as measured by their attendance in school and the number of years enrolled in District #2) is related to higher achievement. Finally, since district leaders made a conscious decision to prioritize professional development over class size, we explore the effect of class size on achievement.

Data issues

The conclusions that can be made from these analyses are limited in several ways by problems associated with the available data. In addition to the issues associated with the use of self-report as a method of measuring teacher engagement in professional development activities mentioned earlier, there are problems with missing data and sample reduction due to lack of variation in some of the data. (See Appendix A for details.) These problems lead to analyses which may not adequately represent the achievement of Asian students (since many did not take the tests in mathematics and reading) and which do not include classrooms which are homogenous with respect to the ethnicity (white versus non-white), socio-economic status (SES) of the students, or their English proficiency. Despite these problems, we believe our findings can provide some insight into the effect of teachers' engagement in professional development on student achievement.

STUDENTS AND TEACHERS IN DISTRICT #2

The schools of District #2 reflect the extraordinary diversity of Manhattan. Some schools are in the West Side's Hell's Kitchen, and some are in extremely affluent areas on the Upper East Side (Elmore & Burney, 1998). Our sample mirrors this diversity. (See Table 1.) Half of all of the third and fifth grade students in the district are male, about 36% are Asian, a little under a third are White, about 20% are Hispanic, and approximately 13% are Black. A significant proportion of the student population includes new immigrants who may be more likely to be classified as English Language Learners. Overall, about 10% of the students in grades three and five are classified as English Language Learners and therefore eligible for special services and in some cases are exempt from testing. 74% of those not yet proficient in English are Asian.

	All Third and Fifth Grade Students in the District (N = 4,566)	Sample (n = 848)
Eligible for free/reduced lunch	61.2%	51.5%
English Language Learners	9.8%	5.4%
Ethnicity		
Asian	36.4%	33.8%
White	30.5%	37.6%
Hispanic	19.6%	13.4%
Black	13.1%	12.7%
Gender		
Male	50.5%	50.5%
Female	49.5%	49.5%

Table 1: Demographics for District #2 students in grades 3 and 5 during 1998-99

Eligibility for free and reduced lunch is often used as an indicator of socio-economic status in educational research (Ensiminger & Slusarcick, 1992); Entwise & Alexander, 1992), and more than 60% of the third and fifth grade students in district #2 are eligible for a free and reduced lunch. On a district-wide basis (i.e., all grades), District #2 is fairly wealthy and ranks as the fourth wealthiest community school district in New York City (HPLC Technical Report I). In fact, the district is ranked in the upper quartile for urban districts nationally[3] (Council of the Great City Schools, 1999). At the same time, they are one of the most socio-economically diverse districts in New York City. Schools have anywhere between 100% and less than 12% of their students eligible for free or reduced price lunch. (See Figure 2.) This means that

[3]Data obtained from the Council of the Great City Schools Website (www.cgcs.org). Most of the data they report is from 1997-98, but for some school districts it is from 1996-97.

professional development in the district must serve the needs of teachers in both high-poverty and affluent school settings.

On the whole, the students in the sample of 37 classrooms for which teacher data were available are similar in Ethnicity and gender to the third and fifth grade students in the district. However, the rate of English proficiency is slightly higher and the poverty rate is substantially lower for the students in our sample. (See Table 1.)

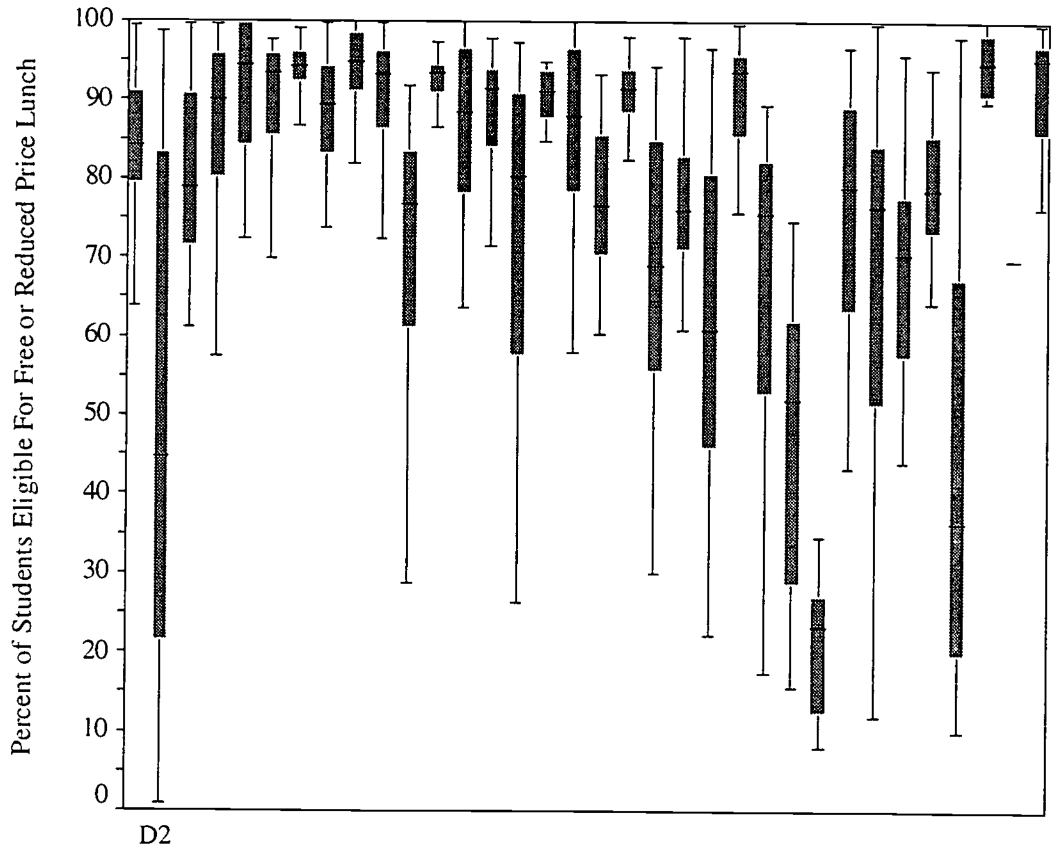

Figure 2: Variation in the percent of "low-SES" students per school in New York City's Community School Districts[4]

Student achievement

The average achievement in both mathematics and reading as measured by the CTB was slightly higher for those students in the sample than for all third and fifth grade students in the district. (See Table 2.). Students in the sample scored on average 7.06 points higher on the mathematics

[4]Data obtained from School Report Card database made available by New York City's Board of Education http://www.nycenet.edu and available on-line at http://207.127.202.63. This database is updated yearly. The data described here was taken from the version available in the summer of 1999.

exam and 7.68 higher on the reading exam. Also, the standard deviations of the sample for mathematics and reading scores were noticeably smaller than for all third and fifth grade students. For mathematics, these standard deviations were 44.45 (n = 791) and 50.12 (N = 4,132); for reading these values were 39.28 (n = 789) and 42.39 (N= 4,085), respectively. Thus, the test performance of the sample students is more homogenous than that for all third and fifth grade students in the district.

	All Third and Fifth Grade Students in the District	Sample students	Difference
Average mathematics score	648.96 (N = 4,132)	656.02 (n = 791)	7.06
Average reading score	658.51 (N = 4,085)	665.19 (n = 789)	6.68

Table 2: Average achievement of District #2 students in grades three and five on the 1999 CTB in mathematics and reading

Attendance and Time in District #2

	All Third and Fifth Grade Students in the District	Sample students
Average Percent of Days in Attendance	94.18%	94.6%
Time in District #2		
1 year	.8%	.7%
2 years	9.3%	9.9%
3 years	89.9%	89.3%

Table 3: Attendance and time in District #2 rates

Attendance was approximately the same for the two groups of students, where on average students were in class for 94% of the days during which class was in session. As shown in table 3, most of the students had been enrolled in District #2 schools for at least two years.[5]

Teachers

Overall, the 37 teachers from whom we received usable questionnaires tended to be white (77.1%) and female (89.2%). Almost all of the teachers reported having already earned a master's degree (91.9%) and about half of them had earned it within the last six years. On average, the teachers had been with the district about eight years (SD = 7.83), and approximately 70% of the teachers reported being at the same District #2 school for five years or less.

