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ABSTRACT

The present study explored some of the implications of Carroll's model of school learning in the context of a group of school districts with varying resource use in regular and compensatory reading programs in the intermediate grades. Subjects were 2,516 students in grades four through six from four school districts. Though the findings of this study are to be regarded as tentative and exploratory, the overall results indicate that time is a potentially important variable in field studies of the factors influencing classroom achievement in specific content areas. The pattern of the results suggests that the total influence of the reading teacher is positive. (The findings are presented in both narrative and table format.) (RB)

DRAFT

The Contributions of Quantity and Quality of Instruction to Reading Programs

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Efforts to improve the effectiveness of instructional programs for different student populations, including the so-called disadvantaged student, generally involve decisions affecting the quantity and quality of instruction. In compensatory programs, particularly in ESEA Title I, at least the time or quantity, if not the quality of instruction is increased as a matter of policy. A compensatory reading program, for example, may allocate more of the available time to formal instructional activities in reading, perhaps also with qualitative improvements in the staff-student ratio, the amount and variety of instructional materials available, the amount of equipment, and the quality of facilities used.

The typical approach to instruction in compensatory education is a generalization from procedures used in regular classrooms to modify instruction for the less able learners. In general reading instruction, these modifications often take the form of making more time available, grouping students, and providing differentiated materials. The implicit model which seems to be involved in both compensatory and regular reading instruction is Carroll's model of school learning (1963) which takes the general form:

$$\text{Rate of Learning (or Amount of Achievement)} = \frac{\text{Time Spent}}{\text{Time Needed}}$$

The model predicts that, where the student spends the time needed, his rate of learning (or achievement per unit of time) will be maximized. The implication of compensatory approaches in reading and other basic skills instruction is that students with special needs do not get all of the effective learning time they need, and thus fall further and further behind their peers.

The present study explored some of the implications of Carroll's model of school learning in the context of a group of school districts with varying resource use in regular and compensatory reading programs in the intermediate

grades. The approach used involved assessing the total time or quantity of reading instruction allotted to all students in the regular classroom and also in the additional reading programs available as a function of Federal and/or State aid. This method allowed an assessment of the impact of allotted time on achievement in regular reading instruction as well as the additional impact of time increments resulting from assignment to one or more special reading programs. Concomitant with the assessment of time, attempts were also made to evaluate the impact of selected qualitative conditions of instruction in regular and special reading programs. Variables defining the conditions of instruction included, not only such traditional influences as teacher age and classroom socioeconomic status, but also a unique approach to indexing the quantity and variety of instructional resources available in all reading conditions, regular or compensatory. In addition, estimates of time available for reading instruction were divided into separate estimates for four instructional modes designated whole group, small group, individual help, and individualized.

In the context of studies done in the real life school setting, the present analysis provides new data on the continuing conceptual and empirical exploration of the effects of quantity and quality of instruction on achievement. The effect of allotted time or quantity of instruction on achievement has been grossly estimated in formal and informal comparisons made among school districts, states, and nations with differing annual time allotments for instruction (Wiley and Harnishfeger, 1974; Bloom, 1974). One study even compared the effects of long-and hort-day programs on preschoolers' cognitive achievement (Handler, 1959). The residue of the little research that is available seems to indicate that total time allotted for instruction has a major impact on overall achievement. With the exception of a few studies (Jarvis, 1962;

Deady, 1970 little information seems to be available on time allotted for instruction in particular program areas, such as reading or mathematics. This information would seem to be of particular importance in the United States where add-on programs in reading and mathematics may make relatively more instructional time available in these areas to certain students.

The present analysis of the effects of qualitative variations in the conditions of instruction reflects the manipulations typically made in reading programs in both regular and compensatory programs. That is, in recent years, reading instruction has become increasingly differentiated in both mode and materials used, presumably to obtain more effective learning time for students with different aptitudes. Little is actually known, however, of the effects of qualitative improvements of the conditions of reading instruction on students' achievement. One may thus ask questions not only about the effects of additional time in reading instruction on achievement, but also about the effects of concomitant improvements in the quality of the instructional environment. In the present study, these measures of quality were indexed in such terms as type of staff available, number of books, number of different prices of equipment, number of supplemental resources, etc.

Altogether this attempt to gather data on the quantity and quality of reading instruction is reflective of variations in the costs and effort involved in reading programs. Variation in time, staff, materials, and equipment are associated with increased costs for instruction while the mode or model of reading instruction is associated with the complexity and amount of effort involved in managing a classroom reading program. Though these aspects of reading instruction are not mutually exclusive, the data from the present study may be relevant to separate policy decisions relating to, not only how available money should be spent in reading instruction, but also to how such instruction might best be organized.

Focus of the Study

The general focus of the study was an examination of the contributions of quantity and quality of instruction to reading achievement. The question concerning quantity was framed in the following way:

1. To what extent does time available for reading instruction contribute to reading achievement?

The method of collection of time data allowed a breakdown of instructional time into modes of instruction with the regular classroom teacher and with any additional reading treatments. The following additional questions could thus be evaluated:

2. To what extent does the contribution of time to achievement vary as a function of instructional mode?

3. To what extent does additional instructional time in reading outside the classroom contribute additional increments in reading achievement?

4. To what extent do the contributions of additional time in reading to achievement vary as a function of instructional mode? Or, as a function of type of staff (reading specialist or aide)?

The question concerning instructional quality was framed in the following way:

5. To what extent does the quality of instructional resources available in reading instruction contribute to reading achievement?

In addition to the foregoing questions, the Carroll model of learning carries with it the implication that both quality and quantity of instruction may interact with time available for instruction, the quality of instruction as defined here, and other factors which define the conditions of classroom instruction. These additional factors, defining the conditions of classroom instruction include teacher variables and characteristics of the student body. The additional questions concerning these interactions were framed as follows:

6. To what extent does the contribution of time in different modes of instruction to achievement vary as a function of student aptitude?

7. To what extent does the contribution of quality of instruction (or other classroom conditions) to achievement vary as a function of student aptitude?

In addition to the foregoing major questions, the organization of the study also made it possible to examine the contributions of other factors traditionally included in research of this type. These additional factors were grouped into: reading class conditions (number of pupils in class, percent white in class, and socioeconomic composition of class); teacher factors (age or experience and degree status) student background (student age and individual socioeconomic status); and student aptitude (prior achievement as measured by standardized scores in the reading area). Data gathered in the study intitially enabled the inclusion of a much larger set of variables, such as teacher expectations, student birth order, frequency of change in reading group composition, and so on, but all of these additional factors were eliminated in a reduction phase of the analyses.

Method

This preliminary analysis is based on a sample of 2516 Ss in grades 4 though 6 in four school districts. These school districts, identified as A, B, C, and D in Table 1, were roughly comparable in the characteristics of

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Insert Table 1 About Here

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their school populations, although District A has higher means for percent white in class and percent of upper status students in class than the other three districts. At the other end of the extreme, District C has much lower means for percent white in class and percent of upper students in class than the other three districts.

