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ABSTRACT

The instructional effectiveness of elementary classroom teachers is investigated through the use of distributions of student achievement scores. The data used for this investigation were reading, language, and arithmetic subtest scores on the Comprehensive Tests of Basic Skills for fifth and sixth grade public school children. Students were classified by their grade equivalent scores on each of the subtests. For each teacher in each of the grades, the scores were computed for each of their students. Upon grouping of students, each teacher received nine data points; mean gain scores for slow, average and fast students in reading, language and arithmetic. It was then determined which cluster of teachers was most effective with certain students and then to follow these teachers the second year of the study and reinvestigate their effectiveness. Results indicate that it may be possible to determine that certain teachers are more successful in working with certain types of students in various subject areas and at differing abilities. (DEP)

USE OF CLASSROOM DISTRIBUTIONS OF STUDENT ACHIEVEMENT TEST SCORES TO EVALUATE THE INSTRUCTIONAL EFFECTIVENESS OF TEACHERS

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Introduction

One of the major barriers to the scientific study of education is the criterion problem, which still continues to be a source of academic debate. Without accepted criteria or appropriate methodology to deal with the criteria, the behavioral scientist has only a tentative basis for the establishment of educational accountability, for the evaluation of educational innovations, for the assessment of teacher effectiveness, or for the validation of teachers' training methods.

The criterion problem, itself, is complex in that it is compounded by several controversies. Among these are issues of either a conceptual or philosophical nature which are not directly subject to solution by the methods of the behavioral scientist. These issues usually focus upon the choice of suitable or appropriate criteria through which the effectiveness of schooling can be ascertained. These issues appear only indirectly pertinent to the methodological issues associated with how to deal with commonly accepted criterion variables. The major focus of this paper is on the selection of a commonly accepted criterion variable and the testing of a new methodology for use in the study of teaching. Specifically, the purpose of this investigation is to determine the instructional effectiveness of classroom teachers through the use of distributions of student achievement scores.

Literature Summary

The relationship of teaching effort to changes in student behavior as reflected by scores on achievement tests is presently unknown. Rosenshine (Smith, 1971), in reviewing recent process-product studies of the classroom

using achievement data, points out the inconsistencies of current research results and the paucity of knowledge regarding the validity of the teacher training curriculum. Evaluators, for a lack of definitive measures, often rely upon simple teacher rating instruments as a means of ascertaining teacher effectiveness. This practice can be documented in almost any teacher training program [i.e., Stanford STEP program (Fortune, Cooper, and Allen, 1969) or University of Illinois (Johnson, 1971)].

The change in student achievement scores appears as a potential criterion throughout the history of educational research. Rice (DuBois, 1970), in his earlier studies of spelling, relied upon student achievement as the dependent variable. Recent models designed to assess educational accountability generally utilize school achievement as one of the major dependent variables. A good example of this practice is the New York City Accountability Model recently designed by Educational Testing Service (McDonald, 1973) which proposes to use student achievement means calculated at school levels cross-sectionally to determine successfully progressing schools. The performance criteria movement in teacher education has suggested that changes in student achievement scores should be regarded as the behavioral criterion used in the validation of selected training criteria (Cooper, 1970). Several national evaluations have utilized means of student achievement at both institutional and classroom levels to study the effects of intervention and specific educational activities. The best example of these efforts can be found in the longitudinal evaluation of Project Follow-Through whose data were collected by Stanford Research Institutes and were analyzed by Abt Associates of Cambridge, Massachusetts. The national evaluation of the Emergency School Assistance Act presently being conducted by Systems Development Corporation

of Santa Monica, California, under contract with the Office of Education, includes student achievement as one of the primary dependent variables.

It is unfortunate that prior research using student achievement means would lead to the forecast that these studies would yield few, if any, results. Several possible explanations of these forecasts are apparent. Among these explanations is the fact that although the teacher is the delivery unit of the activity, students react to this stimulus differentially, producing interactions which mask true treatment of teacher effects at the classroom level. In reality, the teachers may in fact fail to transmit the classroom treatment fully, giving some students more time and reinforcement than they give to others. On the other hand, when using only classroom or school means, much data relative to the reception of the treatments or teaching uniformity are lost or averaged out. If there are differential student reactions to the stimulus, these are averaged out, and the potential of identifying treatment validity or teacher effects is lost. A few studies illustrate the potential of such differential reactions, including the treatment across aptitude interaction studies by Cohen, Snow, Berliner, and others.

The Dilemma

Studies to ascertain the effects of teaching upon student achievement have been the subject of several methodological disputes. Two appear to be major. They are the controversy concerning how to deal with gain scores and the controversy involved with the choice of the unit of analysis. Campbell, Porter, Cronbach and others have offered potential solutions to the gain score problem such that when hypothesized equal controls can be documented, it is no longer an insurmountable problem. However, the choice

of units of analysis still remains subject to debate. This paper attempts to propose a compromise to this problem without being subject to the criticisms of either side of the argument and within the limitations of the gain-score analysis.

