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ABSTRACT

This paper draws upon data from a longitudinal study of students in four Wisconsin elementary schools to probe for the linkages between school- and home-related variables and students' academic achievement. Data were collected from fall 1979 through spring 1982. Subjects, enrolled in the third grade during the 1979-80 school year, were followed through their fourth and fifth grade years. The sample also included children who entered school in the fall of 1980, at the beginning of their fourth grade year. Additional data were collected from parents, teachers, other professional staff, and school and district administrators. Findings indicated that the variables included in the analyses were not particularly helpful in understanding students' gains in reading and mathematics. Findings further emphasize the complexity of human learning and the uniqueness of individual learners. Neither time-on-task in reading or mathematics nor time spent on homework was a potent predictor of student gain. Students of teachers who held a graduate degree did less well than students whose teachers did not have a graduate degree. Teachers' attitudes and beliefs were at least as important as other teacher characteristics. Finally, students' academic aptitude was not as potent a predictor of student gain in reading and mathematics as might be expected. (RH)

SCHOOL RESOURCES, HOME ENVIRONMENT, AND STUDENT ACHIEVEMENT GAIN IN GRADES 3-5

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SCHOOL RESOURCES, HOME ENVIRONMENT, AND STUDENT ACHIEVEMENT IN GRADES 3-5

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The belief that children learn best when the home and school are mutually supportive and work together in concert has long been prevalent in educational circles. The relative importance of each institution in the overall educational process, and the specific ways in which the home and the school either reinforce or negate each other's efforts, is far from clear. The Coleman Report (1966), with its emphasis on the primacy of the home, served to kindle more heated debate rather than to clarify the relationships. There currently appears to be a reaffirmation of the importance of both the home and the school in the learning of children, but still little understanding of the precise nature or the effects of various linkages. This paper draws upon data from a longitudinal study of students in four elementary schools to probe for the linkages between school- and home-related variables and students' academic achievement.

A growing body of research supports the view that schools and teachers do, indeed, make a difference in the learning of children. Studies conducted during the early 1970s by Murnane (1975) and Summers and Wolfe (1977) provided evidence that teachers exert considerable influence on student learning. The body of research on effective schools published during the past ten years lends strong support to the view that student achievement is higher in schools where there is a clear focus on academic goals, appropriately structured learning activities, teaching methods which focus on the learning task to be accomplished, and an expectation of high achievement by students

(Armor, et. al. 1976; Brookover, et al. 1979; Brophy, 1979; Glenn, 1981; Venezky and Winfield, 1979; and Purkey and Smith, 1983).

There is also ample literature dealing with family characteristics and student performance in school. Iverson and Walberg (1982) identified four "schools" of research in this area: the socioeconomic school, the family constellation school (emphasizing family size and birth order, etc.), the British school (emphasizing parental attitudes and expectations), and the Chicago school (emphasizing family behavior and parent-child interactions). These are not competing schools of thought, for researchers identified with one school seldom discredit or deemphasize the significance of work done by others. It has been well established that a strong relationship exists between socioeconomic status and student achievement (Coleman, et al., 1966). However, the mechanisms through which the socioeconomic advantages are transmitted are not well understood. There also are conceptual problems in using socioeconomic factors as independent variables because they tend to lump a variety of factors into a single index. Olson (1985) has observed, "although many associations have been identified between achievement and factors measuring socioeconomic status, family constellation, parents' attitudes and expectations for their children, and the quality and quantity of parent-child interactions, in most cases the dynamics of the relationships are not well understood." It also should be noted that many researchers have used samples comprised of urban and "disadvantaged" children. Whether findings derived from these studies are generalizable to populations with very different demographic characteristics is uncertain.

Population and Sample

The data used in this study were collected from Fall 1979 through Spring, 1982 in four Wisconsin elementary schools. The subjects were students enrolled in grade three during the 1979-80 school year. These students were followed through their fourth-and fifth-grade years (1980-81 and 1981-82). The sample also included children who entered school in fall, 1980, at the beginning of their fourth grade year. In addition, data were collected from parents, from teachers and other professional staff members who instructed these students, and from school and district administrative personnel.

The four elementary schools involved in the study were selected because they:

1. represented varying demographic characteristics,
2. were expected to maintain relatively stable enrollment patterns,
3. professed a commitment to individualizing education, in some manner, for each student, and
4. were willing to participate for the duration of the study.

Community and School District Characteristics

General demographic information obtained from the 1980 census for the communities in which the four schools are located is presented in Table 1. Data for Wisconsin and the nation also are provided for purposes of comparison. Two of the schools are located in urban areas with populations over 50,000; the other two schools are located at communities of less than 10,000. While there is variation

among the communities in their geographic location, educational level and occupational status, the data in Table 1 indicate the four communities are relatively homogeneous with respect to median family income and poverty levels. While the income and poverty levels in these communities are quite representative of Wisconsin as a whole, they are somewhat higher in their educational and occupational levels then the state in general.

/Insert Table 1 here/

Data for the 1979-80 school year were obtained for the four school districts containing these elementary schools and for other Wisconsin school districts of similar size and are presented in Table 2.

/Insert Table 2 here/

Seven other Wisconsin school districts served community populations comparable in size to District 1. For these seven districts a mean and standard deviation were calculated for each of the nine variables shown in Table 2. The results indicate that District 1, when compared to other districts serving similar population sizes, fell within one standard deviation of the mean in all nine categories.

Districts 2 and 3 were compared to 70 other Wisconsin school districts with average daily membership ranging between 1,500 and 3,000 students. When compared to these districts, District 2 and District 3 both fell within one standard deviation of the mean on eight of the nine variables. The average daily membership of each district was slightly more than one standard deviation above the mean of the 70 districts.

District 4 was compared to other Wisconsin districts with average daily membership of 3,000 to 5,000 students and fell within one standard deviation of the mean on five of the nine variables. Its average daily membership was more than two standard deviations above the mean for this group and the district was more than one standard deviation below the mean on average contract salary, teachers' years of local experience, cost per member, and cost per member less transportation. The data presented in Table 2 suggest that the four school districts in which the elementary schools included in this study are located were not atypical when compared to other Wisconsin school districts of similar size.

School Characteristics

The general characteristics of the four schools (summarized in Table 3) indicate they were similar in enrollment but dissimilar in physical plant and organizational patterns. Schools 1 and 2 were housed in traditional buildings (i.e., completely separate self-contained classrooms joined by common hallways), except for a new wing in School 1 containing a large open space for grades 5 and 6. Although the teachers in School 1 were nominally organized into multigrade teams, planning and instruction took place on a graded basis with few exceptions; for example, in year 3 of the study some fifth graders were in math and sciences classes with sixth graders. School 1 was organized in a traditional graded manner; the only exception occurred in year 2 in which some fourth graders were placed in fifth grade math classes. Ability groups within a grade level were formed each year for some academic subjects at both schools 1 and 2. These groups were essentially permanent except for language arts at school 1 at year 1.

/Insert Table 3 here/

In Schools 3 and 4, students were placed in multi-graded instructional units in large open areas with movable walls, chalkboards, and bookshelves. Cross-grade planning and grouping practices occurred at both schools during all three years. However, implementation of an individualized model of instruction was carried out most completely at School 3 where grouping of students across grades was utilized in most subject areas and regrouping occurred as needed. That is, for a particular subject over the course of a year, a student in School 3 was likely to have several different teachers and to be placed in a subgroup with children from more than one grade level according to their common instructional needs. In School 4, cross-grade instructional planning and grouping was used quite extensively but the groups tended to remain stable once established with some exceptions for a particular subject and/or year.

Student Characteristics

General background characteristics of the students who comprised the sample are presented in Table 4. Characteristics such as preschool enrollment which remain more or less constant regardless of yearly fluctuation in the sample size are reported once for the entire sample. Characteristics of the group which changed yearly (e.g., participation in special services), are given on an annual basis.