The study sample consists of those 4th, 5th and 6th graders who had complete data on the major variables under consideration and who had received any of levels 1-6 of the criterion referenced reading tests constructed for the participating schools. The participating districts and schools were selected for the study because they varied on the extent of resource use in reading instruction. District .., for example, generally had a modest investment in added resources for reading instruction, primarily in reading centers run by specialists who performed a coordinating function. The remaining three districts were characterized by more extensive investments in compensatory reading programs which were primarily independent adjuncts to regular reading instruction. In each school, the data were collected from all classes in the 4th, 5th, and 6th grades that had voluntarily participated in the experimental installation of the criterion referenced reading tests. Generally, this meant all classes in a school at the intermediate level whether or not that class had substantial numbers of Ss in compensatory reading programs.

Insert Table 2 About Here

Design

The design for data collection in the study is summarized in Table 2. This is a longitudinal design initiated to obtain repeated administrations of both norm referenced and criterion referenced measures of reading achievement during the second half of the school year. The present report, however, will focus only on an examination of the study questions with the norm referenced measures. To provide a basis for asking these questions, data on the quantity and quality of instruction as well as on other school factors were

obtained during the period from January to June. A list of the variables included in the analyses reported here is given in Table 3. A complete list of all of the variables on which data were gathered is given in Table 4.

Insert Table 3 About Here

Insert Table 4 About Here

Data on the quantity and quality of instruction were gathered in taped interviews given to all principals, teachers, specialists, and selected teacher aides. This interview focused largely on obtaining estimates of the minutes per year of reading instruction over each of four instructional modes: whole group instruction, small group instruction, individual help, and individualized instruction. The method used allowed the interviewers to estimate instructional time allotted to each student by mode within teacher and by mode within any additional reading treatments scheduled for a given student. Data defining allotted time in reading programs were gathered from all personnel involved and enabled a series of cross-checks on time estimates for any given student.

In addition to questions on time, the interview resulted in a record of all materials and equipment used as a resource in reading instruction. An index of materials resource utilization (IMRU) was developed to simultaneously quantify the extent of instructional resources available to a teacher, together with the extent of utilization of resources. This was the measure of quality of instruction used in the study. To obtain an IMRU for each teacher, the interview record grouped instructional resources into four categories, one

for each type of material used: (1) basal series, workbooks, and other skill builder supplements, (2) additional software, (3) hardware, and (4) teacher created materials. A score for each category was determined, based upon the number of materials used in that category and how they were used. In most cases, materials used as a major resource were given a value twice that given supplemental materials, such as additional workbooks. The IMRU was determined by taking the sum of the four scores derived for each category of materials. A brief description of each of the four scores making up the IMRU follows:

> Materials Category #1. This score for basal series, workbooks, and other skill builder supplements was perhaps the most complex. For each basal series used, a value of 2 was added. A value of 1 was added for each workbook used in conjunction with a basal series. In addition, a value of 1 was added if one to three additional skill builder supplements were used, and a value of 2 if more than three of these skill builder supplements were used. The highest possible score allowed for Materials Category #1 was 12.
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> Materials Category #2. Additional software was grouped according to the number of obviously different resources used: less than 3, 3-6, and greater than 6. Values of 1, 2, and 3 were assigned, respectively, when each group of different resources was used as supplemental resources. These values were doubled for groups used as major resources. If more than six major resources were used, a total maximum score of 9 was assigned.
>
> Materials Category #3. In general there were nine different types of hardware used. A value of 2 was assigned to each type of hardware used as a major resource, while 1 was assigned to each type of hardware used as a supplemental resource. The highest possible score, the case in which all nine types of hardware were used as major resources, was 18.
>
> Materials Category #4. The score for teacher created materials is similar to that of hardware. Values of 2 and 1 were assigned to each type of teacher created material used, depending on whether it was a major or supplemental resource, respectively. Since there were five types, the highest possible score was 10.

Total score on the IMRU was largely determined by materials categories 1 and 2, since, by comparison, values derived for categories 3 and 4 were generally low. It remains a problem for future analysis to determine how these various instructional resources may be best combined into one index.

Analysis

The analytical procedures used were designed to improve the quality of the data, reduce the number of the variables included in the analyses relevant to the study questions, and derive the parameters of the reading programs under study.

Following a complete data edit, means were substituted for missing values and basic descriptive statistics were calculated for all of the variables included in the study.[1] These statistics included the means, standard derivations, and frequency distributions within and across all districts in the study, thus providing a basic description of the distributions of the independent and dependent variables. Any variables with extremely low variability were eliminated from the analysis at this point.

A principal components analysis with a varimax rotation was then run on the intercorrelations of a large proportion of the raw data matrix, including selected multiplicative interactions. The resultant rotated factor structure accounted for slightly more than 50% of the variation of the matrix. The first four factors accounted for virtually all of the variation; these were in order of importance: small group instruction (23%), standardized achievement (16%), a teacher factor (9.4%), and whole group instruction (1.4%). A student background factor and individualized instruction contributed additional small amounts of variation to the factor structure.

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[1] When there were gross amounts of data missing for a variable (above 20%), that variable was eliminated from the analysis.

This factor structure is consistent with the study data which showed that reading instruction among students varied most in amount of time in the small group mode. Variation on individualized tutorial modes of instruction was largely restricted to those Ss in compensatory programs, but even compensatory reading instruction is heavily invested in the small group mode.

The results of the factor analysis led to a substantial reduction in the number of variables included in the main analysis of the study, as may be determined by comparing Tables 2 and 3. In addition, this analysis showed that the two administrations of the CAT in January and June were almost interchangeable.[2] There was less than one-fourth of a standard deviation of change in the two scores and they were so highly intercorrelated (r = .86) that the inclusion of the January CAT score as a pretest might have made the main analyses of thestudy infeasible. The decision was then made to first use the PEP reading score taken in the third grade as a means of controlling individual differences in aptitude (PEP scores correlated less than moderately with the achievement factor). These initial analyses were conducted on the data for districts A, B, and D, and were later repeated in a more conservative analysis with the January 1974 CAT as a measure of aptitude using the data for all four districts.[3]

With the number of variables reduced to a manageable set, a series of multiple regressions were run on the combined 4th, 5th, and 6th graders in

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[2]The CAT score used is the ADSS score, a standardized score with interval properties that allows raw scores from different forms and levels of the CAT to be expressed in a single scale.

[3]The January CAT score was ultimately used as a pretest because it appeared that the PEP did not account for initial ability differences among Ss with differing amounts of time in additional reading treatments (r's of time and achievement were consistently negative in additional treatments). District C did not have the third grade PEP scores.

each district, using the June CAT ADSS score as the dependent variable. These analyses were organized to investigate the major study questions defined previously and are outlined in Table 5 for the regression equations with the PEP reading score as a control for aptitude. Equations numbered 49-52 were repeated with both the PEP reading scores and January CAT 74' scores as controls for initial reading achievement at the start of the study. The regressions were run in sets by district, with a separate

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Insert Table 5 About Here

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analysis for each district. Each set of regression includes a dummy code for school and a standard group of variables defining classroom conditions, the teacher factor, general aptitude of student, and student background. The measure of quality of instruction, IMRU's, is included in each regression along with the other measures related to teacher--age and degree status. What is varied in each regression run are the specific estimates of instructional time included in the analysis. The first regression (column 1) includes total teacher time. The second includes total teacher time and whole group instructional time for teacher. In the third analysis, whole group is removed and small group instructional time for teacher is entered along with the control for teacher time. This method of analysis is repeated until each estimate of time has been entered along with an appropriate control for total time. Finally, the interactions are added to the regression equation which includes all of the separate instructional time estimates.