In the choice of units debate, the argumentation is directed toward determining which is the proper unit of analysis--the student in the classroom or the teacher who is the treatment delivery agent or the unit of study. The problem arises since the teacher or the classroom is the unit of concern in the study, but the students are the units upon which achievement is measured. The behavioral scientists who maintain that the students are the proper unit of analysis argue that it is the individual student who receives the teacher stimulus and that "true" teacher effects must be observed across these students. Those who maintain that the teacher or the classroom is the "true" unit of analysis argue that it is the teacher or classroom to which causality is to be attributed and that classroom as opposed to individual student effects is of primary interest. Hence, those who argue for students being the unit of analysis maintain the possibility of teacher-student interaction effects as the primary output of instruction. Those arguing for classrooms or teachers as the unit of analysis are willing to undergo the data losses involved with aggregating student achievement scores up to the proposed analysis unit. These data losses primarily involve losses of potential changes in classroom variance.

The present investigation was exploratory in nature while attempting to provide further insight into the problem discussed above, the purpose being to determine the instructional effectiveness of classroom teachers through the use of distributions of student achievement scores. The primary

data for this study were the reading, language and arithmetic subtest scores on the Comprehensive Test of Basic Skills (CTBS) for fifth and sixth grade students in a large metropolitan school division. These students were tested during the fall and spring of the 1972-73 and 1973-74 school years.

The first step in the investigation was to classify the students based upon the 1972-73 spring CTBS subtest scores. This classification was based upon their grade equivalent scores on each of the subtests; the classification was as follows:

	Slow	Average	Fast
Fifth Grade	≤4.9	5.0-6.8	>6.9
Sixth Grade	≤5.9	6.0-7.8	>7.9

Each student was classified by grade as well as by performance on the three subtests, i.e. Student #000 was a fifth grader, average in reading, average in language, slow in math. For each teacher in each of the two grades, the gain scores (in raw score points) were computed for each of his/her students on each of the three subtests. The mean gain scores for the students on the respective subtests served as the derived data for the investigation. Specifically, each teacher had nine (9) data points; mean gain scores for slow, average and fast students in reading, language and arithmetic.

To restate the problem in slightly different terms, the purpose of this exploratory investigation was to determine which teachers were not effective with which classification of student. Therefore in this investigation it was necessary to determine first of all the cluster of teachers who were most effective with certain students and then to follow these teachers with the second year of the study and investigate their assignment and their effectiveness. In this procedure, the first step was to cluster the

teachers based upon the mean scores in the nine categories (i.e., the nine data points) using Baker's Numerical Taxonomy Package (1972). Following the cluster analysis, univariate single degree of freedom linear contrasts and multivariate simultaneous confidence intervals were computed to determine specifically which clusters of teachers differed significantly, as well as to determine on which of the nine data points they differed (in other words, which teachers differed in their effectiveness with which students). Due to the nature of this investigation, the α level for each of the univariate tests was established at .01 so, therefore, the multivariate level was $1 - (1 - \alpha)^9 = .09$; the α level for the multivariate tests was .05.

The results of this first stage of the study for the sixth grade teachers are found in Table 1. Four clusters of teachers were identified in the cluster analysis and as can be seen, the teachers in cluster 4 were significantly more successful than teachers in the other clusters with all levels of students based upon the student scores on the language subtest of the CTBS. The data also indicated that teachers in clusters 4, 2 and 1 were significantly more successful with slow arithmetic students than teachers in cluster 3; and teachers in clusters 4 and 2 were more successful with fast arithmetic students than were teachers in cluster 3 and 1.

The results for fifth grade teachers are found in Table 2. Three clusters of teachers were identified and the data indicate that the teachers in clusters 3 and 1 were significantly more successful than teachers in cluster 2 with average students in reading and arithmetic based upon the students' scores on these subtests of the CTBS. Further, the teachers in cluster 3 were more significantly successful with fast language and fast arithmetic students than teachers in clusters 1 and 2; the teachers in

cluster 2 were more successful than teachers in cluster 1 with the latter students.

The second stage of the analysis involved following these clusters of teachers into the 1973-74 school year and observing their class assignments in terms of the academic abilities of students. The teachers were classified based upon whether or not they were assigned to classes with distributions of students with which they were significantly more successful during the preceding year, as measured by the three subtests of the CTBS. If such an assignment was made, these teachers were said to be in the "matched" group; if it appeared that such an assignment was not made, then these teachers were said to be in the "non-matched" group. This matching was based upon the pre-test data for the 1973-74 school year. Thus the problem became the investigation of the difference between these two groups in terms of the performance of their students on the CTBS.

