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ABSTRACT

The goals of the study were to specify relevant implementation variables in the context of an implementation model, develop suitable measurement instruments, and test the relationship between the implementation variables and student achievement of program goals. Subjects of the study were members of thirty kindergarten classes in the Kindergarten Extended Day (KED) Program of the St. Louis Public School System, designed to provide supplementary instruction to students identified as deficient in basic skill areas. Eight independent variables characterizing facets of implementation were observed during classroom operation of a language and thinking (LAT) program: (1) time on task, (2) teacher preparedness, (3) correct following of procedures, (4) proper use of materials; (5) teacher effectiveness in maintaining student attentiveness and elicitation of student responses, (6) student interest in the lesson, (7) extensity of coverage, and (8) preparation time for lessons. The dependent variables of the study were student achievements in five of the ten LAT packages (Colors, Shapes, Sizes, Directions, and Blends) as measured by the LAT Criterion Mastery Tests. Statistical analysis of data resulting from observation ratings and mastery tests shows that teachers did vary in their implementation of the LAT program, but that the variation in implementation was not related to class achievement. Most of the variance in achievement levels was due to variance in initial ability. An extensive reference list and three appendixes conclude the report. (MB)

TEACHER VARIATION IN PROGRAM IMPLEMENTATION AND STUDENT ACHIEVEMENT OF PROGRAM OBJECTIVES

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During the recent past, the emergence of curricula and intervention programs developed by federally funded laboratories and R & D centers has resulted in a wide range of programs and materials designed to foster student learning in diverse areas. Simultaneously, there has also been an increased focus of attention on the conduct of educational program evaluations. In many program evaluations, the focus of concern is on the determination of the extent to which specific student outcomes purported to be effected by the installation and use of particular programs and materials indeed occur.

When the primary focus of evaluation is concerned with assessment of student outcomes relative to program objectives, the interpretations of outcome data appear to be relatively simple. That is, the evaluator can state that the program components were installed in a certain number of classrooms, the teachers were provided necessary training prior to usage of the program components, and students did or did not achieve at a level high enough to warrant continued usage. When provided with this type of information, one is tempted to draw conclusions about the merit of the program. This type of evaluation strategy, however, may lead one to draw erroneous conclusions since one assumes stability of treatment with negligible variation between teachers in their adherance to specified guidelines for program usage.

Few, if any, curriculum programs are totally prescriptive. Teacher variation in program implementation is likely to occur.

Specifying materials and usage procedures in either training components or teachers' guides does not guarantee that teachers implement the program in the manner intended by the program developer.

The fragile status of new programs has been amply documented. Although studies of implementation have not generally focused on programs with well defined objectives and procedures, accompanying training programs, built-in record keeping systems, monitoring, and other self-renewing feedback components; the available literature does make it clear that one is naive to assume effective implementation and use. The literature on diffusion and implementation has not generally been concerned with the effectiveness or worth of a program but about whether and how new programs are used in schools. The literature indicates, however, that new programs are generally not used as the program sponsor or developer would like them to be used and often are not implemented at all (Gross, Giaquinta, and Burnstein, 1971).

A review of the literature on implementation and diffusion reveals some of the problems involved in the effective implementation of educational innovations.

a) Values and goals as articulated by users often have little direct influence on innovations (Goodland, et. al., 1970; Smith and Keith, 1971).

b) The process of role change required from users has been misunderstood and neglected. Often innovations require unlearning and relearning and create uncertainty and concern about competencies to perform these new roles (Joyce, 1969; Pellegrin, 1973; Wachaster, 1973; Jones, 1973).

c) The users of innovations seem to be relatively passive adopters of recent innovations. Too often, primacy is given to innovations rather than to the user's capacity to innovate (Charters, et. al., 1973; Miles, 1964).

d) In many cases innovations are not implemented by the user as the developer intended or there is considerable variation in implementation (Connelly, 1972; Mahon, 1972; Fullan, 1972; Gross, et. al., 1971; MacKinzie, 1970; Herron, 1971; Gallagher, 1966; Rosenshine, 1970; Solomon, et. al., 1972; Hess, 1974).

Educational innovations rarely interact directly with students; interaction is mediated for better or worse by the teacher or school administrator and, in many instances, teachers are highly independent agents with respect to externally developed curricula.

Surely one necessary element for effective change in our schools is good curricula, curricula that has been carefully tested, revised, and is usable. Programs with specific objectives and identifiable outcomes are certainly needed, since not many studies have shown that general approaches and ideal conceptions will not, by themselves, bring change to schools. Curricula must be properly used, and it is the use patterns and varieties of implementation strategies that must be studied to determine how to best use the products that have been carefully developed at considerable expense.