The significance of each factor in the regression equations was tested by computing a t for each b weight. The theoretical and practical significance of the various factors in a given equation may be determined by comparisons made among the standardized weights (B') calculated for each factor.

The B' weights, for example, allow one to compare the size of the contribution of aptitude to achievement with that of quantity of instruction, since both variables are expressed in the same units.

Results

Correlational Analyses

The results of the analyses are presented in Tables 6 through 16. First presented are the zero order correlations of the time and instructional quality variables with pretest and post test CAT. The remaining tables include the statistics for eight multiple regression equations in which all the major linear variables and interactions have been included and the January '74 CAT is used to control initial aptitude in reading. The regression tables are presented in pairs: (a) the first equation includes all of the linear terms in an analysis for a given district; and (b) the second equation includes both the linear terms and one set of time x aptitude (January 74' CAT) interactions for that district. The results of the earlier regression analyses, including the third grade PEP reading score, are summarized in lieu of a detailed tabular presentation.

Table 6 shows the correlations of the various total time estimates, time in additional treatments, and the IMRU score with reading achievement in the overall sample. Whole group time is entirely a reflection of teacher

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Insert Table 6 About Here

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instruction, as is teacher instruction which combines all teacher time variables. The variables, instructional time for small group, individualized instruction, and individual help, combine allotted time for teacher and other staff conditions in these modes. The remaining time variables are

specific to staff type, but the last combines all modes and staff in the overall estimate of total reading instruction time.

The correlational results show that teacher time (reflected in whole group and teacher instruction) is unrelated to achievement in the total sample. The remaining more individualized modes of instruction have consistent low negative correlations with achievement (Note that specialist generally reflects individualized instruction and aide generally reflects small group and some tutorial instruction). The IMRU score used as an index of instructional quality is unrelated to achievement in the total sample.

Insert Table 7 About Here

Table 7 again presents the correlations of the various instructional time factors and the IMRU score with achievement, this time by district and with teacher time separated into its modal components. These data tend to indicate that teacher time has a small positive relation with achievement, depending on mode and district. Instructional time in modes or with staff external to the classroom is consistently correlated in the negative direction with achievement, with most of the correlations being significant ($p < .05$). The IMRU also correlates negatively but at a very low level with achievement; four of the eight correlations are significant ($p < .05$).

Insert Table 8 About Here

Table 8 presents the intercorrelations of the time variables presented previously in Table 6. The data show that total instructional time is heavily determined by small group time ($r = .64$). The pattern of the

intercorrelations further shows that teacher time is independent of additional time in other reading treatments and that time estimates for other reading treatments are essentially independent of each other. An examination of the additional intercorrelation matrices in the within district analyses also showed that the separate teacher time estimates are independent of each other, with the exception of low relationships between whole group and small group instructional time (r = -.22, N=947) and individual help and whole group instructional time (r = .37, N=947).

The results of the foregoing correlational analyses support the schema for the main analyses. That is, the various separate estimates of teacher and added instructional time were ultimately entered simultaneously in separate multiple regression equations for each district.

Preliminary Regression Analyses

The preliminary regression analyses, with the PEP third grade reading score as a historical control for student aptitude, were calculated on districts A, B, and D. As shown in Table 5, these regressions were first run with each of the 10 possible instructional time estimates in a separate equation, then with the 7 independent time estimates entered simultaneously, and finally four time x aptitude interactions were added to the equation. At this point, the interactions were all possible multiplicative functions of the CAT 74' pretest with the four total instructional time estimates: whole group (teacher), small group (includes teacher and added time effects), individual help (includes teacher and added time effects), and individualized instruction(a mostly added time effect.)

The results of the regression analyses for the separate time effects showed that the overall contribution of the teacher was positive and significant ($p < .05$), either in total teacher time, or in the whole group or small group modes.

The specialist and aide effects were negative and significant ($p < .01$) in two of the district equations and these effects were also further reflected in the finding of 5 significant negative contributions ($p < .05$) out of a possible 12 for individual help and individualized instructional time.

When the 7 separate time variables were included simultaneously in the multiple regression equation, there were significant positive contributions for teacher time variables in two districts ($p < .05$). The specialist effect was negative in all equations and highly significant in two of the district analyses ($p < .001$). The aide effect, paid or unpaid, was negative and significant in three instances in two of the district equations ($p < .05$).

The overall pattern in the analyses was a weak positive contribution of teacher time and stronger negative contributions for the added time variables. District A departed somewhat from this pattern with a negative contribution for whole group teacher time ($p < .05$) and a positive contribution of small group teacher time ($p < .05$). In addition, the contribution of the aide factor was positive and significant ($p < .05$). Specialist time, which was a very minor factor in the district A reading program, was negative and nonsignificant ($p > .05$).

The results of the preliminary analyses were made more complex by the finding of four significant interactions. In districts A and D, the weights for the whole group time x CAT 74' pretest interactions were significant and negative ($p < .01$). These findings and the negative weights for additional instructional time, of course, suggest that the contributions of instructional time to achievement are not linear over the range of aptitude scores.

The preliminary regression analyses failed to turn up any consistent effects for the IMRU score.

Primary Regression Analyses

The final set of regression analyses included the 74' CAT total reading score as an independent variable. In districts A, B, and D, the regression analyses continued to include the PEP reading score. The analyses were further improved by eliminating father's occupation as an independent variable and by additively combining the percentages for percent working poor and percent unskilled as the index of socioeconomic status of the classroom. This reduced the overall number of variables in the regression equation and improved R^2 when the pretest CAT score was included in the regression equation. Evidently, the pretest CAT score accounts for most of the influences of student background in the regression equation.

The results of the primary regression analyses are presented in pairs for districts in Tables 9 through 16. First to be noted is that from 75 to 80 percent of the variation of post test achievement scores is accounted for in the separate district regression equations. This is in contrast to a range of 54 to 66 percent of post test achievement variation accounted for when PEP reading scores were used as a control for aptitude in the regression equations.

Insert Tables 9 Through 16 About Here

Generally, the results of the multiple regression analyses using the CAT pretest as a control for initial achievement differences parallel the previous regressions with the PEP scores. Teacher instructional time contributes positively to achievement, overall, but is no longer significant when pretest achievement is controlled in the regression equation. The one exception is for district D where the negative relationship of the major teacher time factors with achievement seems to involve suppressor relationships, since total teacher time was positive and significant ($p < .05$) when included in the regression equation without the other time factors.

The factors defining time added to teacher instructional time generally contribute negatively to achievement. In six instances, the contributions of additional instructional time are significant. In district A, there is an absence of any time effects. In district B, the contributions of instructional time for specialist and paid aide are significant ($p < .001$; and $p < .001$, respectively). In district C, the contribution for paid aide also reaches significance ($p < .05$), and in district D, there are significant contributions for specialist and unpaid aide ($p < .001$; and $p < .05$, respectively).