/Insert Table 4 here/

The number of students recorded in the first row of Table 4 for each school refers to the total number of students included in the study during the course of the study. Most of these students entered during the first year, but a few enrolled as fourth graders. Due to normal attrition, the entry of a few new students in fourth grade, and a change in attendance boundaries at one school, the number of students in each year of data collection varied as shown. Because parental consent was required for certain aspects of the study (e.g., use of achievement test data), certain analyses were performed with fewer students.

The student populations of the four schools were quite comparable on most of the dimensions outlined in Table 4. Although a notable exception appears in the aptitude level of students at School 2, these data must be viewed with some caution since the only scores available for School 2 were from a test given after completion of the study. Furthermore, the test administered in School 2 was a different instrument. Data for the other three schools were from baseline testing in grade 2.

Attendance at preschool varied somewhat among the four schools, with the fewest students attending at School 1 and with the greatest number at School 2. Although higher preschool enrollment at School 2 might be related to lower aptitude, this conjecture is not borne out in the special services enrollment. That is, a comparable proportion of School 2 students received special services such as a Title I reading and math program, a remedial or learning disabilities program, other special education programs, or special instruction in speech and hearing. Special educational services were received by somewhat fewer students at School 4. No explanation is available for the high proportion of male students at School 3.

Teacher Characteristics

Background information for the teachers of students in the study is presented in Table 5. Since analysis of students' achievement was based primarily on their performance in regular academic classes, personal characteristics are given only for teachers of academic subjects. Some teachers are represented in the data for two and occasionally for all three years. This is particularly true for Schools 3 and 4 which operated on a multi-grade unit basis, so that some or all of the teachers taught students in the study for two or three consecutive years. The extreme case occurred at School 4 in which all six of the academic subject teachers in Year 1 continued in Year 2.

/Insert Table 5 here/

Table 5 indicates that for the population as a whole, the teachers of regular academic subjects in the third grade were predominantly female, were less often female in the fourth grade, and at the fifth grade were equally divided among males and females. The proportion of teachers who held a master's degree increased over the three-year period from about 1/4 to 1/2 of the teachers. This change in part reflected the increasing number of male teachers. On a school basis, the proportion of female teachers was roughly comparable in the four schools, although there were some differences from year to year. The proportion of teachers holding a master's degree ranged from 1/4 of the teachers at School 3 to about 1/2 of the teachers at School 4. School 4 was the only one in which a significant number of third- and fourth-grade teachers held a master's degree. (Recall, however, that in School 4 the same team of teachers taught both third and fourth grade).

The teachers of academic subjects averaged over ten years of experience during each year of the study. On the whole, teachers in School 4 were less experienced (as well as younger) than teachers in the other schools, and the range of ages was considerably less in School 4 than in the other schools.

Instrumentation and Data Collection

After consent forms were secured from parents and school personnel, data collection proceded during the 3-year period according to the schedule outlined in Table 6. Information was gathered on student, teacher, and school-wide variables. The major dependent variables for which data were collected were student achievement in reading and mathematics, although some data concerning student affective behavior also were collected.

/Insert Table 6 here/

Student Variables

Information about individual students, including their personal, educational and home background, was assembled using a student personal background instrument and an interview with parents. Student use of time in school was measured by means of a student classroom observation form.

Student personnel background record. Basic information concerning each student's personal characteristics such as age, sex, race, handicaps (if any), and previous educational experiences such as preschool enrollment was obtained from school cumulative records. Attendance data and a record of involvement in special programs were

obtained annually. Baseline achievement and aptitude test scores were recorded using the most recent administration data prior to the study. (These baseline test dates ranged from mid-year of grade 1 at School 2 to fall of grade 3 at School 3.) In all but School 2 the Stanford Achievement Test and the Otis Lennon Test of Mental Ability had been administered. At School 2 the Comprehensive Test of Basic Skills and the CTB Test of Cognitive Skills were used; as previously discussed, the latter test was administered after the study. However, because it was the only source of student aptitude data for School 2, the scores were included in the students' records. Table 7 provides information concerning the baseline as well as the post-test program for the study.

/Insert Table 7 here/

Parent Interview. A structured interview with parents was used to accumulate information about students' daily activities at home, i.e., out-of-school uses of time such as homework or TV viewing, and about a wide range of background variables including siblings, family socio-economic status, parents' educational level and occupation, the availability of reading resources in the home, frequency and type of contact with the school by parents and their general attitude toward the school. About 1/3 of the parents were interviewed by telephone during each year of the study. Although an effort was made to contact all parents, the final sample consisted of 199 interviews of a potential 281 families. In part, this was because families not yet interviewed moved after the first (or second) year of the study.

Student classroom observations. The use of time in school by individual students was recorded by the research team using a student classroom observation form designed specifically for the study. Each student was observed for a full school day in the fall, winter, and spring each year. The observations were organized by subject with highest priority given to obtaining complete observations in reading and mathematics; the next priority was assigned to the other academic subjects (language arts, science, and social studies); and lowest priority was accorded art, music, physical education, and special programs.

Each observer observed five students simultaneously and at two-minute intervals characterized each student's use of time by recording one of the following eight categories: on-task, independent study; on-task, one-to-one instruction; on-task, small-group instruction; on-task, large-group instruction; on-task, study with one or more peers; off-task; process behavior; or not observable. The latter three categories all exemplified off-task behavior but were distinguished by causal factors. "Off-task" indicated that the student could have been on-task in one of the preceding modes (e.g., small-group instruction) but instead was visiting, daydreaming, or in some other fashion exhibiting non-attentive behavior. "Process behavior" usually referred to a waiting period when the student, due to factors outside his or her control, wsa forced to wait for the teacher to begin the class, correct a paper, give directions to the class, etc. The "non-observable" category was used when a student left the room for some reason. At least three full days of observation were completed in reading and mathematics classes for 231 students in grade 3, 241

students in grade 4, and 205 students in grade 5. Complete longitudinal profiles over the three years are available for about 185 students.

Stanford Achievement Test

The major dependent variables in the study, student achievement in reading and mathematics, were measured by the Stanford Achievement Test at the end of each school year. The test forms appropriate to the grade level were administered as outlined in Table 7 and although some students were given the entire battery upon the school's request, only results of the reading and mathematics tests were of interest in the study. The tests were administered by project staff and then hand scored, with the exception of School 3 which conducted its own testing program, used the scoring service of the publisher and then provided data to the research staff. The scores recorded included raw score, scaled score, stanine, percentile, and grade equivalent. As indicated in Table 8, performance on the several subtests of the subject test was highly correlated across subtests and with the total test and agreed with the publisher's expected correlations; therefore total test scores were used in the analyses.

/Insert Table 8 here/

Teacher Variables

Information about the personal, educational, and professional background and activities of all teachers in the study was obtained using a teacher personal background record. Additional background information, attitudinal data about their profession, and self-report

data about instructional practices were gathered from academic subject teachers by means of a teacher background, preferences and opinions questionnaire.

Teacher Personal Background Record. All teachers who had contact with the students in the study were requested to complete a questionnaire concerning characteristics such as age, sex, undergraduate and graduate institutions attended, degrees held, participation in continuing education, involvement in professional and community organizations and activities, type and number of years of experience, and reasons for placement at the school and grade/subject. The questionnaire was completed when the teacher joined the study and for variables such as degree attainment was updated annually thereafter. All except one of the 44 teachers of academic subjects completed the questionnaire; the results for these teachers were reported in Table 6.

Teacher Background, Preferences and Opinions Questionnaire. Academic subject teachers provided further personal information such as parental education and employment and the location of previous teaching positions in the first section of a teacher background, preferences and opinions questionnaire which was adapted for this project from an instrument developed by Murnane and Phillips (1979). On the second section of the questionnaire the teachers indicated their preferences, if any, for teaching particular socioeconomic and ability levels of students and provided ratings of the ability and effort of the groups of students they actually taught. In addition, they responded to a variety of questions describing instructional practices such as use of pretesting, homework, competition, grading, and handling discipline matters. The third section of the questionnaire, consisting of 41

five-point Likert scale items, assessed teachers' opinions and beliefs about a wide range of areas including the purpose of schooling, the role of teachers and students, instructional techniques, classroom management, and the like. Of the 44 academic subject teachers, 37 completed this questionnaire.