There is a desperate need for information on variables related to implementation, both positive and negative. These variables may be intrinsic to a specific curriculum program and/or variables of a more general conception relating to organizational structures, teacher support facilities, and, perhaps, teacher personality or

cognitive style and structure variables. In the absence of methods and measures for characterizing the degree of program implementation, it is difficult to provide a realistic appraisal of the efficacy of a program based soley on student outcome data (Stake, 1967, p. 5).

By using appropriate implementation measures, however, the evaluator can systematically look at a program as it is installed in various sites and examine the degree to which implementation variables are present and are related to any teacher training components (if present) and/or student attainment of program objectives. Such information has relevance not only for summative evaluations and for comparative analyses of program effectiveness, but also for formative evaluations which provide data to program developers for revisions of program components needing additional emphasis.

Obviously, the most economical and, perhaps, easiest way to assess program implementation would be to make use of existing instruments. For example, if a program has as one of its components the prescription that the teacher teach indirectly, then the interaction analysis system of Flanders (1968, pp. 257-285) would be an appropriate measure of this implementation component. Or, if the program prescribes that teachers ask many questions that require of students divergent thinking responses, the interaction system of Gallagher and Aschner (1968, pp. 219-233) would seem appropriate.

Some curriculum programs, however, do not have a specification of the type of teacher-pupil interaction as a process variable. In such situations, new instrumentation must be developed that is

program specific to measure the degree of implementation of that program's components. A program may provide materials, transparencies, student workbooks and other manipulatives with specific suggestions concerning the teacher's use of these components. In such instances, the determination of the degree of implementation would focus on teacher usage variables and the relation between variations in usage and student achievement. In addition to actual "usage" variables, certain "teacher variables" may be considered as mediating usage (i.e., teacher affect towards the program, amount of teacher preparation for lessons, etc.) and could be incorporated in implementation models to more fully characterize the degree of implementation.

The goals of the present study were to specify relevant implementation variables in the context of an implementation model, develop suitable measures, and test the relationship between the implementation variables and student achievement.

METHOD

During the 1974-75 school year, 108 kindergarten classes in the St. Louis Public School System were involved in the Kindergarten Extended Day (KED) Program. The Kindergarten Extended Day program is a Title I program designed to provide supplementary instruction to identified Title I eligible students deficient in basic skills areas. The KED program extended the regular half-day kindergarten session into a full-day session using supplementary curriculum programs and materials to provide remedial instruction.

One of the critical components of the KED curriculum was the Language and Thinking Program developed by CEMREL, Inc. and

published by Follett Publishing Company. Language and Thinking is an instructional program which consists of a series of activities packages for the development of essential skills in language and basic concepts. The complete series of packages is planned to provide instructional activities for preschool through primary grades.

The general goals of the LAT program are:

- to develop visual and auditory awareness and discrimination;
- to develop the child's use of the language of the classroom;
- to develop verbal fluency and increase vocabulary size;
- to develop ordering, association, classification, and sequencing skills, and
- to provide practice in doing critical thinking skills, drawing relationships, making inferences, making predictions, analyzing problem situations, synthesizing ideas, recognizing incongruities and analogies, making hypotheses and evaluating situations, events, and actions.

The program is comprised of one hundred and twenty-six instructional objectives contained in nine activity packages. The Language and Thinking packages contain a teacher's guide, student workbooks, manipulatives, audio tapes, transparencies, etc., which are used by the teacher and/or students in covering daily lesson content. Mastery Learning Criterion Tests are available for each package to measure the extent to which the testable objectives of a particular package are being achieved by the students.

SUBJECTS

All students from designated Title I areas, upon entering kindergarten, are given the Comprehensive Test of Basic Skills (CTBS, Level A, Form S, CTB/McGraw-Hill) to determine if they are eligible to participate in Title I programs. Students scoring at, or below, the fifth stanine for the total of the pre-reading subtests are eligible for Title I programs. All students particip-

ating in the KED program met Title I guidelines for eligibility i.e., scored at or below the fifth stanine for the total of the pre-reading subtests.

Title I guidelines for the KED program further specified that each KED class could have no more than fifteen students.

INSTRUMENTATION

MEASURES OF STUDENT ACHIEVEMENT

The dependent variables in this study were student achievement of some of the LAT program objectives as measured by several of the LAT Criterion Mastery Tests. It was anticipated that the KED classes would cover at least five of the ten LAT packages during the 1974-75 school year. These packages were Colors, Shapes, Sizes, Directions, and Blends. The Colors, Shapes, and Sizes packages are covered by a single criterion test while the Directions and Blends packages each have a criterion test.