Two of the interactions which were in the previous analyses with the PEP scores were also significant in the primary analyses. In district B, the CAT 74' pretest x individualized instruction interaction was significant ($p < .001$), and in district D, the CAT 74' pretest x whole group instruction interaction was significant ($p < .01$). Also in district D, the CAT 74' pretest x individualized instruction interaction approached significance ($.10 < p > .05$).

Finally, it should be noted that none of the IMRU contributions were significant in any of the district regression equations.

Discussion

Though the findings of this study are to be regarded as only tentative and exploratory, the overall results seem to indicate that time is a potentially important variable in field studies of the factors influencing classroom achievement in specific content areas. The pattern of the results suggest that the total influence of the reading teacher is positive. When the instructional time components for the teacher are considered separately,

the data further indicate that the whole group mode effect may be nonlinear.

The relationships between additional time (in which mode and staff conditions are confounded) and reading achievement appear to be consistently negative and were apparent even in the conservative analysis simultaneously controlling for initial achievement and all other instructional time factors. These findings, together with the frequent findings of interactions between aptitude and additional reading time, strongly indicate that the contributions of additional instructional time vary as a function of aptitude for reading.

Since the aptitude-additional time interactions are a multiplicative function of their linear terms in z-score form, their approximate nature may be explained. For high aptitude Ss, the effect of increases in instructional time should be a deficit in achievement relative to high aptitude Ss with lower levels of instructional time. For low aptitude Ss, the effect should be just the reverse: increases in instructional time should associated with relative increases in achievement and vice versa. These relationships would be strongest at the extremes of both distributions, which in the present data set are virtually normal for aptitude and were transformed to approximate a normal distribution for instructional time.

The foregoing is suggestive only of the general nature of the interactions which apparently may involve even more complex effects in different instructional mode and/or staff conditions. The interactions and the generally low negative relationships between additional instructional time and initial reading achievement are further suggestive of a substantial lack of optimization of instructional time, mode, and aptitude in the study schools. At the pratical level of the school, this type of optimization cannot

apparently be done effectively until assignment of Ss to additional instructional time is carried out on a cross-grade basis using a common scale for measuring reading aptitude.

The findings fail to indicate that the realtionship of instructional time with achievement varies in any consistent way as a function of particular modes or staff type. In addition, quality of instruction as measured in the IMRU, failed to contribute independently to achievement. An examination of the intercorrelations among the time variables by mode and IMRU scores indicated that IMRU scores were collinear with instructional mode and instructional time (IMRU scores correlated positively with time and even more strongly with time in the more individualized modes of instruction). These relationships suggest that the contributions of IMRU type measures may be more effectively studied within instructional modes or staff type. In any event, the present findings should not be taken to indicate the futility of using more and better instructional materials in the classroom or of collecting data to represent it.

The results of the analysis further showed evidence of the racial composition of the classroom effect noted by Coleman (1966), but no independent effect was noted for social class composition or individual socioeconomic status. This set of findings is most likely due to the specific control used for achievement differences in the present study.

As a final note, caution is advised in interpreting the magnitude of the contributions of instructional time in the present study. Allotted time, which had at best very modest relationships with achievement, is very likely only a weak reflection of the true influence of time in classroom instruction.

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Table 1

Sample Characteristics for Each
District in the Analyses
(N=2516)

Variables	District			
	A	B	C	D
No. Pupils	567	947	479	523
No. Schools	2	7	5[a]	3
No. Teachers	36	56	60	25
Type District	Suburban	Urban	Urban	Urban
% White in class	89%	83%	88%	63%
% Lower Status in class	25%	36%	59%	37%

[a]This number reflects two schools which are not in the analysis. These two additional schools have higher proportions of white and upper status students, thus making District B more comparable to the other districts in the sample than appears at this stage of the analyses.

Table 2

Design for Data Collection

	May 1973	Pre-1974	February 1974	March 1974	April 1974	May 1974	June 1974
Test Administrations:							
PEP[a] Test		X					
CAT[b]	X[d]		X				X
CRT[c]				X	XX	XX	
Reading Program Data Gathered via Interviews and School Records				X	X	X	X

Figure 3. The Design for Data Acquisition.

[a] Pupil Evaluation Program (PEP) norm-referenced tests of reading and mathematics developed by the Bureau of Pupil Testing and Advisory Services at the New York State Education Department. These tests are administered in grades 3 and 6.

[b] California Achievement Test (CAT). Note that up to 3 levels and 2 forms of the CAT were used in the schools.

[c] Criterion-Referenced Test (CRT). Note that up to 8 difficulty levels and 5 forms within each level were available to the schools for testing with this experimental device.

[d] These data are available on a sub-sample of the total sample.

Table 3

Variables Included in the Regression Analysis

Variable No's. by District				Variable Name
A	B	C	D	
1	1	1	1	Student age
2	2	2	2	Father's occupation[a]
3	3	3	3	PEP raw score (Total reading score in 3rd grade)
4	4	4	4	Number pupils in class
5	5	5	5	Teacher degree status
6	6	6	6	IMRU (Index of materials and resource utilization)
7	7	7	7	Post California Achievement Test Total Reading
8	8	8	8	Dummy for school 1
	9	9	9	Dummy for school 2
	10	10		Dummy for school 3
	11	11		Dummy for school 4
	12			Dummy for school 5
	13			Dummy for school 6
9	14	12	10	Teacher age
10	15	13	11	% white in class
11	16	14	12	% working poor
12	17	15	13	% unskilled
13	18	16	14	% skilled blue collar
14	19	17	15	% skilled white collar
15	20	12	16	% business
16	21	19	17	% professional
17	22	20	18	Log minutes per year whole group teacher[b]
18	23	21	19	Log minutes per year small group teacher
19	24	22	20	Log minutes per year individual help teacher
20	25	23	21	Log minutes per year individualized instruction teacher
21	26	24	22	Log total minutes per year small group instruction
22	27	25	23	Log total minutes per year individual help
23	28	26	24	Log total minutes per year individualized instruction
24	29	27	25	Log total minutes per year total teacher
25	30	28	26	Log total minutes per year specialist
27	31	29	27	Log total minutes per year paid aide
27	32	30	28	Log total minutes per year unpaid aide
28	33	31	29	Jan. 74 California Achievement Test Total Reading (CAT)
33	38	36	34	Jan. 74 CAT x whole group instruction
34	39	37	35	Jan. 74 CAT x small group instruction
35	40	38	36	Jan. 74 CAT x individual help
36	41	39	37	Jan. 74 CAT x individualized instruction
37	42	40	38	Classroom socioeconomic status index

[a] Eventually deleted and replaced with classroom SES on which data were complete.

[b] All time variables were log transformed to normalize the distributions.