[5]Students may have been enrolled in District #2 schools for more than three years, but we only have enrollment data going back three years.

Summary

Essentially, the 848 students associated with the teachers who completed usable questionnaires are reasonably representative of District #2 as a whole. They have a smaller proportion of impoverished students, slightly higher English proficiency rates, and more homogenous test scores. Otherwise, they can be considered a reasonable sample of the District #2 student population of third and fifth grade students.

THE CHALLENGE

Overall, average achievement of District #2 third and fifth grade students in the spring of 1999 was strong with a mean performance of 648.96 in mathematics (average percentile rank= 65.41), and 658.51 in reading (average percentile rank = 62.84). (See Figure 3.) Such strong performance might be used as evidence to support District #2's strategy for instructional improvement, including its system of professional development. Skeptics, however, point to the lower than average poverty rates for an urban district enjoyed by District #2 and ask if the greater proportion of affluent students are the source of their success. Indeed, the relationship between 1998 school performance in reading (percentage of students achieving at or above grade level) and school affluence (percentage of students *not* eligible for free and reduced lunch) throughout New York City's 32 community school districts was quite strong (r = 0.89). (See figure 4.)

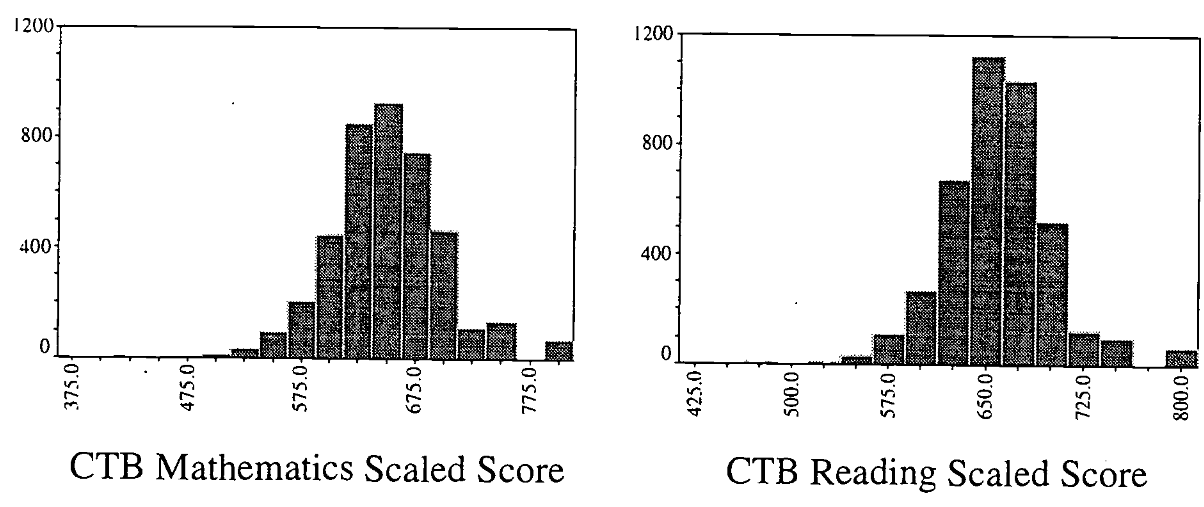

Figure 3: Plots of 1999 CTB scores in mathematics and reading for all District #2 students in grades 3and 5

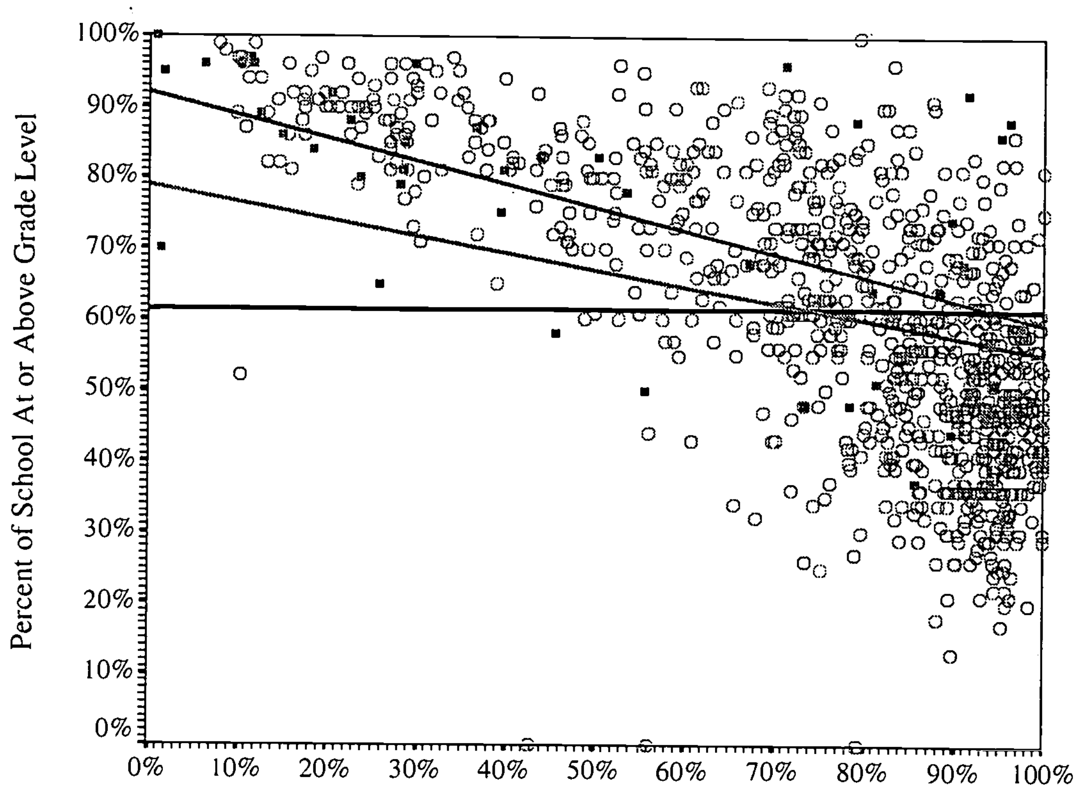

Figure 4: Relationship between school poverty and school performance on the 1998 CTB in reading throughout New York City's community school districts[6] *(Dark squares represent District #2 schools; open circles represent all other community school district schools in New York City.)*

District #2 schools (the dark squares in Figure 4) follow the general trend seen in schools throughout New York City. Those schools with lower proportions of students on free and reduced lunch are more likely to have a larger percentage of their students achieving at or above grade level on the CTB in reading.[7] The upper slanted line in Figure #4 represents a simple linear regression for SES fitted to District #2 data. The lower slanted line represents a fitted regression line for the remaining New York City schools and the horizontal line represents the city-wide average percentage of students per school which perform at or above grade level. These data show that some, but not all, of District #2 schools with high levels of students on free

[6]Data obtained from School Report Card database made available by New York City's Board of Education and available, summer of 1999, on-line at http://207.127.202.63.

[7]The relationship between achievement and eligibility for free and reduced price lunch are similar in mathematics and for all three years for which data are available (1996, 1997 and 1998) via the School Report Card database.

and reduced lunch appear to be doing better than expected. Thus, while District #2 appears to be performing better than average performance gaps still exist.

If all students are to achieve high standards, then these gaps must close. We review the 1999 CTB data on student achievement in mathematics and reading to determine the size of these gaps and therefore the challenge before District #2's professional development system. Below we describe average achievement by gender, ethnicity, socio-economic status and English proficiency and the variation in achievement linked to these factors using the 1999 achievement data for all students in grades 3 and 5.

Gender

Achievement between girls and boys is fairly similar. The differences between their achievement on average are small for mathematics and modest for reading, as reflected in less than 1% of the variance in test scores explained by gender. (See table 4).

	Mathematics	Reading
Female	647.23 (N=2,056)	661.92 (N=2,034)
Male	650.68 (N=2,076)	655.11 (N=2,051)

Table 4: Mean CTB scores in mathematics and reading by gender of District #2 students in grades 3 and 5

Ethnicity

Achievement varies among students of different ethnic backgrounds. (See Table 5.) White students score about 35 points higher than Black and Hispanic students in reading, and White and Asian students scored about 40 points higher than Blacks and Hispanics in mathematics. Ethnicity accounts for 13% of the variance in mathematics scores and 12% of the variance in reading scores.