Methodology

The development of a data base suitable for examining simultaneously the relationships between student achievement and home, school, and teacher variables involved a rather complex procedure. The interviews with parents of students in the sample produced over 100 variables dealing with the characteristics of the family, the student's use of time out of school (including homework), activities in which the student was involved out of school, and parental perceptions of the school's effectiveness and the academic progress of their child. Through a series of cluster analysis and factor analysis procedures, a limited number of the most potent variables was identified and multiple regression procedures were then used to identify relationships between these variables and students' academic achievement (Olson, 1985). The variables found most useful in explaining variance in student achievement and progress were selected for inclusion in the analyses reported in this paper.

The information gathered about teachers included a large number of variables reflecting teacher personal characteristics, instructional behaviors, professional attitudes, and beliefs. Three procedures were used in analyzing these data. First, teacher-student dyads were constructed so that a specific teacher could be associated with a

specific student's academic achievement in reading or mathematics. Second, the data were reduced to a small set of noncolinear variables using cluster analysis and factor analysis procedures. Third, the variables which survived this screening were used in multiple regression equations to identify those which were most useful in explaining variance in student achievement (Rossmiller, 1985) and these variables were incorporated in the analyses described in this paper.

Multiple regression procedures were used to examine relationships between students' use of time in school and their academic achievement. The analyses included the five modes of instruction for which on-task data were gathered as well as time spent in process activities and off-task. The time on-task in various instructional modes was found not to be related strongly or consistently to student academic achievement (Rossmiller, 1983). Consequently, a composite percentage of the on-task time, and time off-task, in reading and in mathematics was employed in the analyses reported in this paper.

Data on expenditures also were collected and, through the use of information concerning the distribution of time to various curricular subjects during each of the three years students were studied, it was possible to estimate accurately the expenditure per student for instruction in various school subjects, including reading and mathematics. The analysis of relationships between expenditure per pupil and student achievement yielded no statistically significant relationships (Frohreich, 1986). Consequently, no data concerning expenditures were included in the analyses reported in this paper.

As a result of the foregoing procedures, 24 independent variables were identified for inclusion in the analyses reported in this paper. Two variables related directly to students (academic aptitude and

gender), eight variables reflected aspects of the student's home environment, 12 variables reflected teacher characteristics, and 2 variables reflected student use of time in school (on- or off-task). These variables are identified and described in Table 9.

/Insert Table 9 here/

Population

Although a total of 281 students were observed during the course of the study, the population available for this analysis was considerably smaller, primarily because only students for whom complete achievement data were available for each year of the study could be used. The creation of teacher-student dyads also reduced the available sample, since a teacher was included in the analysis only if there were at least five teacher-student dyads available for analysis. For the analysis of reading gains, a sample of 100 students was available for the analysis of gains from grade 3 to grade 4 and 95 students were available for the analysis of gains from grade 4 to grade 5 and from grade 3 to grade 5. For the analysis of gain in mathematics, 100 students were available for the analysis of gain from grade 3 to grade 4 and 71 students were available for the analysis of gains from grade 4 to grade 5 and from grade 3 to grade 5.

Analyses

Stepwise multiple regression with forward selection was used in the analysis of the data to identify relationships between home-, school-, and teacher-related variables and the gain in mathematics achievement and reading achievement demonstrated by students from the end of grade

3 to the end of grade 4, from the end of grade 4 to the end of grade 5, and from the end of grade 3 to the end of grade 5. In addition, home-related variables and school- and teacher-related variables were examined in separate regression analyses for the gain demonstrated by students in the sample from the end of grade 3 to the end of grade 5.

Findings

Reading

Tables 10, 11, and 12 summarize the results of the stepwise regression equations in which students' scaled scores in reading were regressed on home-, school-, and teacher-related variables. Separate regression equations were computed for the gain in student achievement from the third to the fourth grade, from the fourth to the fifth grade, and from the third to the fifth grade. Table 13 summarizes the stepwise regression procedures identifying the variables which stepped in (or out) at each stage.

Table 10 indicates that five variables entered the final regression equation for gain in reading during fourth grade. They included one teacher variable (4), two student variables (14 and 16) and two home variables (21 and 22). The five variables produced R = .49 and together accounted for approximately 20% of the variation in student gain in reading during fourth grade. Although the variance accounted for by the equation was significant at beyond the .001 level, only two of the individual variables were significant at the .05 level and three were significant at the .10 level. The most potent predictors of gain in reading achievement were variable 4 (the main purpose of education should be to teach people what to think) and variable 14 (percent of

time on-task in reading at grade 4). These two variables accounted for approximately 15% of the variance in reading gain.

/Insert Table 10 here/

Table 11 provides the final regression equation for gain in reading scaled score from the end of grade 4 to the end of grade 5. The five variables entering the equation produced R = .46 and accounted for approximately 17% of the variance in gain in student reading scores from the end of the grade 4 to the end of grade 5. Note that only variable 16 (academic aptitude) appeared in both Table 10 and Table 11 (but with opposite signs). Of the five variables which entered the equation, three (7, 10, and 13) were teacher-related, one (16) was student-related, and one (23) was home-related. The first two variables entering the equation were 16 (academic attitude) and 10 (whether or not the teacher held a graduate degree), which entered with a negative sign. These two variables accounted for approximately 12% of the variance in gain in reading scores during grade 5. Significance levels for the variables entering the final equation ranged from a low of .002 (10) to a high of .061 (23).

/Insert Table 11 here/

Table 12 shows the final regression equation for gain in reading scaled score from the end of grade 3 to the end of grade 5. Student gain scores in any single year tend to vary more widely than they do over a two-year time span, i.e., there is considerable regression to the

mean. Using gains over a two-year period tends to smooth the data. Six variables entered the final regression equation, producing R = .48 and accounting for approximately 17% of the variance in student gain over the two-year period. One variable (2) was student-related, two (4 and 9) were home-related, and three (15, 16, and 17) were teacher-related. The three teacher-related variables all dealt with their attitudes and beliefs. Time spent on homework entered the equation but with a negative sign and a relatively low level of significance.

/Insert Tables 12 and 13 here/

Table 13 summarizes the stepwise regression analyses for gain in reading and show the step at which each variable entered the equation. Examining the three final regression equations for gain in reading score, it will be noted that only one variable (academic aptitude) entered all three of the final equations, once negatively and twice positively. One variable, Q30, (the main purpose of education should be to teach people what to think) entered two of the three equations, as did the parents' perception of whether or not the school had a strong academic program (STRACAD). Each of the three final regression equations produced R = .46 to .49, and each accounted for around 20% of the variance in student gains in reading.

Table 14 shows the final equation when the gain in student reading scores from the end of grade 3 to the end of grade 5 was regressed on the set of home-related variables alone. Only two variables entered the equation. One of them was academic aptitude (2); the other was the parent's perception of whether or not the school had a strong academic program (9). The equation produced R = .32 and accounted for

approximately 8% of the variance in gain in student reading scores from grade 3 to grade 5.

/Insert Table 14 here/

Table 15 shows the final regression equation when student gain in reading from grade 3 to grade 5 was regressed on teacher-related variables. (Student academic aptitude was not included in this regression.) Four variables (15, 16, 17, and 18) entered the final equation and all of them reflected aspects of teacher attitudes or beliefs. The equation yielded R = .45 and accounted for about 17% of the variance in the gain in reading scaled score from third to fifth grade.