The data for this stage of the analysis is found in Table 3. Multivariate Analysis of Variance (MANOVA, 1972) of these data resulted in an approximate F value (Rao) equal to 3.718 ($p = .027$), i.e. there was a significant difference between the two groups on the linear combination of the mean gain scores on the three subtests of the CTBS. Subsequently, simultaneous confidence intervals were computed (Kramer, 1973) and the results indicated that the students of the teachers in the "matched" group had significantly greater gains ($p < .01$) in reading, language and arithmetic than did the students of the teachers in the "non-matched" group. Due to problems with the 1973-74 fifth grade data, a similar analysis for the fifth grade could not be performed.

As indicated, this investigation was exploratory in nature; however, the researchers were able to conclude that these initial results were

encouraging. Within the obvious limitations of attempting to determine teaching effectiveness in terms of student achievement only, these initial data do indicate that it may be possible to determine that certain teachers can be more successful in working with certain types of students, in terms of their abilities and in various subject areas. It is important to note, however, that this investigation was primarily oriented toward looking at a specific methodology to attack a lingering problem in education. Further investigations are undoubtedly needed to validate this methodology--investigations that will need to regress other personality and demographic variables on these classifications of teachers.

Table 1

Grade 6
Single Degree of Freedom
Linear Contrasts

Group #2 (Slow Language)	Cluster 4 > Clusters 1, 2, 3
Group #3 (Slow Mathematics)	Clusters 4, 2, 1 > Cluster 3
Group #5 (Average Language)	Cluster 4 > Cluster 3, 2, 1
Group #8 (Fast Language)	Cluster 4 > Clusters 3, 2, 1
Group #9 (Fast Mathematics)	Clusters 4, 2 > Clusters 3, 1

Table 2

Grade 5
Single Degree of Freedom
Linear Contrasts

Group #4 (Average Reading)	Clusters 3, 1 > Cluster 2
Group #6 (Average Mathematics)	Clusters 1, 3 > Cluster 2
Group #8 (Fast Language)	Cluster 3 > Clusters 1, 2
Group #9 (Fast Mathematics)	Cluster 3 > Cluster 2 > Cluster 1

Table 3

Mean Gain Scores for Matched and Non-Matched Groups on the 1973-74 CTBS Subtests Grade 6

			Reading	Language	Arithmetic
Matched	N = 8	$\bar{X}$	57.680	61.456	75.780
		s.d.	9.013	7.598	7.694
Non-Matched	N = 17	$\bar{X}$	48.070	50.026	65.148
		s.d.	8.028	9.105	7.597

APPENDIX

TABLE 1
TEACHER GAIN MEANS AND STANDARD DEVIATIONS
ACROSS COGNATE AREAS BY YEARS
GRADE 5

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
1	S	-3.000	8	8.71	10.000	5	8.18	-12.000	7	15.52
	A	-12.750	2	7.41	-8.500	5	9.57	-21.500	2	7.32
1973	F	-6.000	5	4.30	-2.600	3	4.50	-18.000	6	4.63
1	S	———			———			———		
	A	———			———			———		
1974	F	———			———			———		
2	S	-8.750	10	8.18	-21.250	8	12.81	-20.250	15	25.01
	A	-15.667	3	7.09	-12.333	2	2.51	-33.667	6	6.43
1973	F	-5.500	9	6.28	-2.833	12	4.79	-14.333	7	2.16
2	S	-7.111	9	12.59	-14.000	6	4.73	-29.500	6	6.41
	A	-7.000	5	6.28	-2.000	11	16.47	-22.455	11	9.23
1974	F	-6.000	11	2.49	-5.500	8	5.63	-19.000	7	6.86
3	S	-21.000	2	12.51	-24.000	2	4.00	-36.400	5	14.38
	A	-12.600	3	4.61	-9.400	7	4.39	-26.000	2	9.02
1973	F	-3.000	6	4.39	-4.000	3	3.62	-19.000	3	4.19
3	S	-10.625	8	12.98	-19.444	9	11.41	-30.900	10	13.37
	A	-8.625	8	7.13	-13.286	7	6.82	-25.000	11	10.80
1974	F	-2.750	8	3.01	-5.429	7	4.72	-13.667	3	3.06
4	S	-1.000	16	4.65	-8.714	1	0.00	-19.571	13	13.99
	A	-8.000	5	4.36	-4.000	15	11.27	-21.333	7	2.08
1973	F	-2.000	2	4.00	-10.500	4	2.12	-17.500	3	0.71
4	S	-5.250	16	40.97	-12.263	19	10.62	-22.933	15	11.66
	A	-3.545	11	9.28	-10.125	8	6.58	-22.500	10	4.70
1974	F	———			———			-16.000	2	5.66
5	S	-8.500	9	6.36	-3.500	11	4.95	-24.500	10	7.78
	A	-13.000	7	2.12	-16.500	4	0.71	-27.500	7	3.54
1973	F	-5.667	4	5.16	-4.167	5	2.40	-17.500	2	3.08
5	S	-20.500	2	11.25	———			-35.000	4	11.05
	A	-7.250	8	2.96	-12.400	10	4.45	-23.500	10	5.25
1974	F	-4.091	11	6.14	-3.667	9	3.71	-17.286	7	2.50