	Mathematics	Reading
Asian	659.01 (N=1,364)	655.26 (N=1,310)
Hispanic	624.54 (N=821)	641.75 (N=823)
Black	623.81 (N=587)	644.83 (N=589)
White	664.97 (N=1,347)	677.95 (N=1,350)

Table 5: Mean CTB scores in mathematics and reading by ethnicity of District #2 students in grades 3 and 5

Socio-Economic Status

Low SES students (those eligible for free or reduced price lunch) tend to score approximately 25-30 points less on the CTB in mathematics and reading than high SES students. (See table 6.) Socio-economic status accounts for more of the variance in reading scores (13%) than that of mathematics scores (6%). The correlations between SES and mathematics achievement ($r = 0.25$) and between SES and reading ($r = 0.37$) is significant and are similar to those reported in Ensiminger and Slusarcick (1992) and Entwise and Alexander (1992).

	Mathematics	Reading
Low SES	638.52 (N=2,432)	645.56 (N=2,385)
High SES	663.90 (N=1,700)	676.67 (N=1,700)

Table 6: Mean CTB scores in mathematics and reading by SES of District #2 students in grades 3 and 5

English Proficiency

Students proficient in English tended to score approximately 40 points higher on the mathematics CTB and 50 points higher on the reading CTB than those who were not. Clearly students who are proficient in English have an easier time reading and therefore performing on the achievement tests. Despite these large differences, English proficiency accounts for little of the variance—only 2% in mathematics and reading. The overall means for mathematics and reading were almost identical to the means for students proficient in English.

	Mathematics	Reading
Not proficient	612.12 (N=124)	606.39 (N=70)
Proficient	650.27 (N=3,999)	659.56 (N=4,006)

Table 7: Mean CTB scores in mathematics and reading by English proficiency of District #2 students in grades 3 and 5

Time in school

District #2's strategy for improving instruction will have little effect on students' achievement unless those students attend school. Moreover, it is presumed that the longer a student has been in District #2, the more likely it is that they will have benefited from the improvement efforts. To test these suppositions, we review the attendance rates and enrollment time of students and their relationship to achievement in mathematics and reading.

In general, students in grades three and five who have spent more time in District #2 perform better on the CTB in both mathematics and reading. Most enrolled students attend school regularly (mean = 94.2% of days school is in session, SD = 5.67) regardless of gender, socio-economic status or English proficiency. The attendance rate of Asian students is higher than the rest, at approximately 98%, but otherwise there are no differences in attendance rates by ethnicity. Perhaps because so many of the students attend regularly, the correlation between attendance and achievement in mathematics ($r = 0.19$) and reading ($r = 0.10$), although statistically significant, is small.

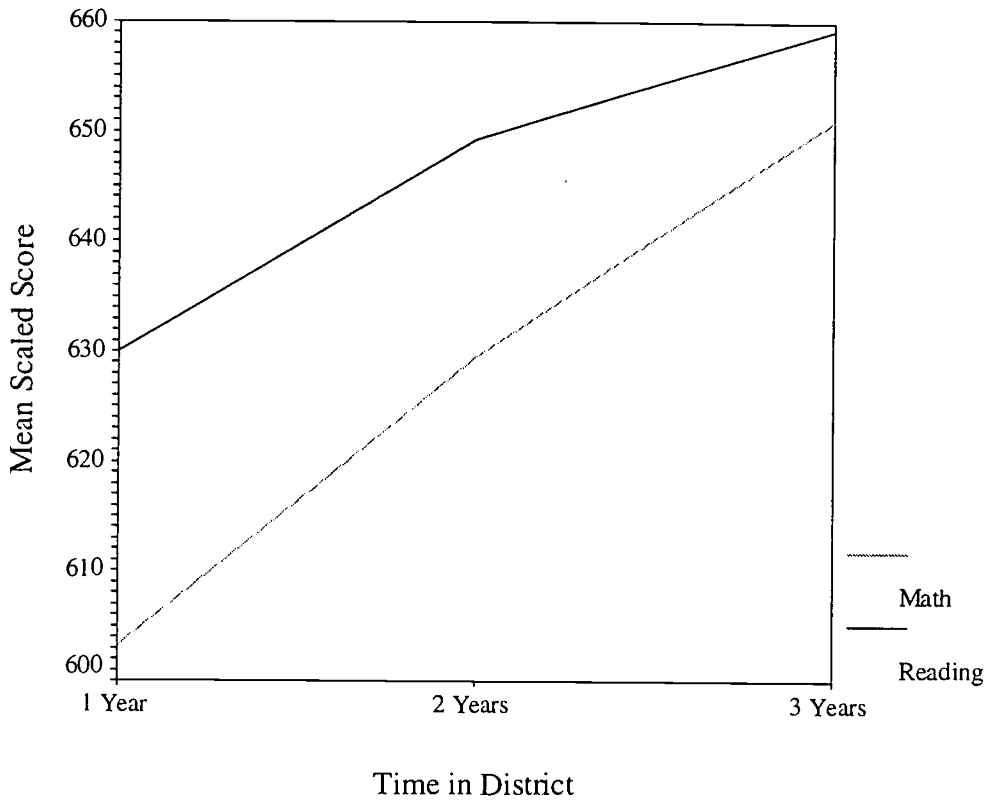

Figure 5: Mean achievement of students compared to time enrolled in District #2 schools

As seen in Figure 5, the mean achievement scores of students in both mathematics and reading were higher for those students who had been enrolled in District #2 longer. (Approximately the same pattern emerged when average percentile ranks associated math and reading were plotted against TID). However, the variance explained by this variable was negligible for both mathematics and reading (1%).

Variation in achievement patterns by classroom

The descriptive statistics reviewed above show that while there is no appreciable difference in the test performance of boys and girls, District #2 does see achievement differences between students of different socio-economic, ethnic and linguistic backgrounds. Attendance appears to improve performance slightly and number or years enrolled in District #2 improves it moderately.

Inferential analyses conducted with multilevel models on the sample of those students for whom we have teacher questionnaire data provide a slightly different picture. (See Appendix A.)

These analyses take into account the relationships between socio-economic status, gender, ethnicity, English proficiency, attendance and District #2 enrollment both within and between individual classrooms. They explore (1) the extent to which within each classroom, student factors (such as ethnicity and socio-economic status) predict individual student achievement; (2) the extent to which aggregates of student factors predict mean student achievement in each classroom, and (3) the extent to which the relationship between student attributes and achievement varies by classroom (i.e. Is gender a stronger predictor of reading achievement in some classrooms than in others?).

	Predictive strength of various student factors within classrooms	Classroom aggregates of student factors predict classroom achievement	Relationship between student factors and achievement varies across classrooms
SES	Math (moderately-weak); Literacy (moderately-strong)	Literacy (strong)	
Ethnicity	Math (moderately-weak)	None	Math; Literacy
Gender	Literacy (moderately-weak)	None	Literacy
English proficiency	—	—	—
Time enrolled in D2	None	None	None
Attendance	Math (weak)	—	None
Grade	—	Math; Literacy (moderate)	None

Table 8: Predictive strength of various student factors (— means a predictor was not used in the model)

The results show that more of student factors explored predict achievement within classrooms than between or across them. (See Table 8.) The within classroom analyses indicate that SES, ethnicity and attendance were moderately weak or weak predictors of individual students' mathematics achievement. In comparison, SES was a moderately strong predictor of individual students' reading achievement, and Gender a moderately-weak predictor. Classroom aggregates of students' SES and grade were able to predict classroom means of achievement in literacy, while only classroom aggregates of grade were able to predict classroom means of achievement in mathematics. Finally, the strength of the relationship between student achievement and ethnicity varied across classrooms in mathematics, while in reading the relationships with Gender and Ethnicity varied across classrooms. In the next section we examine the extent to which teachers' engagement in professional development can account for the variation in these relationships between classrooms. That is, we ask the question, "Are teachers with strong professional development participation patterns more likely to have closed achievement gaps?"

THE ROLE OF PROFESSIONAL DEVELOPMENT

In this section, we first describe teachers' average participation in professional development activities based on their responses to the questionnaire. Then we discuss findings on the relationship between engagement in these various activities and student achievement patterns in both literacy and mathematics. Finally, since District #2 has made an explicit decision to spend more money on professional development at the expense of reducing class size, we examine the extent to which class size relates to student achievement.