Table 4

Original Variable List Used in Principal-Components Analysis

No. Name

Time and Time by Mode and Staff

1. Total Reading Instruction
2. Whole Group Instruction (WGI)
3. Small Group Instruction (SGI)
4. Individual Help (IH) in Reading
5. Individualized Instruction (II)
6. All Specialist Reading Instruction
7. All Paid Aide Reading Instruction
8. All Unpaid Aide Reading Instruction
9. Whole Group Instruction by the Teacher
10. Small Group Instruction by the Teacher
11. Individual Help by the Teacher
12. Individualized Instruction by Teacher

Materials

13. Index of Materials Resource Utilization

Student Characteristics

14. Age
15. Sex
16. Birth Order
17. Father's Occupation
18. Father's Education
19. Mother's Occupation
20. Mother's Education
21. 3rd Grade Reading Ability (PEP TEST)
22. Number of Days Absent
23. Percentage of Days Present
24. Membership in a Specific Reading Class
25. Membership in a Specific School
26. Raw Score on 1st Test Adm. at CRT Lev. 4
27. Raw Score on 1st Test Adm. at CRT Lev. 5
28. Membership in a Specific District

Teacher Characteristics

29. Age
30. Sex
31. Degree Status
32. Total Years of Experience
33. Type of Appointment
34. Teacher Expectancy of Student Performance under real conditions
35. Teacher Expectancy of Student Performance under ideal conditions
36. Ideal minus Real Teacher Expectancy
37. No. of Undergraduate Courses Related to Redg.
38. No. of Graduate Courses Related to Reading
39. No. of Inservice Hours/Month
40. Minutes per week (MPW) Preparation for Reading
41. Min. P/W of Teacher Coordination Time for Rdg.
42. MPW Coordination for Read.
43. Teacher absence
44. MPW Non-instructional Reading Activities

No. Name

Student Body Characteristics

44. No. of Students in Reading Class
45. Percentage of White Students
46. Percentage of Black Students
47. Percentage of Spanish Surnamed Students
48. Frequency of Change in Reading Group Comp.
49. Percentage Working Poor or Unemployed
50. Percentage Unskilled Workers
51. Percentage Skilled Blue Workers
52. Percentage Skilled White Collar
53. Percentage Management Level
54. Percentage Professional
55. No. Absences/day from reading class
56. Mobility "in" and "out"
57. Voc., Comp., Total ADSS on Jan.,1974 C.A.T.
58. Membership in High-C.A.T. Ability Group
59. Membership in High-Middle C.A.T. Ability Grp.
60. Membership in High-PEP Ability Group
61. Membership in High-Middle-Pep Ability Group

School Characteristics

62. Ability Grouping Practices

Interactions

63. High Performing Students by MPW WGI, SGI, IH, II by the Teacher
64. MPW Total Reading Inst. by Student Sex, Age, No. of Days Absent, No. of Pupils in Redg Class, High and Low Performing Students, and Teacher Experience
65. Student Sex by Teacher Sex
66. Teacher Age by Teacher Age
67. Teacher Experience by Teacher Experience
68. Instructional Materials by High Performing Students, Low Performing Students, Teacher Preparation Time, and Teacher Years Experience.

Performance Measures

69. Raw Score (plus 40) on 4th Test Adm., CRT Lev. 4
70. Raw Score (plus 50) on 4th Test Adm., CRT Lev. 5
71. Student Voc. ADSS on June 1974 CAT
72. Student Comp. ADSS on June 1974 CAT
73. Student Total Reading ADSS on June 1974 CAT

Table 5

Specifications for the Regression Analyses

Variable No.	Group/Variable Name	Total Teacher Time	Contributions of Time in Different Teacher Modes		
		1-4	5-8	9-12	13-16
	Reading Achievement				
76	CAT-Total	x	x	x	x
	Districts				
	A	1	5	9	13
	B	2	6	10	14
	C	3	7	11	15
	D	4	8	12	16
90-108	Schools 1-19	x	x	x	x
	Classroom Conditions				
36	No. of pupils	x	x	x	x
163	Percent white	x	x	x	x
168-173	Average SES	x	x	x	x
	Teacher/Quality of Instruction				
26	Age	x	x	x	x
64	Degree status	x	x	x	x
70	IMRU	x	x	x	x
	General Aptitude				
33	PEP - Reading	x	x	x	x
	Specific Aptitude				
84	May 73 CAT Comp				
73	Jan. 74 CAT Comp				
20,23	Criterion Ref. Pretest				
	Student Background				
28	Age	x	x	x	x
29	SES	x	x	x	x
	Quantity of Instruction by Mode				
177	Whole group teacher		x		
178	Small group teacher			x	
179	Individual help teacher				x
180	Individualized teacher				
182	Small group total				
183	Individual help total				
184	Individualized total				
185	Teacher total	x	x	x	x
186	Specialist total				
187	Paid aide total				
188	Unpaid aide total				
	Interactions				
	Jan. 74 CAT x time in mode				

(Table 5 Continued)

Table 5 (Continued

Add Contributions of Additional Reading Time by Mode				Add Contributions of Additional Reading Time by Mode and Staff				Add Contributions of Interactions
17-20	21-24	25-28	29-32	33-36	37-40	41-44	45-48	49-52
x	x	x	x	x	x	x	x	x
17	27	25	29	33	37	41	45	49
18	22	26	30	34	38	42	46	50
19	23	27	31	35	39	43	47	51
20	24	28	32	36	40	44	48	52
x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x
							x	x
							x	x
							x	x
x							x	x
	x							
		x						
			x					
x	x	x	x	x	x	x		
				x			x	x
					x		x	x
						x	x	x
								x

Table 6

Zero-Order Correlations of Time and Instructional Quality Variables With Reading Achievement in the Overall Sample

Total Minutes/Week	CAT 74' Pretest	CAT 74' Post test
1. Whole group	.04	.03
2. Small group	- .16	- .13
3. Individual Help	- .19	- .19
4. Individualized In's.	- .16	- .17
5. Teacher instruction	- .10	- .07
6. Specialist instruction	- .24	- .25
7. Paid aide instruction	- .23	- .23
8. Unpaid aide instruction	- .11	- .10
9. Total reading instruction	- .24	- .22
10. IMRU	- .08	- .07

An r of .062 is significant at $p < .05$

Table 7

Zero Order Correlations of Instructional Time and Quality Variables with Reading Achievement by District[a]

Minutes/Year by Condition	District A		B		C		D	
	Pretest	Post Test	Pretest	Post Test	Pretest	Post Test	Pretest	Post Test
Whole group teacher	- .09[b]	- .06	.19	.18	.05	.07	.05	.06
Small group teacher	- .08	- .07	- .07	- .04	.12	.15	- .33	- .29
Individual help teacher	- .10	- .09	- .08	- .10	- .03	- .03	.32	.31
Individualized instruction teacher			- .01	- 02	- .02	- .01	.19	.14
Total teacher	- .00	- .00	.07	.10	.15	.19	.05	.06
Total specialist			- .35	- .35	- .23	- .22	- .29	- .32
Total paid aide			- .30	- .33	- .21	- .21	- .12	- .01
Total unpaid aide	.00	.00	- .10	- .11	- .08	- .04	- .14	- .18
IMRU	- .11	- .10	.02	.03	- .04	- .04	- .18	- .16
N's	567		947		479		523	

[a]All time variables are in natural log form; all achievement variables are expressed in the CAT ADSS scale score, a normalized interval scale score which permits combining different test levels and forms on a common scale.