/Insert Table 15 here/

Mathematics

Tables 16, 17, and 18 display the final equations for the regression on gain in mathematics scores from grade 3 to grade 4, from grade 4 to grade 5, and from grade 3 to grade 5. As shown in Table 16, six variables were included in the final equation when gain in mathematics from grade three to grade four was regressed on the home-, school-, and teacher-related variables. Variable 12 (number of magazines and journals read by the teacher) entered the equation at step 4 but was removed at step 8 (see Table 19). Of the six variables which entered the final equation, two (3 and 10) were teacher-related. One (17) was student-related, and three (19, 23, and 24) were home-related. The six variables produced R = .44 and accounted for approximately 14%

of the variance in student gain in mathematics from grade 3 to grade 4. The first two variables entering the equation (student gender and number of sports activities in which the student engaged) accounted for about 10% of the variance in student gain scores.

/Insert Table 16 here/

Only one variable (whether or not the teacher held a graduate degree) entered the equation for gain in mathematics scaled score from grade 4 to grade 5 (see Table 17). As was the case with reading, this variable entered with a negative sign. Its correlation with student gain score was -.26 and it accounted for about 5% of the variation in mathematics gain from grade 4 to grade 5.

/Insert Table 17 here/

The teacher's graduate degree status also was the only variable to enter the equation for mathematics gain from grade 3 to grade 5 and it entered with a negative sign. (See Table 18). For the gain from grade 3 to grade 5 the correlation was -.33, accounting for approximately 10% of the variance in student gain in mathematics from grade 3 to grade 5. Coding of the variable was such that holding a graduate degree affected students' gain negatively.

/Insert Tables 18 and 19 here/

Table 20 shows that when mathematics gain from grade 3 to grade 5 was regressed only on the home-related variables the one variable to

enter the equation was the number of sports activities in which the student was involved. The correlation of sports activities with mathematics gain was .17 and it accounted for less than 2% of the variance in student gain in mathematics during the period from the end of grade 3 to the end of grade 5.

/Insert Table 20 here/

Table 21 shows that only one variable, the teacher's graduate degree status, entered the equation when gain in mathematics from grade 3 to grade 5 was regressed on school- and teacher-related variables. The variable entered with a negative sign (-.33) and accounted for about 10% of the variance in mathematics gain from grade 3 to grade 5.

/Insert Table 21 here/

Discussion

One must be quite cautious in discussing the results reported in the previous sections. It must be noted that the data were drawn from only four elementary schools. Furthermore, these schools served middle and lower middle class families, predominently white, located in small or medium-sized cities in one state in the upper midwest. Thus, the sample of students involved in the present study differs markedly from the studies in which samples were drawn from inner city schools.

It also must be noted that gain in student achievement is "slippery" and difficult to measure. The availability of student gains over a two-year period served to smooth the data by permitting

regression to the mean to exert its influence. Thus, we feel somewhat more comfortable with the equations measuring gain over the two-year period from grade 3 to grade 5.

A further word of caution is in order concerning the teacher-related variables. The number of teachers who taught either reading or mathematics to the students in the sample during any one year was quite small, typically 12-15, which in itself suggests caution. The procedures used in constructing the teacher-student dyads resulted in some teachers being weighted more heavily than others, e.g., a teacher who taught 15 students would appear three times as often as one who taught 5 students, which may induce bias. The decision criteria applied in constructing the teacher-student dyads also may have inadvertently biased the sample.

It is noteworthy that none of the regression equations specified in these analyses produced large Rs. In no instance was R greater than .50 and in no instance was more than 25% of the variation in student gain accounted for by the variables included in the equation. Although they were carefully selected from a much larger universe of variables in each area (home, school, and teacher), the variables included in these equations were not particularly useful in explaining variance in student gains. The student's academic aptitude, as expected, entered the equations for gain in reading scores from grade 3 to grade 4, grade 4 to grade 5, and grade 3 to grade 5. However, academic aptitude did not account for more than 8% of the variance in any of the three equations. This variable was rather unstable, both with regard to partial correlation with gain in reading score and with regard to the sign with which it entered the equation. Academic aptitude did not enter any of the three equations for gain in mathematics. This finding was

unexpected and no ready explanation for the lack of a significant relationship between student academic aptitude and gain in mathematics is immediately evident.

The dichotomous variable indicating the teacher's graduate degree status entered negatively for two of the reading regressions (grade 4-5 and grade 3-5). This variable also entered each of the mathematics gain equations, entering with a positive sign for gain from grade 3-4, and with a negative sign for gain from grade 4-5 and grade 3-5. Taken at face value, this finding lends little support to those who recommend graduate work for teachers in the elementary grades. However, one may not conclude on the basis of these findings that teachers who hold a graduate degree are less effective in teaching reading or mathematics than those who hold only a bachelor's degree. In some instances teachers with an advanced degree taught the less able students who did not score well on the standardized test. In addition, our data do not include information concerning the course of study for the advanced degree. Thus, teachers might have pursued their graduate work in a field unrelated to the teaching of either reading or mathematics and, of course, the sample of teachers is small. This finding does raise a question about the cost-effectiveness of paying teachers additional salary for earning graduate credits. In this regard, one may observe that the number of graduate credits the teacher had completed in the past 24 months did not enter any of the regressions.

It is also of interest to note that time on-task entered only one equation (reading grade 3-4), and that percentage of time off-task did not enter any of the regression equations. Although in earlier analyses we had found that time on-task was a useful predictor of the student's achievement test score (Rossmiller, 1983), time on-task was not a

significant predictor of the gain in achievement in either reading or mathematics. This finding does not imply that time on-task is unimportant, but it does indicate that increasing the amount of time on-task is not a panecea which will produce marked improvements in student gain in reading or mathematics.

When only the home-related variables were regressed against student gain in reading from grade 3 to grade 5, just one variable, the parents' perception of whether or not the school had a strong academic program, entered the equation at a statistically significant level. The amount of variance it accounted for, however, was negligible. Only the student's involvement in sports was correlated significantly with gain in mathematics from grade 3-5. Again, the amount of variance explained by the home-related variables was slight. One is tempted to conclude on the basis of these data that home-related variables exerted relatively little influence over the student's gain in reading or mathematics score from grade 3-5. Among the variables that failed to enter the equation, for example, were amount of time spent daily on homework, involvement in art and music activities, the mother's years of school completed, the amount of reading material in the home, and the number of hours per week the mother worked outside the home.

Analysis using only school- and teacher-related variables provided somewhat different results for reading and mathematics. Four variables which measured aspects of teachers' attitudes and beliefs entered the equation for gain in reading from grade 3-5 and they accounted for approximately 17% of the variance in student gain in reading. In mathematics, however, only one variable, the teacher's graduate degree status, entered the equation (negatively). The school- and

teacher-related variables did not account for more than 10% of the variance in gain in mathematics from grade 3-5.

In summary, the variables included in the analyses reported in this paper were not particularly helpful in understanding the gain in scaled scores made by students in reading and mathematics from grade 3 to grade 5. The results further emphasize the complexity of human learning and the uniqueness of individual learners. Time on-task in reading or in mathematics was not a potent predictor of student gain. Time spent on homework was not a significant predictor of student gain. Students of teachers who held a graduate degree did less well than students whose teachers did not have a graduate degree. Teacher's attitudes and beliefs were at least as important as other, more easily quantifiable, characteristics of teachers. And the student's academic aptitude, although a useful predictor of student gain, was not as potent a predictor of student gain in reading and mathematics as might be expected.

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Table 1

CHARACTERISTICS OF COMMUNITIES IN WHICH SAMPLE SCHOOLS WERE LOCATED[1]

School	Community population	Type of area and geographic location	High school graduates[2] (%)	4+ years college[2] (%)	1979 median family income	1979 family income below poverty level (%)
1	51,500	Medium city, light industry, northwestern Wisconsin	77.3	20.4	$19,135	7.1
2	4,100	Small town/rural, large industry nearby, southern Wisconsin	78.0	14.6	21,181	3.2
3	10,000	Small city, light industry, southern Wisconsin	66.9	14.3	20,648	3.6
4	53,000	Medium city/ urbanized area, light industry, north central Wisconsin	68.1	14.6	20,770	4.8
Wisconsin	4,705,800		69.6	14.8	20,915	6.3

[1]Data from 1980 Census.