Extent to which District #2 teachers engage in various professional development activities

Teachers were asked to respond twice to six questions about the frequency of their participation in professional development activities in their school—once with respect to mathematics and once with respect to literacy. The activities described were all ones that are part of the regular daily routine in District #2 schools, rather than special events, workshops or inservices. Teachers indicated how frequently they engaged in these activities in the last academic year (1998-99): daily, weekly, monthly, one or two times, never. These data were coded as 5 = daily to 1 = never. (See Table 9.)

How often in the past year did you...	Mathematics Mean	Mathematics Std. Dev.	Literacy Mean	Literacy Std. Dev.
Have detailed discussions about instructional practice with other teachers in your school? (5a & 5g)	3.32	1	3.81	1.02
Plan lessons with other teachers in your school? (5b & 5h)	2.97	1.14	3.30	1.13
Observe another teacher's practice in your school? (5c & 5i)	2.19	1.17	2.51	1.07
Have another teacher observe your practice and provide feedback? (5d & 5j)	1.62	.86	1.78	.98
Have a professional developer observe your practice and provide feedback? (5e & 5k)	1.78	.92	1.86	.89
Talk with your principal about your practice? (5f & 5l)	1.86	.79	2.51	1.04
Overall mean	2.39		3.15	

Table 9: Mean response to items about engagement in the school professional culture (5 = daily; 4 = weekly; 3=monthly; 2=one or two times; 1 = never)

Teachers were also asked to indicate whether or not they participated in a variety of professional development activities in the district as a whole. These activities tended to be in the form of particular roles (e.g. mentor teacher) or special events (e.g. a three week participation in the Professional Development Lab). Teachers were asked to indicate if they had participated in the described activity (yes) or not (no). Five of these activities were divided into two kinds: (1) those District professional development activities in which the teacher acted as a *receiver* of assistance (PcReceive) and (2) those in which the teacher acted as a *provider* of assistance (PcProvide). All five of these activities can be considered forms of "High maintenance professional development," as they require significant coordination and commitment on the part of District #2 personnel. Three items fell into the *PcReceive* cagetory: "Work with a mentor teacher"; "Participate in the professional development lab (PDL) as a visiting teacher"; and "Observe another teacher at work in another school in your district that was not part of a PDL experience." Two items fell into the *PcProvide* category: "Serve as a mentor for a novice teacher"; "Participate as a PDL resident teacher." Each teacher was given a score for the number of PcReceive items for which they indicated "yes" and a score of the number of PcDeliver items for which they indicated "yes". (See Table 10.)

	Mean	Std. Dev.
PcRecieve	.67	.74
PcProvide	.32	.52

Table 10: Mean response to items about engagement in District #2 professional community

These data indicate that professional development participation rates are somewhat higher in literacy than in mathematics. Teachers report on average nearly weekly discussions of instructional practice in literacy and monthly opportunities to plan literacy lessons with other teachers in their school. In mathematics, however, teachers are more likely to engage in the described professional development activities on a monthly or occasional basis. About 60% of the teachers had participated as a recipient in any of the district's "high maintenance" professional development in the past year while approximately one third had participated at least once as providers. However, there was substantial variability in responses for these variables.

Influence of professional development on student achievement

The multilevel analyses on the sample of student data for which we also have teacher questionnaire responses indicates that only a few of the professional development activities described above account for any of the between classroom differences in achievement patterns. (See Appendix A for details.) None of the teacher professional development experiences could explain differences in classroom level differences in mathematics achievement and only two of the professional development experiences could explain classroom level differences in literacy achievement.

None of the teachers responses to the professional development experiences described on the questionnaire could explain differences in the classroom means for mathematics. As described earlier, the relationship between mathematics and ethnicity differed by classroom. (See Table 8.) However, engagement in the professional development could not explain those differences either. On the other hand, two professional development activities did explain classroom differences in reading achievement. Those teachers who discuss literacy instruction more frequently with other teachers are more likely to have high classroom averages on the CTB in reading. Moreover, the relationship between gender and achievement was weaker in those classrooms where teachers discussed their literacy instruction with colleagues or their principal frequently. However, differences in the relationship between ethnicity and reading achievement were not explained by engagement in any of the professional development activities.

In summary, engagement in professional development as measured by this questionnaire and reported by the 37 respondents does not appear to have significant influence on student achievement in either literacy or mathematics. Only the activity of discussing instruction with other teachers accounted for any variance in classroom averages for reading achievement. In addition, engagement in professional development did not appear to help to reduce differences often seen in the achievement patterns of students from different socio-economic status, ethnic, and linguistic backgrounds. Only the relationship between gender and reading achievement appeared to be reduced by increased engagement in professional development. None of the relationships in mathematics were affected by engagement in professional development.

Influence of class size on student achievement

Since District #2 made an explicit decision to invest in professional development rather than class size reduction, we decided to investigate the overall effect of class size on student achievement. Class size does vary throughout the district, due in part to naturally occurring fluctuations in enrollment patterns in schools and in part to special funds provided to the district *explicitly* for the purpose of class size reduction. We ran two multilevel models to explore the relationship between class size and student performance. (See Appendix A for details.) Findings in the literature on class size reduction indicate that this strategy is most effective for students in grades 1-3 (Finn, 1998; Finn & Achilles, 1990; Finn & Voelkl, 1994). In order to compare our results to this literature, our first model included only the students in the 103 third grade classrooms in District #2. The second included 174 classrooms which contained students in grades 3 and 5. The results in mathematics and reading from both models are similar. They show that with all other predictors held constant, reducing class size by one student will *increase* average classroom performance by about one point. In short, for all practical purposes, class size does not appear to have any relationship with classroom level student achievement in District #2. In other words, District #2's decision to spend its discretionary funds on professional development rather than class size reduction has had no deleterious effects on student achievement.

CONCLUSION

In this study we have tried to better understand the influence of a variety of factors on student achievement. As expected, we found that many of the variables that District #2 cannot control—students poverty rates, their ethnicity, and their proficiency in English—exert an influence on student performance in reading and mathematics. There was evidence that socio-economic status had a strong relationship with classroom level reading performance, but teachers' reported engagement in professional development was found to make a difference in two areas: the relationship between gender and reading achievement was weakened when teachers discussed their literacy instruction with colleagues and with their principal frequently.

Why did professional development not show more powerful effects in reducing the achievement gaps? There are many possible explanations, some methodological and some conceptual.

Methodologically, the survey sample, although fairly representative with respect to students (i.e., the students taught by the teachers in the sample were very similar to all third and fifth grade students district-wide), may not have been representative with respect to teachers, and the available data did not permit us to ascertain teacher representativeness. In addition, we had no means of checking the reliability of teachers' reported engagement in professional development on the survey. Teachers may have been swayed to answer in ways that were socially desirable and/or may have had difficulty accurately remembering some of their professional development experiences.

Conceptually, the lack of powerful effects from professional development may be explained by how we defined professional learning—as an attribute of the individual teacher rather than as a characteristic of the overall climate of professional culture in a given school. In District #2, the emphasis has been on establishing a school-wide culture of learning for adults as well as for children. Not only are all teachers expected to continue to learn, but they are also expected to assist the learning of other teachers and to assume responsibility for the learning of all the children in their school, not just those in their individual classrooms. If this is indeed the case, one might expect to find the effects of professional development spread out more among children throughout the school as opposed to neatly tagged between one teacher and her students. Despite the fact that our survey tried to measure "participation in a community," we may need to think about additional measurements of the strength of the learning community to which an individual teacher has access.

On the whole this study has provided a foundation for future studies that will measure the linkages between and among various aspects of the District #2 theory of action and student outcome measures. In addition to professional development, future work will take into consideration overall building climates, as well as the actual practices of teachers in the classroom as additional influences on student achievement.

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APPENDIX A

We provide here a more detailed summary of some of the methodological issues surrounding our analyses and more detailed statistical results.