[b]An r of .062 is significant at $p < .05$.

Table 8

Intercorrelations of Instructional Time Variables
In The Overall Sample

Total Minutes/Week	1	2	3	4	5	6	7	8	9
1. Whole group teacher	—								
2. Small group total	-.35	—							
3. Individual help total	.08	-.03	—						
4. Individualized instruction total	-.09	-.17	100	—					
5. Teacher instruction total	.35	.64	.03	.04	—				
6. Specialist instruction	-.05	.02	.02	.64	-.08	—			
7. Paid aide instruction	.05	.19	.57	.06	.06	.04	—		
8. Unpaid aide instruction	.12	-.00	.37	.02	.09	.00	.06	—	
9. Total reading instruction	.25	.64	.24	.24	.85	.25	.34	.18	—

An r or .062 is significant at $p < .025$

Table 9

District A Multiple Regression Analysis Using Linear Predictors

ANALYSIS OF VARIANCE FOR THE MULTIPLE LINEAR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION	14	1804748.98602	128910.64186	135.3583
DEVIATION ABOUT REGRESSION	552	525706.18194	952.36627	
TOTAL	566	2330455.16796		

COEFFICIENT OF DETERMINATION .7744 MULTIPLE CORR. COEFFICIENT .8800

VARIABLE NO.	MEAN	STD. DEVIATION	REG. COEFF.	STD. ERROR OF REG. COE.	COMPUTED T VALUE	PARTIAL CORR. COE.	B	SIG. LEVEL
1	21.27743	1.70530	1.04864	1.04143	1.00692	0.04282	.03	
3	32.93034	10.45460	0.50923	0.16552	3.07653	0.12984	.08	p < .01
4	30.97354	4.26229	0.09898	0.41805	0.23677	0.01008	.01	
5	6.84586	0.80283	3.05149	2.11485	1.44289	0.06130	.04	
6	9.14286	3.14306	0.15698	0.82880	0.18941	0.00806	.01	
8	0.57143	0.49531	-1.92265	4.06089	-0.47345	-0.02015	-.01	
9	43.48677	9.60433	0.06142	0.22115	0.27773	0.01182	.01	
10	89.03316	8.70642	0.72864	0.18774	3.88122	0.16299	.10	p < .001
17	5.93204	2.80701	0.63736	0.66672	0.95597	0.04066	.03	
18	7.81801	2.26160	0.26913	0.73498	0.39338	0.01674	.01	
19	2.62658	0.90988	0.03965	1.73548	0.02285	0.00097	.00	
27	2.39278	0.67833	2.32868	2.01778	1.15408	0.04905	.02	
28	-0.00282	1.00472	50.03240	1.90701	26.23609	0.74496	.78	p < .001
37	25.97160	16.64773	0.15954	0.10873	1.46741	0.06234	.04	
7	481.73739	54.16726						

Table 10

District A Multiple Regression Analysis Using Linear Predictors and Multiplicative Interactions

ANALYSIS OF VARIANCE FOR THE MULTIPLE LINEAR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION	18	1807384.95526	100410.27529	105.1959
DEVIATION ABOUT REGRESSION	548	523076.21271	954.5076	
TOTAL	566	2330459.16796		

COEFFICIENT OF DETERMINATION .7756 MULTIPLE CORR. COEFFICIENT .8807

VARIABLE NO.	MEAN	STD. DEVIATION	REG. COEFF.	STD. ERROR OF REG. COE.	COMPUTED T VALUE	PARTIAL CORR. COE.	B	SIG. LEVEL
1	21.77743	1.70530	1.05082	1.05040	1.00040	0.04273	.03	
3	32.93034	10.45460	0.49723	0.16829	2.99013	0.12670	.08	p < .01
4	30.97354	4.26229	0.27092	0.46262	0.58561	0.02501	.02	
5	6.84586	0.80283	3.06072	2.12055	1.44337	0.06154	.04	
6	9.14286	3.14306	0.16655	0.83183	0.20022	0.00855	.01	
8	0.57143	0.49531	-1.19708	4.10259	-0.29179	-0.01246	-.01	
9	43.48677	9.60433	-0.04897	0.22339	-0.21953	-0.00938	.01	
10	89.03316	8.70642	0.72657	0.19349	3.75497	0.15838	.10	p < .001
17	5.93204	2.80701	0.46368	0.67888	0.68301	0.02916	.02	
18	7.81801	2.26160	0.29211	0.78621	0.37155	0.01587	.01	
19	2.62658	0.90988	1.06112	1.87602	0.56562	0.02416	.02	
27	2.39278	0.67833	2.54368	2.06729	1.23044	0.05249	.03	
28	-0.00282	1.00472	49.79804	1.94940	25.54528	0.73726	.78	p < .001
33	-0.08898	1.04974	-1.37958	1.51913	-0.90814	-0.03876	-.02	
34	-0.09991	0.85956	-2.26710	1.89193	-1.19830	-0.05112	-.03	
35	-0.09547	1.13638	1.01761	1.27639	0.79726	0.03404	.02	
36	-0.06296	1.49926	0.33322	0.94430	0.35288	0.01507	.01	
37	25.97160	16.64773	0.11706	0.11429	1.02420	0.04371	.03	
7	461.73739	64.16706						

Table 11

District B Multiple Regression Analysis Using Linear Preditors

ANALYSIS OF VARIANCE FOR THE MULTIPLE LINEAR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	22	3909335.21862	177697.05539	164.4573
DEVIATION ABOUT REGRESSION...	924	998387.49230	1080.50594	
TOTAL...	946	4907722.71093		

COEFFICIENT OF DETERMINATION .7966 MULTIPLE CORR. COEFFICIENT .8925

VARIABLE NO.	MEAN	STD. DEVIATION	REG. COEFF.	STD.ERROR OF REG.COE.	COMPUTED T VALUE	PARTIAL CORR. COE.	B	SIG. LEVEL
1	22.20000	1.99524	0.90574	0.64950	1.39451	0.04583	.03	
3	28.06938	10.23760	0.81157	0.14148	5.73617	0.18543	.12	p <.001
4	24.61457	4.63696	0.14694	0.36095	0.40710	0.01339	.01	
5	6.00634	1.07536	-0.32155	1.31473	-0.24457	-0.00805	.00	
6	11.32735	4.16044	0.22444	0.29999	0.74816	0.02461	.01	
8	0.11088	0.31414	-4.24458	7.36504	-0.57631	-0.01896	-.02	
9	0.19535	0.39668	0.26509	6.48929	0.04085	0.00134	.00	
10	0.06019	0.23796	8.77483	5.68034	1.54477	0.05075	.03	
11	0.17951	0.38399	6.74093	4.59292	1.46768	0.04823	.04	
12	0.17212	0.37769	6.39733	4.20655	1.52080	0.04997	.03	
13	0.07181	0.25830	8.98234	6.29196	1.42759	0.04691	.03	
14	39.64604	12.14516	0.06594	0.11384	0.57923	0.01905	.01	
15	83.01943	18.15113	0.05647	0.13818	0.40868	0.01344	.02	
22	5.41988	2.90557	0.42067	0.44996	0.93490	0.03074	.02	
23	7.53108	2.36996	0.64929	0.50472	1.28643	0.04228	.02	
24	3.09029	1.39692	-1.69007	1.05542	-1.60132	-0.05261	-.03	
25	2.74305	1.55872	0.23481	0.88963	0.26394	0.00868	.00	
30	3.37166	2.26932	-1.10284	0.53648	-2.05570	-0.06747	-.03	p <.05
31	2.88120	1.77381	-2.59138	0.66373	-3.90424	-0.12739	.06	p <.001
32	2.35751	0.56281	-2.20265	2.00903	-1.09638	-0.03604	-.02	
33	0.00222	1.00500	53.63218	1.57895	33.96691	0.74518	.75	p<.001
42	37.22101	32.51469	0.00787	0.05994	0.13121	0.00432	.00	
7	440.39704	72.02685						