[2]Persons 25 years and older.

Table 1A

OCCUPATIONAL STATUS BY MAJOR CATEGORIES IN THE COMMUNITIES IN WHICH SAMPLE SCHOOLS WERE LOCATED[1]

School (Community)	Managerial, professional (%)	Technical, sales, administrative support (%)	Service (%)	Farming, forestry, fishing (%)	Precision production, crafts, repair (%)	Operators, fabricators, laborers (%)
1	24.6	33.6	18.6	.9	8.3	14.0
2	17.9	35.4	15.4	.4	10.3	20.6
3	22.6	29.5	13.5	1.8	13.4	19.1
4	21.9	33.4	14.6	.7	10.1	19.2
Wisconsin	20.1	27.4	14.1	5.5	12.1	20.9

[1]Data from 1980 Census for employed persons over 16 years of age.

Table 2

COMPARISON OF SAMPLE SCHOOL DISTRICTS WITH OTHER WISCONSIN SCHOOL DISTRICTS SERVING COMMUNITIES OF SIMILAR SIZE OR HAVING SIMILAR AVERAGE DAILY MEMBERSHIP (ADM)

Variable	School District 1	Other school districts serving communities of similar population size (N = 7)		School District 2	School District 3	Other school districts with ADM of 1,500 to 3,000 students (N = 70)		School District 4	Other school districts with ADM of 3,000 to 5,000 students (N = 25)	
		Mean	S.D.			Mean	S.D.		Mean	S.D.
Total ADM	9,767	9,702	2,103	2,471	2,692	2,044	381	4,621	3,699	435
Total pupil/ teacher ratio	17:1	16.76:1	1.55	17.1:1	15.9:1	16.54:1	1.79	17.3:1	16.83:1	.85
Minority enrollment	203	335	271	11	20	56	70.53	80	80	52
Contract salary average	17,756	17,020	1,208	14,591	15,034	14,551	2,582	15,035	16,581	1,127
Teachers' average experience (in years)										
Local	10.4	11.4	1.22	7.7	10.5	9.3	2.32	8.3	9.94	1.47
Total	13.9	14.07	1.64	9.3	12.3	12.0	2.73	11.2	12.65	1.55
Cost/member	2,469	2,458	333	2,117	2,350	2,305	226	2,197	2,417	191.45
Cost/member less transportation	2,357	2,409	327	1,993	2,226	2,135	201	2,048	2,314	234.08
Equalized valuation/ member	93,254	117,260	39,001	82,308	113,360	92,143	25,214	83,619	94,148	26,143

Table 3

CHARACTERISTICS OF THE FOUR SCHOOLS IN WHICH THE STUDY WAS CONDUCTED

	School 1	School 2	School 3	School 4
Days of Instruction				
Year 1	176	180	179	178
Year 2	177	180	179	180
Year 3	175	178	179	180
Enrollment				
Year 1	577	484	512	456
Year 2	607	454	493	476
Year 3	553	363	481	440
Grades enrolled	K-6	K-6	K-6	K-6
Physical plant	traditional, self-contained classrooms, except for new open space gr. 5-6 wing	traditional, self-contained classrooms	open space	open space
Organizational pattern	primary unit (gr. K-2) intermed. unit (gr. 3-4) upper unit (gr. 5-6)	K-6, graded	primary unit (gr. K-3) intermed. unit (gr. 3-5) upper unit (gr. 5-6)	kindergarten, graded primary unit (gr. 1-2) intermed. unit (gr. 3-4) upper unit (gr. 5-6)
Other	Art, music, and physical education are taught by regular classroom teachers, not special teachers.			

Table 4

BACKGROUND CHARACTERISTICS OF STUDENT SAMPLE

	School 1	School 2	School 3	School 4	Total
Entry Characteristics					
N	88	63	51	79	281
Age in months, fall, 1979 ($\bar{x}$)	102	101	102	103	102
Males (%)	51	51	63	54	54
Nonwhite (%)	5	3	2	0	3
Preschool attendance (%)	20	39	28	27	28
Aptitude ($\bar{x}$)	116	104[a]	116	115	113
By-Year Characteristics					
N					
Year 1	74	56	43	70	243
Year 2	78	55	47	69	249
Year 3	61	50	45	61	217
Special services enrollment (%)[b]					
Year 1	18	18	16	6	14
Year 2	14	13	19	4	12
Year 3	5	8	9	3	6
Days present ($\bar{x}$)					
Year 1	168	174	172	172	171
Year 2	170	175	173	173	173
Year 3	167	173	174	175	172

[a]Data are from the Test of Cognitive Skills (1982), given in fall, 1983, when students were in sixth grade; for the other three schools, scores are from a grade 2 administration of the Otis-Lennon Mental Ability Test (1973).

[b]A student is counted once, regardless of the number of special programs in which s/he was enrolled.

Table 5

BACKGROUND CHARACTERISTICS OF TEACHERS
OF REGULAR ACADEMIC SUBJECTS

School	Year	N[a]	Female	Master's degree held	Age			Years of Experience		
					Mean	S.D.	Range	Mean	S.D.	Range
1	1	4	4	0	45.0	15.8	29-61	11.7	6.6	6-18
	2	3/1	3	0	44.7	16.4	26-57	9.7	8.0	2-18
	3	5	1	5	44.5	13.0	33-63	14.4	8.8	8-29
2	1	2	2	0	47.5	10.6	40-55	11.0	5.7	7-15
	2	4[b]	2	1	35.0	7.3	25-42	7.5	4.6	2-13
	3	3/1	2	2	42.3	4.2	39-47	14.0	3.5	10-16
3	1	5	4	0	34.6	13.6	25-58	10.2	10.2	3-28
	2	6/3	4	2	41.7	15.6	25-59	14.0	11.4	1-29
	3	11/5	7	3	39.8	12.7	26-60	11.3	9.8	2-30
4	1	6	4	4	33.8	3.8	31-41	8.7	3.3	6-14
	2	6/6	4	4	34.8	3.8	32-42	9.7	3.3	7-15
	3	4	2	1	34.7	5.0	30-40	8.7	6.2	5-18
Total[c]	1	17	14	4	38.3	11.8	25-61	10.1	6.4	3-28
	2	19/10	13	7	38.6	11.3	25-59	10.6	7.5	1-29
	3	23/6	12	11	40.1	10.7	26-63	11.9	8.3	2-30

[a]Numbers to the right of the slashes indicate the number of teachers who had been present the previous year; for example, 1 of the 3 teachers from School 1 in Year 2 had participated in the study in Year 1.

[b]Data were not available for a fifth teacher who participated.

[c]Data are available for 43 of the 44 academic subject teachers who took part in the study. Because some of the teachers participated for two or three years, the apparent number of participating teachers over the three years is 59.