TABLE 1
(continued)

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
6	S	-11.000	2	7.78	-9.000	3	17.68	-28.000	3	7.65
	A	-6.500	8	2.12	-5.000	10	2.83	-14.500	8	13.43
1973	F	-5.857	16	4.52	-8.000	12	4.20	-17.857	17	4.81
6	S	——			-19.800	5	16.04	-26.667	3	21.57
	A	-8.091	11	8.56	-9.444	18	6.20	-21.222	9	5.07
1974	F	-6.722	18	2.78	-5.000	6	2.19	-16.353	17	7.32
7	S	-6.500	14	8.23	-5.250	14	9.22	-20.500	13	11.63
	A	-10.500	2	10.66	-7.000	3	11.22	-26.500	2	3.11
1973	F	-10.000	2	2.81	-17.000	2	3.83	-21.000	2	2.25
7	S	——			——			——		
	A	——			——			——		
1974	F	——			——			——		
8	S	-3.000	2	11.19	-14.375	2	13.70	-28.250	3	7.94
	A	-15.600	7	11.52	-19.200	10	8.44	-33.800	5	6.61
1973	F	-3.000	16	4.39	-6.000	13	3.62	-15.000	17	4.19
8	S	-9.429	7	5.26	-3.400	5	6.58	-13.500	4	7.27
	A	-7.000	8	3.55	-11.429	7	4.79	-24.000	2	15.56
1974	F	-1.600	10	3.81	-3.077	13	3.32	-16.500	6	6.09
9	S	-12.750	14	19.79	-6.583	5	6.83	-21.750	2	19.69
	A	-6.000	8	4.24	-9.000	12	4.24	-18.000	14	5.66
1973	F	-8.667	2	2.08	-5.000	6	7.47	-18.333	7	4.04
9	S	-7.250	8	10.17	-13.143	7	10.42	-20.000	5	18.85
	A	——			-3.000	1	0.00	-18.000	3	3.51
1974	F	——			——			——		
10	S	-7.714	12	6.97	-14.571	13	11.12	-23.286	11	14.07
	A	-5.000	12	2.12	-10.000	9	4.24	-19.500	8	4.95
1973	F	-4.667	3	2.31	-2.333	4	2.08	-13.000	7	1.73
10	S	——			——			——		
	A	——			——			——		
1974	F	——			——			——		

TABLE 1
(continued)

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
11	S	-8.600	13	17.61	-12.600	15	14.98	-18.600	8	17.66
	A	-8.200	7	6.94	-12.400	7	2.07	-23.400	12	10.92
1973	F	-10.500	5	3.54	-11.500	3	2.12	-19.000	3	5.66
11	S	-8.467	15	11.98	-14.765	17	12.39	-30.917	12	14.84
	A	-9.250	8	7.32	-14.571	7	4.69	-25.778	9	7.08
1974	F	3.000	5	19.84	-1.750	4	6.13	-16.667	6	8.76
12	S	-13.800	6	14.46	-17.000	—	9.92	-23.200	6	20.09
	A	-12.500	8	5.24	-13.333	—	6.31	-20.667	8	9.22
1973	F	-4.500	4	4.95	-5.500	—	2.12	-18.000	4	2.83
12	S	—			-6.700	10	7.96	-20.125	8	7.99
	A	-5.818	11	6.16	-9.091	11	5.22	-18.500	10	6.11
1974	F	-4.000	1	0.00	-7.500	2	4.95	-14.500	6	7.50
13	S	-9.400	12	14.46	-17.000	—	9.92	-22.900	9	20.09
	A	-10.200	3	6.91	-15.000	—	4.85	-20.200	7	6.50
1973	F	-4.000	2	2.83	-6.500	—	3.00	-20.000	2	3.74
13	S	—			-7.308	13	8.20	-19.643	14	12.09
	A	-6.857	7	7.01	-9.000	11	5.81	-19.286	7	8.63
1974	F	-5.000	2	2.83	—			-17.000	3	2.65
14	S	-15.400	5	9.42	-23.000	5	11.98	-52.200	4	9.83
	A	-11.500	7	6.36	-8.500	10	0.71	-23.000	11	4.24
1973	F	-5.750	11	2.87	-4.000	8	5.89	-18.000	8	3.37
14	S	-15.125	8	9.11	-16.600	10	10.76	-34.167	12	12.45
	A	-8.333	9	5.07	-15.286	7	3.25	-27.167	6	4.17
1974	F	-6.667	3	2.52	-10.000	2	2.83	—		
15	S	-8.000	5	12.17	-9.000	6	7.68	-27.600	4	7.06
	A	-4.500	10	4.95	-13.500	10	9.19	-26.000	2	2.83
1973	F	-3.000	9	3.55	-5.000	11	3.73	-18.000	4	3.13
15	S	-10.000	4	1.83	-6.667	3	4.93	-35.375	8	7.96
	A	-8.455	11	5.20	-10.857	14	4.31	-29.071	14	6.32
1974	F	-2.364	11	4.80	-2.833	6	4.62	-19.000	1	0.00