Table 12

District B Multiple Regression Analysis Using Linear Predictors and Multiplicative Interactions

ANALYSIS OF VARIANCE FOR THE MULTIPLE LINEAR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	26	3924342.09191	150936.23430	141.2081
DEVIATION ABOUT REGRESSION...	920	983380.61901	1068.89198	
TOTAL...	946	4907722.71093		

COEFFICIENT OF DETERMINATION .7996 MULTIPLE CORR. COEFFICIENT .8942

VARIABLE NO.	MEAN	STD. DEVIATION	REG. COEFF.	STD.ERROR OF REG.COE.	COMPUTED T VALUE	PARTIAL CORR. COE.	B	SIG. LEVEL
1	22.20000	1.99524	0.88643	0.65114	1.36136	0.04484	.02	
3	28.06938	10.23760	0.79003	0.14166	5.57675	0.18083	.11	p < .001
4	24.61457	4.63696	0.12043	0.36551	0.32949	0.01086	.01	
5	6.00534	1.07536	-0.82518	1.32137	-0.62449	-0.02058	-.01	
6	11.32735	4.16044	0.23522	0.30499	0.77123	0.02542	.01	
8	0.11088	0.31414	-1.96620	7.39837	-0.26576	-0.00876	-.01	
9	0.19535	0.39668	3.26488	6.51707	0.50097	0.01651	.02	
10	0.06019	0.23796	10.80744	5.78995	1.86659	0.06142	.04	
11	0.17951	0.38399	10.04465	4.72662	2.12513	0.06989	.05	p < .05
12	0.17212	0.37769	5.70809	4.30338	1.32642	0.04369	.03	
13	0.07181	0.25830	10.82929	6.31981	1.71355	0.05640	.04	
14	39.64604	12.14516	0.03506	0.11436	0.30655	0.01011	.01	
15	83.01943	18.15113	0.10544	0.13904	0.75838	0.02500	.03	
22	5.41988	2.90557	0.49527	0.46275	1.07028	0.03526	.02	
23	7.53108	2.36996	0.69530	0.50741	1.37030	0.04513	.03	
24	3.09029	1.39692	-1.75134	1.10995	-1.57786	-0.05195	-.03	
25	2.74305	1.55872	0.66639	0.89357	0.74576	0.02458	.01	
30	3.37166	2.26932	-2.29804	0.62740	-3.66279	-0.11989	-.07	p < .001
31	2.88120	1.77381	-3.11485	0.68947	-4.51775	-0.14732	-.08	p < .001
32	2.35751	0.56281	-2.21302	2.03225	-1.08895	-0.03588	-.02	
33	0.00222	1.00500	52.80509	1.59177	33.17385	0.73802	.74	p < .001
38	0.19684	1.00296	-1.36695	1.22836	-1.11283	-0.03666	.02	
39	-0.13279	1.10453	-1.45501	1.09574	-1.32788	-0.04374	-.02	
40	-0.13757	1.05063	0.22406	1.19626	0.18730	0.00618	.00	
41	-0.27320	1.01197	-4.65139	1.30260	-3.57086	-0.11692	-.07	p < .001
42	37.22101	32.51469	0.02446	0.05987	0.40860	0.01347	.01	
7	44.39704	72.02685						

Table 13

District C Multiple Regression Analysis Using Linear Predictors

ANALYSIS OF VARIANCE FOR THE MULTIPLE LINEAR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	17	1693350.18035	99608.83414	79.9047
DEVIATION ABOUT REGRESSION...	461	574680.80987	1245.59612	
TOTAL...	478	2268030.99023		

COEFFICIENT OF DETERMINATION .7466 MULTIPLE CORR. COEFFICIENT .8641

VARIABLE NO.	MEAN	STD. DEVIATION	REG. COEFF.	STD.ERROR OF REG.COE.	COMPUTED T VALUE	PARTIAL CORR. COE.	B	SIG. LEVEL
1	21.90501	2.27494	-0.42794	0.79707	-0.53690	-0.02500	-.01	
4	20.81002	4.09656	1.20035	0.87221	1.37621	0.06397	.07	
5	5.86096	0.90750	0.51916	2.37109	0.21895	0.01020	.01	
6	10.33194	4.01155	0.60353	0.61979	0.97376	0.04531	.03	
8	0.41336	0.49295	42.76869	15.85310	2.69781	0.12467	.30	p <.01
11	0.37996	0.48588	33.21972	18.40030	1.80539	0.08379	.24	
12	28.60021	7.45463	0.18966	0.34503	0.54971	0.02559	.02	
13	28.16952	28.71474	0.78882	0.29379	2.68495	0.12408	.33	p <.01
20	5.50082	3.10850	0.34785	0.64812	0.53671	0.02499	.02	
21	7.80920	2.48372	1.40282	0.80860	1.73487	0.08054	.05	
22	2.61589	0.96605	2.74942	2.14947	1.27911	0.05947	.04	
23	2.91032	1.93811	-0.37609	1.03464	-0.36350	-0.01693	-.01	
28	2.85137	1.57354	-0.78731	1.15604	-0.68104	-0.03179	-.02	
29	3.50446	2.36421	-1.50869	0.78343	-1.92576	-0.08933	-.05	
30	2.46555	0.97750	2.20682	1.80406	1.22325	0.05688	.03	
31	0.00104	1.00254	48.53429	2.12417	22.84862	0.72874	.70	p <.001
40	60.14196	35.08445	-0.00261	0.05664	-0.04616	-0.00215	.00	
7	383.57891	68.38276						

Table 14

Display of Multiple Regression Analysis Using Linear Predictors and Multiplicative Interactions

ANALYSIS OF VARIANCE FOR THE MULTIPLE LINEAR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	21	1700113.67419	80957.79401	65.1463
DEVIATION ABOUT REGRESSION...	457	567917.31604	1242.70747	
TOTAL...	478	2268030.99023		