Missing data

9.5% of the students were missing achievement scores in mathematics and 10.5% were missing them in reading. 28.5% of those students with missing test scores in mathematics and 14.5% of those missing scores in reading were also English Language Learners. Many of these students were most likely exempt from testing due to their lack of English proficiency. Asian students were more likely to be missing test data than other students. In fact, they accounted for 69.1% of the missing data in mathematics and 73.5% of the missing data in reading, and overall 82% of the Asian students were missing test scores in mathematics and 78.7% were missing them in reading. 68.6% of those Asian students with missing achievement data in reading and 88.4% in mathematics are considered English Language Learners. This suggests that reading scores are higher than they would be if English Language Learners were not exempted from these tests.

In addition, the teachers' questionnaire's were not always complete. Three teachers did not respond to one of the twelve questions (5a-5l) in the section on their engagement in "Professional community of your school"; four teachers did not respond to one of the seven questions (6a-g) on their engagement in the "Professional community of District #2"; and quite a few did not respond to the three questions (7a-7c) about engagement in the "Professional community beyond District #2". No teacher missed answering more than one of the questions in the first 19 of these questions (5a-5l and 6a-6g). Items 7a-7c were not used in analysis and the missing values for items 5a-5l and 6a-6g were imputed from the teachers' modal response.

Lack of variation in some classrooms

Several of the 37 classrooms for which both teacher and student data was available show no variation on key variables. For example, 11 classrooms showed no variation in the SES of their students—they were either all eligible for free or reduced lunch, or none of the students were eligible. In 13 classrooms, all the students had been enrolled in the district for the same number of years, and for ethnicity 8 classrooms showed no variation. Multilevel models are designed to work with quantitative variables and hence ethnicity was recoded from four categories into two. We chose to collapse the categories into white and non-white because early analyses showed that the achievement of white students differed significantly from the rest of the students. Once this re-categorization was made, three of the classrooms consisted of all white students and five of all non-white students. Finally, more than half of the classrooms (20) showed no variation in English proficiency. Because multilevel analyses are designed to explain variation at different levels of the system, lack of variation within particular classrooms on any given variable excluded that classroom and all the students within it from the analysis. Since English proficiency affected more than half of the classrooms, it was dropped from all analyses as a student-level predictor. Even with this provision, most of the multilevel analyses could only be run on a portion of the data in the sample. Actual numbers in the various analyses ranged from 10-37 classrooms and 185-848 students.

The loss of these classrooms and students from the HLM analyses has three consequences. First, it introduces additional bias into our results. Of the 11 classrooms with no variation in SES, 7 were composed entirely of low SES students. Likewise, those with no variation in ethnicity tended to be nonwhite, and those with no variation in the number of years students had been enrolled in District #2 tended to have been in the district at least three years. Second, and relatedly, our ability to generalize our findings is weakened, since they exclude homogenous classrooms. Finally, the precision with which classroom-level effects can be estimated was reduced, in some cases significantly. These problems are somewhat endemic of school-based research (e.g. Newmann & Associates, 1996).

HLM Analyses

To address the research questions a series of multilevel analyses (students nested within teachers/classrooms) were performed using the HLM computer program (Bryk, Raudenbush, & Congdon, 1997). Under the assumption that $i=1,2,.., n_i$ students (level 1) are nested within $j=1,2,\ldots,J$ classrooms (level 2), and that District #2 students and classrooms are representative of an identifiable population, we fitted regression models to mathematics and, separately, to reading scores. We examined residuals for the fitted models and found no serious evidence of nonnormality and heteroscedasticity, although we did find evidence of nonlinearity associated with the TID variable that appeared to be quadratic in nature. In these cases, we used two strategies (a) We created a new variable TID^2 that was included in our analyses (b) We performed a log-transformation for TID to try to reduce the quadratic effect and used this variable in our analyses. The results of our analyses using TID^2 and log(TID) were similar to those based on TID, and only the latter are reported. Finally, plots of the residuals against products of the predictor variables suggested that interaction-type predictors were not needed. We used a significance level of .05, although for a few cases we treated p-values slightly larger (e.g., .060) as statistically significant because of our concern that our tests may be underpowered.

We began by fitting an unconditional model that allowed us to explore the total variation between classroom means. The initial level 1 and level 2 models were:

$$Y_{ij} = \beta_{0j} + r_{ij} \qquad (1a)$$
$$\beta_{0j} = \gamma_{00} + u_{00}$$

In equation (1a), Y_{ij} is a test score for student i in classroom j ($i=1,2,..,n_{jk}$; $j=1,2,..,J_k$), β_{0j} is the mean achievement of classroom j, r_{ij} is an error term that is assumed to follow a normal distribution $N(0,\sigma^2)$, and u_{00} represents the difference between each student's test score and the classroom mean and is a random effect. Next, we modeled variation in classroom mathematics and readings means using classroom-level predictors. The level 1 model was the same as (1a) but the level 2 model was

$$Y_{ij} = \beta_{0j} + r_{ij} \qquad (1b)$$
$$\beta_{0j} = \gamma_{00} + \gamma_{01} W_{1j} + \gamma_{01} W_{2j} + \ldots + \gamma_{0j} W_{tj} + u_{0j}$$

where β_{0j} is the mathematics or reading mean of the jth classroom, γ_{00} is the intercept, γ_{01} is a slope capturing the relationship between a classroom level predictor such as %High SES students and classroom achievement, and u_{0j} is a random error that is assumed to follow a normal distribution N(0, τ_{00}). Although we would have preferred to perform these analyses separately for third and fifth grade teachers, the small number of teachers made this strategy unfeasible. Instead, we added Grade as a level 2 predictor. We then examined the effects of predictors of student achievement by fitting a (conditional) level 1 regression model to the data for each classroom:

$$Y_{ijk} = \beta_{0j} + \beta_{1j}\ \text{SES} + \beta_{2j}\ \text{Ethnicity} + \beta_{3j}\ \text{TID} + \beta_{4j}\ \text{Gender} + \beta_{5j}\ \text{Attendance} + r_{ij} \qquad (1c)$$

where β_{1j} is the slope capturing the relationship between SES and achievement (p = 1,2,.., P level 1 predictors), and r_{ij} is an error term that is assumed to be normally-distributed with constant variance σ^2 (Level 1). All level 1 predictors were centered about their group means. We then attempted to explain variation among classroom intercepts and slopes using a level 2 model of the form:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} W_{1j} + \gamma_{01} W_{2j} + \ldots + \gamma_{0j} W_{tj} + u_{0j} \qquad (1d)$$
$$\beta_{pj} = \gamma_{10} + \gamma_{11} W_{1j} + \gamma_{21} W_{2j} + \ldots + \gamma_{tj} W_{tj} + u_{tj}\ ,\ t = 1,2,.., T \text{ level 2 predictors}$$

where γ_{00} is the mean achievement across classrooms, γ_{01} is slope relating the level 2 predictor W_{0j} to level 1 classroom mean β_{0j}, u_{0j} is the effect of classroom j on mean achievement conditioning on level 2 predictor W_{tj}, γ_{10} is the intercept for level 2 regressions, γ_{tj} is a slope relating the level 2 predictor W_{tj} to level 1 slope β_{pj}, and u_{tj} is the effect of a classroom on the level 1 slope conditioning on W_{tj}. Level 2 predictors included %high SES, %White, %English Proficient, and Grade level, as well as variables based on the survey that teachers responded to. All level 2 predictors were centered about their grand mean.

Essentially, the model for β_{0j} in (1d) attempts to predictor variation in classroom means as a function of classroom level predictors like SES and teachers reported professional development. Similarly, the model for β_{pj} in (1d) attempts to predict variation in level 1 slopes relating predictors like SES and achievement as a function of classroom level predictors.

Mathematics Results

The results of fitting model (1a) to the mathematics data are summarized in the upper portion of Table 11. The resulting chi-square test for mathematics ($\chi^2 = 677.94$, $p < .00$) indicates that there was significant variation among the mathematics means, with 46% of the variation attributable to between-classroom variation. These results provide evidence that student achievement in mathematics varies across classrooms.

Next, we fitted model (1b) to the classroom mathematics means with the predictors %High SES, %White, Grade, and items 5a-5f from the teachers survey were added as individual predictors. The results indicate that only the predictor Grade was significant.

Next we fitted model (1c) to the data. The results of these analyses are summarized in the middle portion of Table 11. The median R among the regression models fitted within classrooms was .40 and the median R^2 was .16.