TABLE 1
(continued)

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
16	S	-21.000	9	13.13	-20.714	7	11.01	-33.571	8	6.13
	A	0.500	8	2.12	-15.500	12	6.36	-23.000	14	5.66
1973	F	-2.000	7	1.41	-5.500	4	5.89	-13.500	2	7.78
16	S	-6.000	9	8.85	-12.000	14	8.37	-31.333	3	13.32
	A	-9.727	11	6.86	-7.667	6	5.72	-22.789	19	7.02
1974	F	-6.143	7	4.30	-7.286	7	6.32	-16.000	5	18.51
17	S	-14.650	21	14.13	-13.400	20	15.04	-28.950	20	15.44
	A	-8.000	7	2.00	-10.667	10	7.37	-24.000	14	3.46
1973	F	-1.000	8	4.39	9.000	6	3.62	-14.000	2	4.19
17	S	1.794	34	12.01	-5.485	33	10.34	-17.765	34	11.22
	A	5.750	8	5.60	-1.000	8	12.34	-13.875	8	5.72
1974	F	7.600	5	7.13	-7.000	2	1.41	-18.000	1	0.00
18	S	-15.500	13	9.19	-15.500	14	16.26	-24.500	15	7.78
	A	-15.500	13	6.36	-14.000	13	12.73	-32.000	13	1.41
1973	F	-6.000	2	7.21	-4.333	2	2.08	-18.667	1	0.00
18	S	-7.440	25	12.09	-6.739	23	10.35	-4.882	17	15.25
	A	-9.500	4	10.66	-4.500	2	10.61	-3.500	8	13.96
1974	F	-3.000	1	0.00	-11.000	1	0.00	-4.000	1	0.00
19	S	-5.800	8	12.44	-1.200	7	5.80	2.000	7	8.06
	A	-2.000	2	5.00	-13.000	4	8.87	-33.000	2	9.00
1973	F	-5.000	3	4.24	5.000	2	5.66	-14.000	2	22.63
19	S	-0.833	6	4.75	-3.000	7	11.78	-9.400	10	16.32
	A	29.333	3	18.77	27.333	6	24.18	24.000	3	13.11
1974	F	41.600	5	20.35	———			———		
20	S	-3.333	14	10.17	-7.333	14	15.02	-21.778	15	12.11
	A	-11.000	8	4.55	-2.000	10	4.90	-21.205	9	8.30
1973	F	-6.000	5	19.94	1.000	3	15.70	-19.000	8	25.07
20	S	-4.640	28	9.15	-7.517	29	12.89	-13.536	28	15.58
	A	———			9.000	1	0.00	-22.500	2	6.36
1974	F	———			———			———		

TABLE 1
(continued)

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
21	S	-24.000	10	14.31	-23.500	8	11.7	-41.750	11	8.96
	A	-10.000	4	5.66	-12.500	7	0.71	-31.500	2	3.54
1973	F	-11.000	5	4.87	-10.000	4	3.89	-16.000	6	4.37
21	S	——			——			——		
	A	——			——			——		
1974	F	——			——			——		
22	S	-4.667	8	17.01	-13.000	5	10.44	-28.333	7	24.54
	A	-12.000	3	4.24	-17.000	6	5.66	-22.000	2	8.48
1973	F	-4.000	4	2.39	-1.000	4	5.62	-12.000	6	3.42
22	S	——			——			——		
	A	——			——			——		
1974	F	——			——			——		
	S									
	A									
1973	F									
	S									
	A									
1974	F									
	S									
	A									
1973	F									
	S									
	A									
1974	F									
	S									
	A									
1973	F									
	S									
	A									
1974	F									