Table 6

INSTRUMENTATION AND SCHEDULE OF DATA COLLECTION

Instrument	Administration Schedule
Student Variables	
Student Personal Background Record	once upon entry, updated annually
Parent Interview	once, one-third of the families each year
Student Classroom Observations	three classes annually per student per academic subject (reading, language arts, mathematics, science, social studies); as time permitted, classes in other subjects (art, music, physical education, special services)
Stanford Achievement Test	annually, end of year
Self-Observation Scales	annually, end of year
Teacher Variables	
Teacher Personal Background Record	once upon entry, updated annually if teacher participated for more than one year
Teacher Background, Preferences, and Opinions Questionnaire	once
Purdue Teacher Opinionaire	once
Teacher Time Allocation Record	three weeks annually

(Table continued)

Table 6 (Continued)

Instrument	Administration Schedule
School and School District Variables	
Principal Personal Data Questionnaire	once, updated annually
Leader Behavior Description Questionnaire	once
School Data Questionnaire	once, updated annually
Instruction and Instruction Related Expenditures Form	annually (for each school staff member)
FTE/Pupil Count for Instructional/ Noninstructional Personnel Form	annually
Individual Student FTE Assignments and Costs Form	annually
Gross and Operating Expenditure Data Form for Wisconsin/Non-Wisconsin School Districts	annually
Material, Equipment, and Physical Resources Form	annually (for each building)

Table 7

ACHIEVEMENT, ATTITUDE, AND APTITUDE TESTS FOR THE STUDY

Year of Study	School	Test	Test Date	Norms	Administrators	Notes
Baseline	1	Stanford Achievement Test Primary Level II, Form A	March, 1979	end of grade 2	local staff	
	2	Comprehensive Tests of Basic Skills Level B, Form S	Feb., 1978	mid grade 1	local staff	
	3	Stanford Achievement Test Primary Level II, Form A	Sept., 1979	beg. grade 3	local staff	Scores were converted to end of grade 2 norms.
	4	Stanford Achievement Test Primary Level I, Form A	Oct., 1978	beg. grade 2	local staff	
1	1, 2, 4	Stanford Achievement Test Primary Level III, Form A	April/May, 1980	end grade 3	project staff	
	3	Stanford Achievement Test Primary Level III, Form A	Sept., 1980	beg. grade 4	local staff	Scores were converted to end of grade 3 norms.
2	1, 2, 4	Stanford Achievement Test Intermed. Level I, Form A	May, 1981	end grade 4	project staff	
	3	Stanford Achievement Test Intermed. Level I, Form A	Sept., 1981	beg. grade 5	local staff	Scores were converted to end of grade 4 norms.
3	1-4	Stanford Achievement Test Intermed. Level II, Form A	April, 1982	end grade 5	project staff	

(Table continued)

(Continued)

School	Test	Test Date	Norms	Administrators	Notes
1-4	Self-Observation Scales (SOS), Form A (Yrs. 1 and 3) Form C (Yr. 2)	April/May, 1980 (Yr. 1) May, 1981 (Yr. 2) April, 1982 (Yr. 3)	NCS national norms for the Intermediate level of the test	project staff	
1	Otis-Lennon Mental Ability Test (OLMAT)	March, 1979	Per chronological age	local staff	If data were not available for the baseline test date (e.g., students were absent, or students entered the study the second year), then whatever recent aptitude data were available were coded.
2	CTB Test of Cognitive Skills, Level 3, 1981	October, 1982[a]	"	local staff	
3	Otis-Lennon Mental Ability Test (OLMAT)	January, 1979	"	local staff	
4	Otis-Lennon Mental Ability Test (OLMAT)	February, 1979	"	local staff	

2 had declared a moratorium on aptitude testing until fall, 1982. These data
ed because they were the only scores available.

Table 8

CORRELATIONS AMONG ACHIEVEMENT TEST SCALE SCORES FOR THE STUDY SAMPLE AND STANDARDIZATION SAMPLE[1]

	Year 1		Year 2		Year 3	
	Study	Standard.	Study	Standard.	Study	Standard.
READING						
Comprehension/Study Skills	.67	.78	.61	.69	.63	.73
Comprehension/Total Reading	.88	.96	.86	.93	.90	.94
Study Skills/Total Reading	.94	.93	.93	.91	.91	.92
MATHEMATICS						
Concepts/Computation	.61	.69	.66	.72	.72	.77
Concepts/Applications	.72	.76	.72	.76	.76	.79
Computation/Applications	.63	.68	.68	.68	.77	.76
Concepts/Total Math	.89	.91	.91	.90	.90	.91
Computation/Total Math	.83	.88	.86	.89	.90	.92
Applications/Total Math	.91	.91	.90	.91	.93	.93

[1]Source: Technical Manual, Stanford Achievement Tests (1973).

Table 9

Description of Home-School-and Teacher-Related Variables
Used in Step-wise Regression Analyses

GAIN--Difference ( ) in score on Stanford Achievement Test in reading or mathematics, Grade 3-4, Grade 4-5, Grade 3-5
WTCH--Teacher identifier
- -Q 21--On the average, how much homework do you assign per day?
- -Q 30--The main purpose of education should be to teach people what to think.
- -Q 41--Making a lesson dramatic often results in students missing the point of the lesson.
- -Q 42--Teachers should talk to students just as they would to an adult.
- -Q 47--A teacher generally ought to engage in a fair amount of sheer repetition.
- -Q 55--Even at the risk of boring some students, the teacher should take pains to explain things thoroughly.

TCHMF--Teacher's gender
TGRDEG--Whether teacher holds a graduate degree
NGR24--Number of graduate credits earned by teacher in past 24 months.
NMAGJ--Number of magazines and journals teacher reads
YTCH--Year of teaching experience
PON--Percent of time student was on-task in reading or mathematics.
POFF--Percent of time student was off-task in reading or mathematics.
ACAPT--Student's academic aptitude score
SMALEFEM--Student's gender
HOMEWORK--Number of minutes/day student spends on homework.
SPORTS--Number of sports in which student is involved.
XMAWORK--Number of hours/week mother is employed
ARTMUSIC--Number of art or music activities in which student is involved.
MASKUL--Number of years of schooling completed by student's mother
STRACAD--Parent's perception of whether or not the school has a strong academic program.
READMATL--Number of items of reading material in student's home
MAWORK--Whether or not student's mother employed outside the home

Table 10

Regression of Student Gain in Reading Scaled Score, Grade 3-4, on Home, School, and Teacher Variable

Multiple Correlation Coefficient..... .4863
Coefficient of Determination..... .2365
Corrected Coefficient of Determination..... .1958

Variable	Regression Coefficient	Std. Error of Regression Coefficient	Standardized Regression Coefficient	Partial Correlation Coefficient	Partial F Value With 1 and 94 Deg. Freedom	Sig. Level
Constant	.048	.059		.084	.667	.415
2 WTCH				.029		.783
3 Q30				.004		.971
4 Q30	-.184	.058	-.285	-.310	10.004	.002
5 Q41				.166		.108
6 Q42				.054		.601
7 Q47				.060		.562
8 Q55				.101		.328
9 TCHMF				-.021		.843
10 TGRDEG				-.055		.594
11 NGR24				-.087		.401
12 NMAGJ				-.107		.301
13 YTCH				.052		.618
14 PONR	.150	.057	.236	.260	6.802	.010
15 POFFR				.026		.800
16 ACAPT	-.107	.061	-.158	-.177	3.036	.084
17 SMALEFEM				.032		.756
18 HOMEWORK				.135		.193
19 SPORTS				.146		.158
20 XMAWORK				-.031		.763
21 ARTMUSIC	.117	.060	.178	.198	3.835	.053
22 MASKUL	.112	.058	.177	.196	3.737	.056
23 STRACAD				.078		.454
24 READMATL				.073		.481
25 MAWORK				-.111		.283

Analysis of Variance Summary Table

Source of Variation	Sum of Squares	Deg. Freedom	Mean Square
Linear Regression	9.72088	5	1.94418
Residuals from Regression	31.39041	94	.33394
Corrected Total	41.11129	99	

F-Ratio = 5.82 with 5 and 94 Deg. Freedom
Significance Level of F-Ratio = .0001

Table 11

Regression of Student Gain in Reading Scaled Score, Grade 4-5, on Home, School, and Teacher Variables

Multiple Correlation Coefficient..... . 4599
Coefficient of Determination..... .2115
Corrected Coefficient of Determination..... .1672

Variable	Regression Coefficient	Std. Error of Regression Coefficient	Standardized Regression Coefficient	Partial Correlation Coefficient	Partial F Value With 1 and 89 Deg. Freedom	Sig. Level
Constant	.001	.072				
2 WTCH				.001	.000	.991
3 Q21				-.030		.775
4 Q30				-.050		.638
5 Q41				.010		.926
6 Q42				.007		.948
7 Q47	.133	.069	.228	.034	3.686	.747
8 Q55				.199		.058
9 TCHMF				-.002		.987
10 TGRDEG	-.387	.124	-.596	.019	9.657	.858
11 NGR24				-.313		.002
12 NMAGJ				-.064		.546
13 YTCH	.377	.167	.377	.047	4.991	.657
14 PONR				.230		.028
15 POFER				-.015		.886
16 ACAPT	.133	.069	.201	-.011	3.739	.916
17 SMALEFEM				.201		.056
18 HOMEWORK				-.079		.457
19 SPORTS				-.121		.257
20 XMAWORK				.079		.459
21 ARTMUSIC				.049		.644
22 MASKUL				-.042		.691
23 STRACAD	-.120	.063	-.184	-.087	3.586	.416
24 READMATL				-.197		.061
25 MAWORK				-.040		.706
				.128		.228