COEFFICIENT OF DETERMINATION .7496 MULTIPLE CORR. COEFFICIENT .8658

VARIABLE NO.	MEAN	STD. DEVIATION	REG. COEFF.	STD.ERROR OF REG.COE.	COMPUTED T VALUE	PARTIAL CORR. COE.	B	S.L. LEVEL
1	21.90501	2.27494	-0.37449	0.79845	-0.46902	-0.02193	-.01	
4	20.81002	4.09656	1.27530	0.87672	1.45464	0.06789	.08	
5	5.86096	0.90750	0.53366	2.37420	0.22477	0.01051	.01	
6	10.33194	4.01155	0.81200	0.62865	1.29167	0.06031	.05	
8	0.41336	0.49295	43.92825	16.05658	2.73584	0.12694	.31	p < .01
11	0.37996	0.48588	33.60706	18.58393	1.80839	0.08429	.23	
12	23.60021	7.45463	0.19066	0.34691	0.54959	0.02570	.02	
13	28.16952	28.71474	0.77190	0.29488	2.61771	0.12154	.32	p < .01
20	5.50082	3.10850	0.45406	0.65267	0.69570	0.03253	.02	
21	7.80920	2.48372	1.37798	0.81599	1.68873	0.07875	.05	
22	2.61589	0.96605	2.51304	2.15523	1.16602	0.05446	.04	
23	2.91032	1.93811	-0.54950	1.04543	-0.52562	-0.02458	-.02	
28	2.85137	1.57354	-1.77781	1.29886	-1.36875	-0.06390	-.04	
29	3.50446	2.36421	-1.71130	0.85811	-1.99427	-0.09288	-.06	p < .05
30	2.46555	0.97750	1.71354	1.86504	0.91877	0.04294	.02	
31	0.00104	1.00254	46.73469	2.28215	20.47836	0.69176	.68	p < .001
36	0.04866	1.00680	0.65125	1.73742	0.37483	0.01753	.01	
37	0.11340	0.78605	2.34470	2.24792	1.04305	0.04873	.03	
38	-0.19259	0.85869	-2.67644	2.18652	-1.22406	-0.05717	-.03	
39	-0.18058	0.90557	-3.09006	2.10647	-1.46219	-0.06824	-.04	
40	60.14196	35.08445	-0.00749	0.05687	-0.13175	-0.00616	-.01	
7	383.87891	68.88276						

Table 15

District D Multiple Regression Analysis Using Linear Predictors

ANALYSIS OF VARIANCE FOR THE MULTIPLE LINEAR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	18	2359726.50964	131095.91720	117.6571
DEVIATION ABOUT REGRESSION...	504	561567.01379	1114.22027	
TOTAL...	522	2921293.52343		

COEFFICIENT OF DETERMINATION .8078 MULTIPLE CORR. COEFFICIENT .8988

VARIABLE NO.	MEAN	STD. DEVIATION	REG. COEFF.	STD.ERROR OF REG.COE.	COMPUTED T VALUE	PARTIAL CORR. COE.	B	SIG. LEVEL
1	21.57208	1.92561	1.07717	1.18051	0.91246	0.04061	.03	
3	30.68413	10.13740	0.61501	0.18444	3.33446	0.14692	.08	p <.001
4	25.15296	4.32044	0.75093	0.61502	1.22099	0.05431	.04	
5	5.53155	0.74949	2.29214	2.79344	0.82055	0.03653	.02	
6	10.91969	3.30929	0.02049	0.92484	0.02216	0.00099	.00	
8	0.46845	0.49948	-21.74139	12.36108	-1.75886	-0.07811	-.15	
9	0.19312	0.39512	-0.57074	7.83190	-0.07287	-0.00325	.00	
10	37.19197	9.79111	0.47163	0.21927	2.15091	0.09537	.06	p <.05
11	63.94532	32.74722	0.05702	0.15102	0.37759	0.01682	.03	
18	4.38795	2.69905	-0.81846	1.10267	-0.74226	-0.03304	-.03	
19	7.28989	3.11621	-0.43466	0.76582	-0.56757	-0.02527	-.02	
20	3.45153	1.69918	0.25633	1.25264	0.20463	0.00911	.01	
21	3.08494	2.17631	-1.74599	1.13426	-1.53932	-0.06841	-.05	
26	3.41143	2.34606	-3.08428	0.72106	-4.27744	-0.18717	-.10	p <.001
27	2.69572	1.41734	0.07523	1.09049	0.06898	0.00307	.00	
28	2.40854	0.72584	-6.94136	2.47270	-2.80720	-0.12408	-.07	p <.01
29	-0.00115	1.00325	52.66163	2.41121	21.84037	0.69731	.70	p <.001
38	38.09446	30.92042	0.08078	0.11371	0.71039	0.03163	.03	
7	422.45272	74.80874						

District D Multiple Regression Analysis Using Linear Predictors and Multiplicative Interactions

ANALYSIS OF VARIANCE FOR THE MULTIPLE LINEAR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	22	2371329.25836	107787.69356	97.9952
DEVIATION ABOUT REGRESSION...	500	549964.26507	1099.92853	
TOTAL...	522	2921293.52343		

COEFFICIENT OF DETERMINATION .8117 MULTIPLE CORR. COEFFICIENT .9010

VARIABLE NO.	MEAN	STD. DEVIATION	REG. COEFF.	STD. ERROR OF REG. COE.	COMPUTED T VALUE	PARTIAL CORR. COE.	B	SIG. LEVEL
1	21.57208	1.92561	1.07255	1.18401	0.90586	0.04048	.03	
3	30.68413	10.13740	0.64299	0.18723	3.43424	0.15180	.09	$t < .001$
4	25.15296	4.32044	0.96087	0.64911	1.48028	0.06606	.06	
5	5.53155	0.74949	2.62730	2.82845	0.92888	0.04151	.03	
6	10.91959	3.30929	-0.40741	0.94816	-0.42968	-0.01921	-.02	
8	0.46845	0.49948	-14.25141	13.02007	-1.09457	-0.04889	-.10	
9	0.19312	0.39512	3.53247	8.09188	0.43655	0.01952	.02	
10	37.19197	9.79111	0.45331	0.23005	1.97047	0.08778	.06	$p < .05$
11	63.94532	32.74722	0.12417	0.15664	0.79270	0.03543	.05	
18	4.38795	2.69905	-2.00527	1.23257	-1.62690	-0.07257	-.07	
19	7.28989	3.11621	-0.95614	0.80889	-1.18205	-0.05279	-.04	
20	3.45153	1.69918	0.22331	1.28217	0.17417	0.00779	.00	
21	3.08494	2.17631	-2.57918	1.18895	-2.16928	-0.09656	-.08	$p < .05$
26	3.41143	2.34606	-3.55532	0.77624	-4.58017	-0.20067	-.11	$p < .001$
27	2.69572	1.41734	0.57238	1.16618	0.49082	0.02194	.01	
28	2.40854	0.72584	-5.62911	2.62927	-2.14094	-0.09531	-.05	$p < .05$
29	-0.00115	1.00325	51.67564	2.44041	21.17503	0.68759	.69	$p < .001$
34	0.05446	1.07122	-6.00378	2.26279	-2.65326	-0.11783	-.09	$p < .01$
35	-0.32992	1.05363	-3.72629	2.14780	-1.73494	-0.07736	-.05	
36	0.13340	1.03009	1.74831	1.91345	0.91370	0.04083	.02	
37	-0.06107	1.01479	-3.84453	1.99035	-1.93159	-0.08606	-.05	
38	38.09446	30.92042	0.01414	0.12652	0.11176	0.00500	.00	
7	422.46272	74.90874						