TABLE 2
TEACHER GAIN MEANS AND STANDARD DEVIATIONS
ACROSS COGNATE AREAS BY YEARS
GRADE 6

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
1	S	2.429	19	8.70	8.429	2	7.48	6.571	19	13.83
	A	0.000	5	8.54	3.000	3	7.00	3.667	9	15.53
1973	F	-1.333	6	1.53	4.667	8	8.14	7.000	2	4.58
1	S	-9.667	6	7.31	12.143	7	13.72	11.250	4	7.63
	A	16.333	3	18.77	10.500	2	4.95	1.750	4	21.41
1974	F	2.000	2	8.49	3.000	2	1.41	6.000	2	0.00
2	S	-0.750	14	9.71	10.750	18	16.46	-1.250	16	12.87
	A	1.833	6	7.78	6.000	5	5.25	7.000	7	5.51
1973	F	1.750	8	4.06	3.750	4	4.65	2.500	5	1.85
2	S	1.000	12	8.06	5.889	9	8.46	3.273	11	11.34
	A	7.375	8	6.59	7.875	8	3.72	9.500	8	3.55
1974	F	1.900	10	3.28	4.917	12	5.45	5.727	11	4.76
3	S	3.250	10	8.62	10.500	2	5.07	-0.750	9	12.07
	A	5.167	6	7.83	7.000	7	5.66	4.500	8	4.85
1973	F	2.429	2	4.79	7.143	9	4.06	2.000	2	2.77
3	S	8.222	9	8.27	8.800	10	10.85	10.000	7	9.81
	A	10.600	5	6.39	7.375	8	9.84	12.000	11	11.97
1974	F	2.250	8	3.77	4.000	3	5.57	4.000	4	6.32
4	S	-2.000	8	11.58	26.833	3	12.22	1.833	10	14.13
	A	9.000	4	3.51	64.000	7	0.58	8.000	3	6.11
1973	F	0.000	3	4.02	65.000	5	5.95	2.000	2	3.50
4	S	11.625	16	6.84	———			24.091	11	8.73
	A	12.400	5	7.64	———			25.571	7	13.30
1974	F	3.000	2	1.41	———			29.000	5	12.29
5	S	-11.000	18	2.34	9.000	15	22.05	-16.000	19	29.67
	A	7.000	1	0.00	20.000	11	7.00	20.000	9	5.51
1973	F	4.091	13	5.47	2.818	5	5.19	4.364	3	5.14
5	S	-10.600	5	14.26	3.500	8	9.93	6.000	3	14.93
	A	1.714	7	8.24	3.000	7	6.68	2.400	10	7.28
1974	F	0.556	18	5.64	4.600	15	4.24	5.000	17	4.90

TABLE 2
(continued)

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
6	S	-10.875	14	14.38	12.125	15	10.45	-5.500	18	5.87
	A	-6.000	6	8.82	37.000	7	13.86	-7.000	8	5.89
1973	F	-6.000	7	21.21	23.000	5	37.48	1.000	5	11.31
6	S									
	A									
1974	F									
7	S	-1.273	18	7.30	-0.545	14	9.84	-9.909	14	10.86
	A	10.000	8	5.66	15.500	11	0.71	7.500	12	12.02
1973	F	-2.000	2	4.58	8.000	3	1.52	5.000	2	4.39
7	S	1.500	16	8.01	1.357	14	6.11	-0.800	15	8.34
	A	-4.222	9	7.07	11.571	7	8.42	0.778	9	5.87
1974	F	1.800	5	3.96	6.429	7	5.50	6.500	6	3.51
8	S	-1.500	12	4.81	8.875	12	8.48	8.500	12	10.57
	A	6.500	4	6.19	22.250	3	28.14	0.250	5	2.87
1973	F	7.000	6	3.57	3.000	7	1.36	3.000	5	7.86
8	S	0.688	16	9.31	8.706	17	5.18	0.182	11	5.83
	A	1.000	7	8.60	16.000	5	8.34	10.333	3	6.03
1974	F									
9	S	2.286	5	7.30	6.857	9	7.22	10.143	4	9.49
	A	10.500	10	3.54	16.000	7	1.41	14.000	10	9.90
1973	F	1.250	11	3.10	6.250	9	5.68	1.250	2	4.03
9	S	-9.000	1	0.00						
	A	1.200	10	5.81	5.800	10	9.73	2.800	10	6.14
1974	F	1.000	9	2.74	6.500	10	5.08	1.125	8	4.88
10	S	1.167	22	7.20	9.333	15	13.28	5.417	23	15.12
	A	2.200	3	5.97	8.800	5	4.44	10.800	2	7.12
1973	F	0.000	2	6.96	1.000	3	9.08	1.000	2	1.29
10	S	4.571	14	5.97	11.353	17	7.86	6.000	11	7.28
	A	1.222	9	6.91	8.600	5	7.30	3.333	6	4.46
1974	F	2.000	4	2.16	8.667	3	4.04	8.000	2	1.41