The slopes associated with SES, Ethnicity, and Attendance were all statistically significant predictors of mathematics performance. For example, the slope for the within-classroom regression of mathematics on SES, with the effects of the other predictors held constant, was 8.25, meaning that, on average, high SES students tend to score about 8 points higher than those in the low SES group. Similarly, the significant slope of 9.33 for Ethnicity means that, with the other predictors held constant, White students tended to score about 9 points higher than Nonwhite students. The slope for Attendance (.80) indicates that each 1% increase in attendance is associate with about a 1 point gain in test scores. The introduction of these student-level predictors increased the explained variation by about 5% compared to the unconditional model (1a). The reliability of the estimated slopes was quite low, for example, .05 for Ethnicity. However, low reliability for estimated slopes are common in HLM analyses (Bryk & Raudenbush, 1992).

The results for model (1c) also indicate that there was significant variation among the Math/Ethnicity slopes. To study this variation, we fitted model (1d) to the mathematics data with the level 2 predictors classroom %High SES, %White, Grade, PcReceive and PcProvide. We refitted the model to the mathematics data after dropping the PcReceive and PcProvide predictors because they did not appear to contribute anything and we added items 5a-5f as individual predictors. The results for the refitted model (1d) are reported in Table 11.

Only Grade was a significant predictor of intercepts (classroom mathematics means), and none of the level 2 predictors of level 1 slopes were significant.

Reading Results

The results of fitting model (2a) are summarized in the upper portion of Table 12. The resulting χ^2 statistic of 558.24 ($p < .00$) tells us that reading means varied significantly across classrooms. We also computed the proportion of the variance in the means that was between-classrooms, .41 or 41%. This value tells us that there is substantial variation among the means that could potentially be explained.

We next fitted model (2b) to the reading data for each classroom. The results from model (2b) are reported in Table 12. In addition to Grade and SES, item 5g (Have detailed discussions about instructional practice in literacy with other teachers in your school?) was a significant predictor of classroom reading means. The estimated slope for item 5g (9.08) suggests that teachers who have more detailed discussions tend to be associated with higher performing classrooms.

Next, we fitted model (2c) to the reading data within classrooms. The median coefficient of determination (R) among the regression models fitted within classrooms was .46 and the median R^2 was .21. The results of these analyses are summarized in the middle portion of Table 12. SES and Gender were each statistically significant predictors of reading within classrooms. The slope for the regression of reading on SES, with the effects of the other predictors held constant, was 14.73, meaning that, with the other predictors held constant, high SES students score about 15 points higher on this test than low SES students. Similarly, the slope for Gender was -7.58, meaning that, with the other predictors held constant, females tended to score 7 to 8 points higher than males. There was also significant variation among the Read/Gender and Read/Ethnicity slopes. Collectively, the results from model (2c) tell us that student-level SES and Gender have a significant effect on reading scores but Ethnicity and Attendance do not, and that the Read/Gender and Read/Ethnicity slopes vary across classrooms.

We attempted to explain variation among the classroom intercepts and slopes by fitting model (2d) with level 2 predictors %High SES, Grade, %White, PcReceive, and PcProvide. The latter two predictors did not appear to contribute anything and were dropped. Items 5g-5l from the teachers survey were then included as level 2 predictors. Results are reported in Table 12. For the intercept model, Grade and %High SES were significant predictors of classroom reading means, along with item 5g (Have detailed discussions about instructional practice in literacy with other teachers in your school?).

For the level 1 slopes, items 5g (Have detailed discussions about instructional practice in literacy with other teachers in your school?) and 5l (Talk with your principal about your literacy practice) were significant predictors of the Read/Gender relationship.

The estimated slope for 5g (-12.44) tells us that teachers who reported having these detailed discussions more tend to be associated with classrooms with smaller Reading/Gender slopes. Similarly, the slopefor 5l (-7.89) indicates that the Read/Gender relationship is weaker in the classrooms of teachers who talk with their principal about their literacy practice.

On the whole, the Read/Gender relationships were weaker in classrooms in which teachers have frequent discussions about their literacy practice with other teachers and their principal. However, the statistically significant variance components in model (2d) for Gender, SES, Ethnicity, and Attendance indicate that there is variation among these slopes to be explained.

Class Size Analyses

Classroom data for 103 third grade teachers were analyzed. As seen in Table 13, Class Size was not a significant predictor of classroom performance, although other level 2 predictors were. For grades 3 and 5 in the district, data for 174 teachers were available. As reported in Table 13, Class Size was a significant predictor of mathematics and reading means. For mathematics, the estimated slope of .87 tells us that with the other predictors held constant, increasing class size by one student will, on average, increase mathematics achievement by about one point, a negligible effect. The estimated slope for reading (1.05) has much the same interpretation. These results support District #2's decision to not invest its resources in reducing class sizes.

Table 11
Results For HLM Analysis Of CTB Mathematics Scores

Mathematics Model (1a)

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	653.092584	5.144519	126.949	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	30.34228	920.65389	36	677.76191	0.000
level-1,	R	33.06847	1093.52370			

Mathematics Model (1b)

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	653.012751	3.568998	182.968	0.000
ETHNIC, G01	60.193792	38.724094	1.554	0.132
GRADE, G02	21.460993	4.567492	4.699	0.000
5A, G03	9.387094	5.952049	1.577	0.127
5B, G04	0.029524	5.641621	0.005	0.996
5C, G05	1.923934	5.759355	0.334	0.741
5D, G06	-4.267847	6.352632	-0.672	0.507
5E, G07	4.977797	5.063989	0.983	0.335
5F, G08	7.773208	5.922266	1.313	0.201
SES, G09	10.259771	32.482059	0.316	0.754
ENGPROF, G010	40.350336	57.429685	0.703	0.488

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	20.31464	412.68479	26	186.81293	0.000
level-1,	R	33.10517	1095.95257			

Mathematics Model (1c)

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	653.080638	5.145518	126.922	0.000
For SES slope, B1				
INTRCPT2, G10	8.259717	3.703430	2.230	0.032
For ETHNIC slope, B2				
INTRCPT2, G20	9.336815	3.756926	2.485	0.018
For TID slope, B3				
INTRCPT2, G30	7.245707	4.162354	1.741	0.090
For ATTEND slope, B4				
INTRCPT2, G40	0.800697	0.245490	3.262	0.003

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	30.40082	924.21007	15	395.75678	0.000
SES slope,	U1	2.31882	5.37693	15	10.50108	>.500
ETHNIC slope,	U2	7.71127	59.46370	15	24.02798	0.054
TID slope,	U3	2.07777	4.31714	15	5.81471	>.500
ATTEND slope,	U4	0.23685	0.05610	15	10.99551	>.500
level-1,	R	32.20236	1036.99192			

Mathematics Model (1d)

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	653.010909	3.552886	183.797	0.000
ETHNIC, G01	66.683583	37.327521	1.786	0.085
GRADE, G02	21.426511	4.548974	4.710	0.000
5A, G03	-10.062558	5.832037	-1.725	0.095
5B, G04	-1.439341	5.227066	-0.275	0.785
5C, G05	3.824885	5.060141	0.756	0.456
5D, G06	-5.135109	6.205719	-0.827	0.415
5E, G07	5.581971	4.966827	1.124	0.271
5F, G08	7.869413	5.891206	1.336	0.193
SES, G09	11.291599	32.292417	0.350	0.729
For SES slope, B1				
INTRCPT2, G10	7.341997	4.788423	1.533	0.137
ETHNIC, G11	12.210507	41.717514	0.293	0.772
GRADE, G12	-5.505344	6.407849	-0.859	0.398
5A, G13	8.634999	6.765884	1.276	0.213
5B, G14	-6.977148	4.675538	-1.492	0.147
5C, G15	3.632446	6.059803	0.599	0.554
5D, G16	4.429433	9.268999	0.478	0.636
5E, G17	0.712337	5.371656	0.133	0.896
5F, G18	-14.518049	9.185661	-1.581	0.125
SES, G19	9.373425	40.427702	0.232	0.819