Analysis of Variance Summary Table

Source of Variation	Sum of Squares	Deg. Freedom	Mean Square
Linear Regression	8.35497	5	1.67099
Residuals from Regression	31.14360	89	.34993
Corrected Total	39.49857	94	

F-Ratio = 4.78 with 5 and 89 Deg. Freedom
Significance Level of F-Ratio = .0007

Table 12

Regression of Student Gain in Reading Scaled Score, Grade 3-5, on Home, School, and Teacher Variab

Multiple Correlation Coefficient..... .4749
Coefficient of Determination..... .2255
Corrected Coefficient of Determination..... .1727

Variable	Regression Coefficient	Std. Error of Regression Coefficient	Standardized Regression Coefficient	Partial Correlation Coefficient	Partial F Value With 1 and 88 Deg. Freedom	Sig. Level
Constant	-.104	.067		-.162	2.383	.126
2 ACAPT	.117	.067	.170	.183	3.046	.084
3 SMALEFEM				-.098		.358
4 HOMEWORK	-.076	.059	-.128	-.137	1.674	.199
5 SPORTS				.039		.718
6 XMAWORK				.024		.822
7 ARTMUSIC				-.041		.706
8 MASKUL				-.079		.462
9 STRACAD	-.099	.068	-.146	-.154	2.124	.148
10 READMATL				-.021		.844
11 MAWORK				.094		.382
13 WTCH				-.058		.590
14 Q21				-.017		.873
15 Q30	.321	.132	.268	.251	5.939	.016
16 Q41	-.277	.117	-.272	-.245	5.612	.020
17 Q42	.315	.103	.328	.310	9.326	.003
18 Q47				-.114		.286
19 Q55				-.025		.818
20 TCHMF				-.006		.957
21 TGRDEG				-.015		.891
22 NGR24				-.011		.917
23 NMAGJ				.065		.543
24 YTCH				.056		.604
25 PONR				-.085		.426
26 POFFR				.023		.828

Analysis of Variance Summary Table

Source of Variation	Sum of Squares	Deg. Freedom	Mean Square
Linear Regression	9.55831	6	1.59305
Residuals from Regression	32.82537	88	.37302
Corrected Total	42.38369	94	

F-Ratio = 4.27 with 6 and 88 Deg. Freedom
Significance Level of F-Ratio = .0008

Table 13

Summary of Stepwise Regression of Gains in Reading Scaled Scores on Selected Home, School and Teacher Variables

Step No.	Variable	In/out	R	R^2	Change in R^2	Sig. Level
			Grade 3 - Grade 4 (n=100)			
1	Q30R	In	.276	.076		.006
2	PONR2	In	.386	.149	.073	.005
3	ARTMUSIC	In	.430	.185	.036	.043
4	MASKUL	In	.460	.212	.027	.074
5	ACAPT	In	.486	.236	.024	.085
6	Q41R	In	.507	.257	.021	.108
			Grade 4 - Grade 5 (n=95)			
1	ACAPT	In	.284	.081		.005
2	TGRDEGR	In	.354	.125	.044	.033
3	YTCHR2	In	.394	.156	.031	.076
4	Q47R	In	.424	.180	.024	.106
5	STRACAD	In	.460	.211	.031	.061
			Grade 3 - Grade 5 (n=95)			
1	ACAPT	In	.242	.058		.018
2	STRACAD	In	.323	.104	.046	.033
3	Q42R	In	.364	.133	.029	.086
4	Q30R	In	.399	.159	.026	.096
5	Q41R	In	.459	.211	.052	.018
6	HOMEWORK	In	.475	.226	.015	.199

Table 14

Regression of Student Gain in Reading Scaled Score, Grade 3-5, on Home Variables

Multiple Correlation Coefficient..... .3228
Coefficient of Determination..... .1042
Corrected Coefficient of Determination..... .0847

Variable	Regression Coefficient	Std. Error of Regression Coefficient	Standardized Regression Coefficient	Partial Correlation Coefficient	Partial F Value With 1 and 92 Deg. Freedom	Sig. Level
Constant	-.097	.066				
2 ACAPT	.156	.068	.227	-.151	2.148	.146
3 SMALEFEM				.233	5.296	.023
4 HOMEWORK				-.114		.276
5 SPORTS				-.127		.225
6 XMAWORK				.081		.441
7 ARTMUSIC				-.063		.545
8 MASKUL				.007		.945
9 STRACAD	-.145	.066	-.214	-.103		.325
10 READMATL				-.220	4.695	.032
11 MAWORK				-.018		.862
				.042		.688

Analysis of Variance Summary Table

Source of Variation	Sum of Squares	Deg. Freedom	e
Linear Regression	4.41668	2	2.20834
Residuals from Regression	37.96700	92	.41268
Corrected Total	42.38368	94	

F-Ratio = 5.35 with 2 and 92 Deg. Freedom
Significance Level of F-Ratio = .0063

Table 15

Regression of Student Gain in Reading Scaled Score, Grade 3-5, on School and Teacher Variables

Multiple Correlation Coefficient.....	.4541
Coefficient of Determination.....	.2062
Corrected Coefficient of Determination.....	.1710

Variable	Regression Coefficient	Std. Error or Regression Coefficient	Standardized Regression Coefficient	Partial Correlation Coefficient	Partial F Value With 1 and 90 Deg. Freedom	Sig. Level
Constant	-.114	.067		-.177	2.902	.091
13 WTCH				-.047		.660
14 Q21				-.051		.629
15 Q30	.394	.127	.329	.310	9.552	.002
16 Q41	-.250	.116	-.245	-.221	4.637	.033
17 Q42	.390	.101	.405	.376	14.786	.000
18 Q47	-.159	.070	-.229	-.231	5.074	.026
19 Q55				-.053		.617
20 TCHMF				-.018		.861
21 TGRDEG				.005		.964
22 NGR24				.052		.621
23 NMAGJ				.008		.938
24 TYCH				-.057		.589
25 PONR				-.103		.333
26 POFFR				.003		.974

Analysis of Variance Summary Table

Source of Variation	Sum of Squares	Deg. Freedom	Mean Square
Linear Regression	8.74103	4	2.18526
Residuals From Regression	33.64265	90	.37381
Corrected Total	42.38368	94	

F-Ratio = 5.85 with 4 and 90 Deg. Freedom
Significance Level of F-Ratio = .0003

Table 16

Regression of Student Gain in Mathematics Scaled Score, Grade 3-4, on Home, School, and Teacher Variables

Multiple Correlation Coefficient..... .4408
Coefficient of Determination..... .1943
Corrected Coefficient of Determination..... .1423

Variable	Regression Coefficient	Std. Error of Regression Coefficient	Standardized Regression Coefficient	Partial Correlation Coefficient	Partial F Value With 1 and 93 Deg. Freedom	Sig. Level
Constant	-.202	.053				
2 WTCH				-.365	14.302	.000
3 Q21	-.180	.079	-.328	.022		.832
4 Q30				-.229	5.167	.025
5 Q41				-.022		.831
6 Q42				.119		.252
7 Q47				.113		.276
8 Q55				-.008		.938
9 TCHMF				.087		.401
10 TGRDEG	.166	.080	.296	.097		.353
11 NGR24				.210	4.286	.041
12 NMAGJ				-.109		.295
13 YTCH				-.113		.277
14 PONM				.075		.469
15 POFFM				.042		.687
16 ACAPT				-.053		.614
17 SMALEFEM	.105	.058	.185	.021		.840
18 HOMEWORK				.183	3.233	.075
19 SPORTS	-.136	.065	-.218	-.088		.396
20 XMAWORK				-.212	4.367	.039
21 ARTMUSIC				.004		.968
22 MASKUL				- .003		.978
23 STRACAD	.076	.055	.135	-.098		.349
24 READMATL	.098	.057	.165	.140	1.861	.175
25 MAWORK				.173	2.863	.094
				.031		.767