TABLE 2
(continued)

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
11	S	1.077	10	5.88	3.077	15	6.43	2.077	11	9.42
	A	2.000	8	5.65	6.000	3	2.83	4.000	6	7.12
1973	F	-1.000	5	3.10	3.000	4	5.68	21.000	5	4.03
11	S	0.048	21	11.12	———			2.909	22	7.25
	A	5.500	2	2.12	8.000	1	0.00	4.000	2	1.41
1974	F	———			———			———		
12	S	9.000	3	11.83	9.000	3	14.48	18.000	2	7.56
	A	-2.333	13	3.67	4.833	1	0.00	8.333	3	5.78
1973	F	7.200	3	5.89	5.000	2	1.73	3.800	1	0.00
12	S	4.273	11	8.83	37.000	1	0.00	11.750	8	11.16
	A	5.000	6	5.29	29.000	1	0.00	14.625	8	11.86
1974	F	3.800	5	3.03	42.000	3	3.46	13.000	3	4.36
13	S	13.800	5	10.06	30.600	1	0.00	29.000	6	21.11
	A	31.000	12	5.70	33.000	8	5.00	65.000	9	9.37
1973	F	59.000	11	6.71	36.000	15	2.82	-2.000	13	2.68
13	S	———			———			———		
	A	———			———			———		
1974	F	———			———			———		
14	S	3.000	18	22.90	-9.000	14	5.77	-5.000	13	13.75
	A	4.333	5	18.15	12.000	4	13.11	10.667	10	2.31
1973	F	0.091	7	3.48	6.636	6	3.83	2.636	7	2.91
14	S	1.667	3	5.51	13.500	2	0.71	5.000	2	5.66
	A	4.700	10	8.64	11.300	10	6.46	17.083	12	12.62
1974	F	2.400	10	4.14	7.273	11	7.71	5.444	9	4.61
15	S	4.667	15	7.42	10.000	2	12.71	10.000	13	11.47
	A	4.800	12	9.76	16.800	5	9.26	7.000	10	6.04
1973	F	5.000	2	1.41	11.000	5	5.66	15.000	5	0.72
15	S	6.333	6	14.79	12.500	4	8.66	7.167	6	24.31
	A	-0.200	5	5.36	8.625	8	7.98	7.800	5	5.45
1974	F	3.500	8	4.99	2.500	6	5.92	6.750	8	6.45

TABLE 2
(continued)

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
16	S	1.571	13	8.52	8.714	18	10.80	3.857	13	11.91
	A	3.000	3	0.00	6.333	2	0.58	7.333	5	13.32
1973	F	-9.000	7	4.24	3.000	2	9.90	-2.000	4	12.73
16	S	-0.450	20	10.27	6.294	17	9.69	7.091	11	11.61
	A	1.500	6	4.93	7.111	9	5.30	18.077	13	16.42
1974	F	0.000	2	1.41	4.000	2	2.83	12.500	4	5.74
17	S	0.455	20	9.92	3.545	7	10.54	4.000	15	6.96
	A	4.000	3	6.96	15.000	5	0.38	8.000	6	4.01
1973	F	6.500	4	4.95	18.000	3	5.66	5.500	7	2.12
17	S	3.471	17	6.91	8.938	16	8.95	9.067	15	9.07
	A	2.000	4	9.31	5.500	4	10.25	4.333	3	1.15
1974	F	5.750	4	0.96	8.667	3	2.08	10.000	5	6.16
18	S	-1.077	8	9.87	25.615	5	10.07	8.231	5	11.08
	A	4.000	14	2.12	38.000	3	7.77	-1.000	16	3.54
1973	F	-1.000	6	7.19	52.000	1	2.81	8.000	1	0.00
18	S	1.533	15	8.00	20.000	1	0.00	12.100	10	11.50
	A	6.000	4	2.16	———			11.333	9	6.58
1974	F	1.750	4	2.36	———			12.500	2	16.26
19	S	-1.214	12	14.32	8.429	8	13.26	6.071	9	29.00
	A	-1.000	7	7.75	11.000	8	3.20	2.000	10	5.34
1973	F	5.667	9	2.08	16.000	5	17.78	10.000	5	7.94
19	S	-10.556	9	17.17	———			2.167	6	10.23
	A	-5.000	1	0.00	———			1.000	1	0.00
1974	F	———			———			———		
20	S	9.400	5	7.60	33.800	9	19.70	18.800	7	6.34
	A	2.000	7	2.12	51.000	7	20.71	17.000	14	0.71
1973	F	6.000	22	7.63	53.000	15	6.67	17.000	19	2.54
20	S	11.118	17	8.37	11.000	1	0.00	14.313	16	11.67
	A	13.167	6	11.92	———			18.571	7	12.30
1974	F	3.000	2	4.24	———			16.667	3	8.50