For ETHNIC_99 slope, B2				
INTRCPT2, G20	10.960718	5.561733	1.971	0.059
ETHNIC, G21	-12.894096	48.439101	-0.266	0.792
GRADE, G22	3.812638	6.517927	0.585	0.563
5A, G23	-7.394372	7.667351	-0.964	0.344
5B, G24	10.222126	6.430855	1.590	0.123
5C, G25	-4.596610	6.066551	-0.758	0.455
5D, G26	3.881598	9.951435	0.390	0.699
5E, G27	-5.095645	7.095185	-0.718	0.479
5F, G28	-2.282356	7.951124	-0.287	0.776
SES, G29	-17.928027	45.399689	-0.395	0.696
For TID slope, B3				
INTRCPT2, G30	7.224935	5.398413	1.338	0.192
ETHNIC, G31	59.373326	47.903289	1.239	0.226
GRADE, G32	-10.844502	8.705929	-1.246	0.224
5A, G33	3.645690	6.544341	0.557	0.582
5B, G34	-3.990862	6.171613	-0.647	0.523
5C, G35	-3.896521	7.839240	-0.497	0.623
5D, G36	-3.952537	9.618936	-0.411	0.684
5E, G37	3.569954	7.302212	0.489	0.628
5F, G38	-8.327660	8.164636	-1.020	0.317
SES, G39	38.956577	43.196870	0.902	0.375
For ATTEND slope, B4				
INTRCPT2, G40	0.798822	0.298750	2.674	0.013
ETHNIC, G41	4.769597	2.858329	1.669	0.106
GRADE, G42	-0.407577	0.334800	-1.217	0.234
5A, G43	-0.267455	0.489015	-0.547	0.588
5B, G44	-0.483165	0.338130	-1.429	0.164
5C, G45	0.168043	0.402572	0.417	0.679
5D, G46	-0.861872	0.579447	-1.487	0.148
5E, G47	-0.106769	0.367679	-0.290	0.774
5F, G48	0.514591	0.497243	1.035	0.310
SES, G49	5.111695	2.472979	2.067	0.048

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	20.26608	410.71398	9	83.58281	0.000
SES slope,	U1	4.59156	21.08247	9	9.12336	0.166
ETHNIC slope,	U2	12.04388	145.05495	9	16.37565	0.012
TID slope,	U3	4.84977	23.52031	9	2.94991	>.500
ATTEND slope,	U4	0.24197	0.05855	9	8.35795	0.212
level-1,	R	32.35517	1046.85688			

Table 12
Results For HLM Analysis Of CTB Reading Scores

Reading Model (2a)

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	662.280375	4.317502	153.394	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	25.30949	640.57022	36	558.24708	0.000
level-1,	R	30.40556	924.49819			

Reading Model (2b)

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	662.685817	2.228848	297.322	0.000
ETHNIC, G01	7.448670	20.231497	0.368	0.715
GRADE, G02	16.175729	2.599440	6.223	0.000
5G, G03	9.083674	3.732370	2.434	0.022
5H, G04	1.869847	2.956997	0.632	0.532
5I, G05	-0.516238	3.003392	-0.172	0.865
5J, G06	4.783978	3.781595	1.265	0.217
5K, G07	4.296573	3.459883	1.242	0.226
5L, G08	2.920262	3.298353	0.885	0.384
SES, G09	-45.347030	19.024306	-2.384	0.025
ENGPROF, G010	34.637015	32.384196	1.070	0.295

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	11.64448	135.59395	26	100.98348	0.000
level-1,	R	30.53450	932.35564			

Reading Model (2c)

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	662.301899	4.292136	154.306	0.000
For GENDER slope, B1				
INTRCPT2, G10	-7.586848	2.575859	-2.945	0.006
For SES slope, B2				
INTRCPT2, G20	14.737999	3.629536	4.061	0.000
For ETHNIC slope, B3				
INTRCPT2, G30	5.826674	3.493383	1.668	0.104
For TID slope, B4				
INTRCPT2, G40	6.487186	3.903203	1.662	0.105
For ATTEND slope, B5				
INTRCPT2, G50	0.379387	0.227760	1.666	0.104

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	25.24571	637.34576	15	321.20067	0.000
GENDER slope,	U1	9.22236	85.05184	15	31.29114	0.008
SES slope,	U2	7.53399	56.76108	15	16.94593	0.322
ETHNIC slope,	U3	8.74098	76.40469	15	24.29300	0.060
TID slope,	U4	5.50627	30.31901	15	14.65968	>.500
ATTEND slope,	U5	0.34290	0.11758	15	17.96483	0.264
level-1,	R	28.86794	833.35809			

Reading Model (2d)

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	662.651577	2.253796	294.016	0.000
ETHNIC, G01	8.119714	20.337180	0.399	0.692
GRADE, G02	16.119780	2.632666	6.123	0.000
5G, G03	9.878577	3.727697	2.650	0.014
5H, G04	1.237995	2.919261	0.424	0.674
5I, G05	0.165422	2.986153	0.055	0.957
5J, G06	5.105720	3.805099	1.342	0.191
5K, G07	4.992662	3.427511	1.457	0.157
5L, G08	2.540843	3.309503	0.768	0.449
SES, G09	-48.896171	19.026688	-2.570	0.016
For GENDER slope, B1				
INTRCPT2, G10	-8.040602	2.589800	-3.105	0.005
ETHNIC, G11	-15.575266	23.994956	-0.649	0.521
GRADE, G12	-2.051752	2.950794	-0.695	0.493
5G, G13	-12.444959	4.255298	-2.925	0.007
5H, G14	1.940369	3.437619	0.564	0.577
5I, G15	3.215108	3.385550	0.950	0.351
5J, G16	-1.607124	4.399529	-.3650	0.717
5K, G17	2.030383	3.976866	0.511	0.613
5L, G18	-7.898333	3.734769	-2.115	0.044
SES, G19	-8.351451	22.397151	-0.373	0.712

For SES slope, B2				
INTRCPT2, G20	12.467107	4.705070	2.650	0.014
ETHNIC, G21	2.000650	35.883289	0.056	0.956
GRADE, G22	-5.323053	5.238998	-1.016	0.319
5G, G23	0.264004	7.080439	0.037	0.971
5H, G24	-0.441269	4.699818	-0.094	0.926
5I, G25	-2.998954	5.266500	-0.569	0.573
5J, G26	-12.288643	10.696594	-1.149	0.261
5K, G27	4.476093	7.389689	0.606	0.549
5L, G28	-0.599631	9.414356	-0.064	0.950
SES, G29	-14.228995	35.514464	-0.401	0.691
For ETHNIC slope, B3				
INTRCPT2, G30	9.074033	5.537363	1.639	0.113
ETHNIC, G31	47.327615	39.256097	1.206	0.239
GRADE, G32	4.586920	6.132847	0.748	0.461
5G, G33	-4.955017	7.852609	-0.631	0.533
5H, G34	-3.653943	5.425661	-0.673	0.506
5I, G35	-0.606292	6.164050	-0.098	0.923
5J, G36	3.000968	8.275420	0.363	0.719
5K, G37	1.307166	6.852255	0.191	0.850
5L, G38	1.108920	7.469489	0.148	0.883
SES, G39	45.474387	40.670031	1.118	0.274
For TID slope, B4				
INTRCPT2, G40	7.356268	4.937930	1.490	0.148
ETHNIC, G41	29.517014	37.369165	0.790	0.437
GRADE, G42	3.986587	6.951466	0.573	0.571
5G, G43	4.070174	6.733061	0.605	0.550
5H, G44	-2.601371	4.877678	-0.533	0.598
5I, G45	-3.794195	6.152032	-0.617	0.542
5J, G46	1.078552	11.962922	0.090	0.929
5K, G47	4.474839	11.681518	0.383	0.704
5L, G48	-6.438830	7.606449	-0.846	0.405
SES, G49	18.141809	34.437817	0.527	0.602
For ATTEND slope, B5				
INTRCPT2, G50	0.417795	0.288930	1.446	0.160
ETHNIC, G51	1.953515	2.417164	0.808	0.426
GRADE, G52	-0.172282	0.299214	-0.576	0.569
5G, G53	-0.079366	0.529826	-0.150	0.882
5H, G54	-0.165270	0.338897	-0.488	0.629
5I, G55	0.414785	0.339598	1.221	0.233
5J, G56	-0.158416	0.404141	-0.392	0.698
5K, G57	-0.285166	0.377176	-0.756	0.456
5L, G58	0.436263	0.445493	0.979	0.337
SES, G59	1.180178	2.261851	0.522	0.606