Analysis of Variance Summary Table

Source of Variation	Sum of Squares	Deg. Freedom	Mean Square
Linear Regression	6.29540	6	1.04923
Residuals From Regression	26.10950	93	.28075
Corrected Total	32.40489	99	

F-Ratio = 3.74 with 6 and 93 Deg. Freedom
Significance Level of F-Ratio = .0022

Table 17

Regression of Student Gain in Mathematics Scaled Score, Grade 4-5, on Home, School, and Teacher Variables

Multiple Correlation Coefficient..... .2565
Coefficient of Determination..... .0658
Corrected Coefficient of Determination..... .0522

Variable	Regression Coefficient	Std. Error of Regression Coefficient	Standardized Regression Coefficient	Partial Correlation Coefficient	Partial F Value With 1 and 94 Deg. Freedom	Sig. Level
Constant	.125	.053				
2 WTCH				.274	5.581	.021
3 Q21				.071		.561
4 Q30				.009		.939
5 Q41				.047		.696
6 Q42				.091		.453
7 Q47				.092		.449
8 Q55				.088		.467
9 TCHMF				-.001		.991
10 TGRDEG	-.123	.055	-.256	.073		.546
11 NGR24				-.256	4.857	.030
12 NMAGJ				-.060		.622
13 YTCH				.027		.822
14 PONM				.022		.853
15 POFFM				-.120		.322
16 ACAPT				.095		.434
17 SMALEFEM				.098		.421
18 HOMEWORK				-.105		.387
19 SPORTS				.139		.249
20 XMAWORK				.133		.272
21 ARTMUSIC				.056		.642
22 MASKUL				.052		.669
23 STRACAD				-.079		.516
24 READMATL				.049		.685
25 MAWORK				.073		.550
				.090		.458

Analysis of Variance Summary Table

Source of Variation	Sum of Squares	Deg. Freedom	Mean Square
Linear Regression	.96485	1	.96485
Residuals from Regression	13.70564	69	.19859
Corrected Total	14.67049	70	

F-Ratio = 4.86 with 1 and 69 Deg. Freedom
Significance Level of F-Ratio = .0309

Table 18

Regression of Students Gain in Mathematics Scaled Score, Grade 3-5, on Home, School and Teacher Variables

Multiple Correlation Coefficient..... .3321
Coefficient of Determination..... .1103
Corrected Coefficient of Determination..... .0974

Variable	Regression Coefficient	Std. Error of Regression Coefficient	Standardized Regression Coefficient	Partial Correlation Coefficient	Partial F Value With 1 and 69 Deg. Freedom	Sig. Level
Constant	.513	.132		.423	14.994	.000
2 ACAPT				.105		.385
3 SMALEFEM				-.077		.524
4 HOMEWORK				.145		.229
5 SPORTS				.070		.566
6 XMAWORK				.088		.470
7 ARTMUSIC				.076		.530
8 MASKUL				-.059		.628
9 STRACAD				.007		.956
10 READMATL				.051		.677
11 MAWORK				.139		.249
13 WTCHM				.024		.846
14 Q21				.076		.531
15 Q30				.049		.685
16 Q41				.036		.770
17 Q42				.088		.469
18 Q47				-.046		.702
19 Q55				-.090		.459
20 TCHMF				-.033		.788
21 TGRDEG	-.722	.247	-.332	-.332	8.553	.004
22 NGR24				.080		.509
23 NMAGJ				-.086		.476
24 YTCH				-.059		.625
25 PONM				-.132		.277
26 POFFM				.134		.270

Analysis of Variance Summary Table

Source of Variation	Sum of Squares	Deg. Freedom	Mean Square
Linear Regression	1.69378	1	1.69378
Residuals from Regression	13.66389	69	.19803
Corrected Total	15.35767	70	

F-Ratio = 8.55 with 1 and 69 Deg. Freedom
Significance Level of F-Ratio = .0047

Table 19

Summary of Stepwise Regression of Gain in Mathematics Scaled Scores on Selected Home-School-and Teacher-Related Variables

Step No.	Variable	In/out	R	R^2	Change in R^2	Sig. Level
		Grade 3 - Grade 4 (n=100)				
All Variables						
1	SMALEFEM	In	.273	.074	.074	.006
2	SPORTS	In	.320	.103	.029	.084
3	STRACAD	In	.365	.133	.030	.069
4	NMAGJ	In	.391	.153	.020	.139
5	READMATL	In	.411	.169	.016	.182
6	Q21M	In	.432	.186	.017	.159
7	TGRDEG	In	.452	.205	.019	.151
8	NMAGJ	Out	.441	.194	-.011	.277
		Grade 4 - Grade 5 (n=71)				
1	TGRDEG	In	.257	.066	.052	.031
		Grade 3 - Grade 5 (n=71)				
1	TGRDEG	In	-.332	.097	.097	.005

Table 20

Regression of Student Gain in Mathematics Scaled Score, Grade 3-5, on Home Variables

Multiple Correlation Coefficient..... .1744
Coefficient of Determination..... .0304
Corrected Coefficient of Determination..... .0164

Variable	Regression Coefficient	Std. Error of Regression Coefficient	Standardized Regression Coefficient	Partial Correlation Coefficient	Partial F Value With 1 and 69 Deg. Freedom	Sig. Level
Constant	.156	.055				
2 ACAPT				.323	8.012	.006
3 SMALEFEM				.049		.688
4 HOMEWORK				-.078		.523
5 SPORTS	.085	.057	.174	.143	2.165	.236
6 XMAWORK				.174		.145
7 ARTMUSIC				.106		.380
8 MASKUL				.033		.788
9 STRACAD				-.052		.669
10 READMATL				.020		.868
11 MAWORK				.038		.754
				.128		.292

Analysis of Variance Summary Table

Source of Variation	Sum of Squares	Deg. Freedom	Mean Square
Linear Regression	.46722	1	.46722
Residuals from Regression	14.89044	69	.21580
Corrected Total	15.35767	70	

F-Ratio = 2.17 with 1 and 69 Deg. Freedom
Significance Level of F-Ratio = .1457

Table 21

Regression of Student Gain in Mathematics Scaled Score, Grade 3-5, on School and Teacher Variables

Multiple Correlation Coefficient..... .3321
Coefficient of Determination..... .1103
Corrected Coefficient of Determination.. .0974

Variable	Regression Coefficient	Std. Error or Regression Coefficient	Standardized Regression Coefficient	Partial Correlation Coefficient	Partial F Value With 1 and 69 Deg. Freedom	Sig. Level
Constant	.513	.132				
13 WTCHM				.423	14.994	.000
14 Q21M				.024		.846
15 Q30M				.076		.531
16 Q41M				.049		.685
17 Q42M				.036		.770
18 Q47M				.088		.469
19 Q55M				-.046		.702
20 TCHMFM				-.090		.459
21 TGRDEGM	-.722	.247	-.332	-.033		.788
22 NGR24M				-.332	8.553	.004
23 NMAGJM				.080		.509
24 YTCHM				-.086		.476
25 PONM				-.059		.625
26 POFFM				-.132		.277
				.134		.270

Analysis of Variance Summary Table

Source of Variation	Sum of Sources	Deg. Freedom	Square
Linear Regression	1.69378	1	1.69378
Residuals from Regression	13.66389	69	.19803
Corrected Total	15.35767	70	

F-Ratio = 8.55 with 1 and 69 Deg. Freedom
Significance Level of F-Ratio = .0047