TABLE 2
(continued)

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
21	S	0.250	17	10.21	28.000	14	19.36	10.000	13	10.13
	A	2.500	12	2.12	29.500	12	41.72	18.500	9	0.71
1973	F	6.000	6	4.95	64.000	8	1.41	22.000	5	4.24
21	S	12.000	24	13.08	3.333	3	17.67	20.440	16	13.63
	A	15.750	4	13.43	———			16.667	9	7.30
1974	F	-1.000	2	9.90	———			15.000	3	3.61
22	S	-5.000	11	7.67	46.000	8	13.32	10.000	6	9.84
	A	-1.000	9	7.00	40.000	9	8.43	4.000	13	1.73
1973	F	8.000	6	7.47	78.000	9	2.14	6.000	7	6.41
22	S	1.636	11	8.88	———			-1.667	12	9.19
	A	2.000	5	9.77	-4.000	1	0.00	4.333	3	2.31
1974	F	———			———			———		
23	S	-0.286	5	7.95	12.000	4	6.24	12.571	9	11.57
	A	-3.000	4	2.12	9.000	6	2.42	10.000	11	16.97
1973	F	5.667	3	3.51	15.667	2	12.50	6.000	2	8.19
23	S	0.875	8	7.79	17.000	5	7.97	6.780	9	10.94
	A	5.714	7	6.52	5.444	9	7.28	10.889	9	11.13
1974	F	3.333	6	2.88	0.000	2	2.83	9.667	3	8.02
24	S	-1.625	26	6.93	1.625	17	5.66	7.250	15	7.85
	A	0.000	2	3.20	20.000	3	2.13	16.000	11	5.63
1973	F	2.750	3	5.06	12.250	9	4.65	8.000	3	2.16
24	S	2.167	12	8.52	7.000	11	7.31	0.833	6	21.76
	A	-2.857	7	4.18	17.400	5	9.10	8.846	13	8.13
1974	F	1.333	3	2.08	8.500	2	12.02	4.667	3	4.93
25	S	-5.000	14	11.31	0.000	4	18.38	-15.000	9	34.65
	A	0.000	2	3.20	-6.000	20	6.51	-2.000	15	6.66
1973	F	1.000	7	5.57	7.333	2	2.31	2.667	6	5.13
25	S	1.267	15	9.21	5.333	9	9.10	-0.333	12	9.77
	A	0.000	5	6.40	5.400	5	9.76	8.000	10	10.74
1974	F	2.333	3	3.51	11.000	3	6.08	1.000	1	0.00

TABLE 2
(continued)

Teacher No/Year	Level	Reading $\bar{x}$	Reading n	Reading s	Language $\bar{x}$	Language n	Language s	Arithmetic $\bar{x}$	Arithmetic n	Arithmetic s
26	S	-3.800	10	4.32	19.000	12	21.27	5.600	21	11.55
	A	13.000	19	4.10	11.000	18	6.41	8.000	13	3.28
1973	F	-1.500	6	4.95	5.500	5	2.12	3.000	4	1.56
26	S	-9.167	36	13.81	-1.485	33	11.49	9.080	25	10.12
	A	0.286	7	6.63	7.667	3	10.07	8.300	10	8.81
1974	F	———			3.333	3	3.51	13.000	4	10.98
27	S	9.733	15	8.03	9.667	16	8.20	9.000	18	7.57
	A	3.000	3	5.66	6.000	11	4.24	14.000	5	8.48
1973	F	-5.000	6	4.97	-3.000	5	2.13	0.000	3	4.14
27	S	1.625	8	15.90	13.125	8	16.00	0.227	22	10.17
	A	8.750	16	10.57	9.529	17	7.92	0.800	10	5.88
1974	F	9.375	8	12.13	-0.333	6	3.50	———		
28	S	3.556	9	3.68	6.111	10	7.11	15.333	8	8.19
	A	5.500	10	0.71	9.000	9	2.83	15.500	12	9.19
1973	F	4.000	2	6.77	7.000	2	3.18	9.000	1	0.00
28	S	———			———			———		
	A	———			———			———		
1974	F	———			———			———		
29	S	-9.000	9	8.82	-7.000	6	13.86	19.000	10	5.89
	A	-2.000	3	4.24	10.500	11	9.19	9.500	9	9.23
1973	F	2.000	1	0.00	-2.000	3	7.64	11.000	1	0.00
29	S	———			———			———		
	A	———			———			———		
1974	F	———			———			———		
	S									
	A									
1973	F									
	S									
	A									
1974	F									