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	11.99880	143.97112	9	46.57529	0.000
GENDER slope,	U1	8.23798	67.86432	9	19.11040	0.004
SES slope,	U2	10.33249	106.76040	9	13.28477	0.038
ETHNIC slope,	U3	15.10920	228.28778	9	17.96506	0.007
TID slope,	U4	4.76284	22.68462	9	9.66720	0.139
ATTEND slope,	U5	0.62935	0.39609	9	15.19335	0.019
level-1,	R	29.10450	847.07184			

Table 13
Results of Class Size Analyses

Third Grade Students Mathematics

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	629.930395	1.881022	334.887	0.000
%WHITE, G01	-54.141740	7.390549	-7.326	0.000
%ENGPROF, G02	32.617642	13.205602	2.470	0.014
%HIGH SES, G03	25.155339	5.545321	4.536	0.000
CLASSIZE, G04	0.053286	0.355934	0.150	0.881

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	16.64838	277.16858	93	478.73455	0.000
level-1,	R	35.69181	1273.90560			

Third Grade Students Reading

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	645.664505	1.534370	420.801	0.000
%WHITE, G01	-16.317332	6.020536	-2.710	0.007
%ENGPROF, G02	20.406238	10.862657	1.879	0.060
%HIGH SES, G03	39.359024	4.511479	8.724	0.000
CLASSIZE, G04	0.076555	0.292560	0.262	0.794

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	13.15547	173.06640	93	387.12844	0.000
level-1,	R	32.53366	1058.4388			

Grades 3 and 5 Mathematics

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	642.882173	1.527293	420.929	0.000
ETHNIC99, G01	-54.278577	5.758188	-9.426	0.000
GRADE99, G02	20.155079	1.791231	11.252	0.000
SES99, G03	30.520461	4.377997	6.971	0.000
CLASSIZE, G04	0.876496	0.292402	2.998	0.003

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	18.79331	353.18861	173	1171.68593	0.000
level-1,	R	34.97202	1223.04206			

Grades 3 and 5 Reading

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	P-value
For INTRCPT1, B0				
INTRCPT2, G00	653.788918	1.303879	501.418	0.000
ETHNIC99, G01	-21.110381	4.914668	-4.295	0.000
GRADE99, G02	12.446887	1.528369	8.144	0.000
SES99, G03	44.008727	3.736030	11.780	0.000
CLASSIZE, G04	1.058299	0.250179	4.230	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	15.96949	255.02472	173	1101.85049	0.000
level-1,	R	30.65360	939.64337			

APPENDIX B

Teacher Background Survey & Consent Form
High Performance Learning Communities Project
Learning Research and Development Center, University of Pittsburgh

Dear District #2 teacher:

District #2 has entered into a 5 year collaboration with the University of Pittsburgh to improve and study the nature of the district's learning communities. As District #2 moves toward the development of a standards-based learning culture, the University of Pittsburgh researchers are assisting and studying the process at all levels: the district, the schools and the classrooms. As a professional member of the District #2 community, you are being asked to complete the attached questionnaire which is a part of the overall research study.

There are no foreseeable risks associated with this study and the District will benefit from learning more about classroom and school reform. Any information obtained about you from this questionnaire will be utilized for research only and will be kept confidential. Information about you will be coded and your name will be removed from any report. Information which might link you to the research will be kept in locked files for five years and only the research team will have access to it. There is no adverse effect if you choose not to complete this form.

If you have any further questions about this research, you can contact Nancy Israel at the High Performance Learning Communities Project at (412) 624-7452. Any questions about your rights as a research participant will be answered by the Office of the Senior Vice Chancellor for Health Sciences, University of Pittsburgh (412-647-9834). By signing this form, you agree to participate in this research study.

Please sign this consent form and complete the survey attached to it. Place the completed survey and consent form in the enclosed envelope, seal it and return it to the principal of your school. Please keep the copy of the consent form for your own records.

Thank you for participating in this collaborative effort aimed at improving district learning communities.

Sincerely,

Lauren Resnick
Principal Investigator

Participant's Name ____________________ Date ____________________

1. Name: ______________________________
(Please print)

2. School: PS ____________ **Official Class Number:** ____
(Please print)

3. Education

a. What is the highest degree you have completed thus far?
❑ High school diploma
❑ Bachelor degree
❑ Master degree
❑ Doctorate

b. When did you complete this degree? ____________(year)

c. What educational certifications have you acquired thus far?

Please list all certifications below. Include teaching certifications and others, such as adminstrative ones. Specify grade levels and subject matter where appropriate.	**Year received**

d. How many courses in mathematics, literacy and assessment have you taken for college or university credit? (Include only those courses for which you received credit toward either an undergraduate or graduate degree. Please *exclude* workshops and other professional development activities for which you did *not* receive credit toward a degree.)

Area	**Total number of courses taken**	**Number of these courses taken in the last five years**
a. Mathematics		
b. Mathematics curriculum & methods		
c. Writing		
d. Literature		
e. Literacy curriculum and methods		
f. Assessment and/or testing		

4. Teaching experience

a. How many years have you been teaching in a school that serves K-12 students? ___________

b. How many years have you been teaching in your current school district? ___________

c. How many years have you been teaching at your current school? ___________

d. What grade(s) did you teach this past academic year? ___________

e. How many years have you been teaching in your current grade(s)? ___________

f. Are you currently teaching a grade level(s) for which you are certified? ❑ Yes ❑ No

g. Are you a subject matter specialist? ❑ Yes ❑ No

If yes, what subject(s) did you teach this year? ___________

If yes, how many years have you been teaching your current subject(s)? ___________

h. Are you currently teaching a subject(s) for which you are certified? ❑ Yes ❑ No

5. Professional community in your school

On average, how often in the past academic year did you...		Daily	Weekly	Monthly	1 or 2 times	Never
a.	Have detailed discussions about instructional practice in **mathematics** with other teachers in your school?	❑	❑	❑	❑	❑
b.	Plan **mathematics** lessons with other teachers at your school?	❑	❑	❑	❑	❑
c.	Observe another teacher's **mathematics** practice in your school?	❑	❑	❑	❑	❑
d.	Have another teacher observe your **mathematics** practice and provide feedback?	❑	❑	❑	❑	❑
e.	Have a professional developer observe your **mathematics** practice and provide feedback?	❑	❑	❑	❑	❑
f.	Talk with your principal about your **mathematics** practice?	❑	❑	❑	❑	❑
g.	Have detailed discussions about instructional practice in **literacy** with other teachers in your school?	❑	❑	❑	❑	❑
h.	Plan **literacy** lessons with other teachers at your school?	❑	❑	❑	❑	❑
i.	Observe another teacher's **literacy** practice in your school?	❑	❑	❑	❑	❑
j.	Have another teacher observe your **literacy** practice and provide feedback?	❑	❑	❑	❑	❑
k.	Have a professional developer observe your **literacy** practice and provide feedback?	❑	❑	❑	❑	❑
l.	Talk with your principal about your **literacy** practice?	❑	❑	❑	❑	❑

6. Professional community in your district

In the past academic year, did you...			
a.	Work with a mentor teacher?	❑ Yes	❑ No
b.	Serve as a mentor for a novice teacher?	❑ Yes	❑ No
c.	Participate in the professional development lab (PDL) as a visiting teacher?	❑ Yes	❑ No
d.	Participate in PDL as a resident teacher?	❑ Yes	❑ No
e.	Observe another teacher at work in another school in your district that was not part of a PDL experience?	❑ Yes	❑ No
f.	Participate in the Standards Network?	❑ Yes	❑ No
g.	Serve as a mathematics lead teacher?	❑ Yes	❑ No

7. Professional community beyond your district

In the last *two* years, did you...		...in mathematics		...in literacy	
a.	Attend a workshop or conference outside your district?	❑ Yes	❑ No	❑ Yes	❑ No
b.	Make a presentation at a conference outside your district?	❑ Yes	❑ No	❑ Yes	❑ No
c.	Lead or facilitate a workshop or inservice session on improving teaching practice outside your district?	❑ Yes	❑ No	❑ Yes	❑ No

8. Background information

a. When did you graduate high school? ___________(year)

b. What is your ethnic background? (Please check all that apply.)
❑ Black
❑ White
❑ Asian, Asian-American, or Pacific Islander
❑ Hispanic, Puerto Rican, Latino or Chicano
❑ Native American or Alaskan Native
❑ Other (please specify): ____________________

c. What is your gender?
❑ Male
❑ Female

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