The LAT criterion tests are keyed to the measurable objectives of the LAT program and, as such, have adequate content validity. Reliability coefficients (Kuder-Richardson Formula 20) for each of the subtests of Colors-Shapes-Sizes and Blends tests[1] are as follows:

[1]These coefficients were obtained from the test results of the 1972-73 pilot study of the LAT program in the St. Louis Public School System. Due to extraneous circumstances, the Directions Test was not administered and reliability data is not available.

Colors - Shapes - Sizes		
Subtest	1.	.43
	2.	.57
	3.	.49
	4.	.80
	5.	.72
	6.	.55
	7.	.74
	8.	.62
	9.	.69
	10.	.60

(N=294)

Blends		
Subtest	1.	.68
	2.	.23
	3.	.54
	4.	.67
	5.	.52
	6.	.41
	7 & 8.	.53

(N=297)

MEASURES OF DEGREE OF IMPLEMENTATION

The primary independent variables in the study were eight variables characterizing facets of implementation of the LAT program. A sample of the KED classes were periodically visited by an observer who rated the teacher on her implementation of the LAT program using an observation form containing the following scales:

1. Time on Task - The observer recorded the clock time (in minutes) spent on the LAT lesson
2. Teacher Preparedness (for LAT lesson) - The teacher was rated on a five point scale measuring the extent to which the teacher was prepared to teach the LAT lesson.
3. Correct Following of Procedures - This scale measures the extent to which the teacher followed the procedures for a particular lesson as specified in the teacher's guide.
4. Proper Use of LAT Materials - This scale measures whether or not a teacher used particular materials (i.e., manipulatives, transparencies, etc.) for a lesson as indicated in the teacher's guide and whether or not the particular materials were used according to recommended procedures as specified in the teacher's guide.
5. Teacher Effectiveness in Maintaining Student Attention and Elicitation of Student Responses - The teacher was rated on a five point scale characterizing the extent to which the teacher was able to maintain a high level of student attention and response during the lesson.

6. Student Interest (in the lesson) - The teacher was rated on a five point scale characterizing the extent to which students appeared interested in a lesson, enjoyed the activities and volunteered to participate.
7. Extensity of Coverage (of lesson objectives) - This scale measures the extent to which the teacher actually covered the several objectives that should have been covered for a particular lesson as specified in the teacher's guide.
8. Reported Preparation Time for Lessons - Immediately after each classroom observation, the observer asked the teacher to indicate approximately how much time the teacher devoted to preparation for LAT lessons.

A classroom observation form was completed for each observation. A copy of this instrument and instructions for its use are presented in Appendix I.

Only six of the eight variables are strictly implementation variables. Teacher Effectiveness and Student Interest are variables of a more general conception that could mediate student achievement in virtually any curricula area. It is very likely that an "effective" teacher would generate a high level of student interest which would certainly effect student achievement even in the teacher and students had no packaged curriculum materials.

In addition to the data obtained on implementation, data on one other independent variable was collected in order to disentangle the effects of students' initial ability level from the effects of implementation on the measures of student achievement. The most readily available measure of student's initial ability was the total Pre-Reading score yielded from the Comprehensive Test of Basic Skills. Although all students in the KED program were at, or below, the fifth stanine, there is considerable room for variation within this eligibility criteria.

PROCEDURES

Teacher Inservice

Immediately prior to the beginning of the 1974-75 school year, all participating KED teachers and aides were provided inservice training in the use of the LAT, DUSO, and BRL components of the KED curriculum program. Teachers were also given instruction in the administration of the Comprehensive Test of Basic Skills. During the latter part of November, 1974, KED teachers were provided further inservice training in the use and administration of the LAT Criterion Mastery Tests.

Student Testing and Selection

During the first part of September, 1974, all kindergarten students in designated Title I areas were administered the Comprehensive Test of Basic Skills. Students meeting the Title I eligibility criteria were eligible to participate in the KED program. Sufficient funds were not available to establish enough KED classes to accomodate all of the eligible students. Within particular schools, the lowest scoring students were selected first for participation. When existing classes were filled, remaining students were placed on a waiting list and could enter the program when vacancies occurred. A total of 108 KED classes were thus formed, each containing 15 students. Students in the KED classes attended their regular kindergarten class (with the regular kindergarten teacher) for one-half day receiving instruction according to the Kindergarten Curriculum Guide. For the other half-day session, the KED students received instruction using the LAT, DUSO, and BRL programs presented by a Title I

teacher and aide.

The administration of the CTBS, identification and selection of students, and formation of the KED classes was not completed until the middle part of October, 1974.

Sampling of Classes and Scheduling of Observations

Although 108 KED classes were formed, a sample of only 30 classes was obtained for purposes of the study. Classes were not selected at random, but were selected from schools representing each of the four subdistricts of the St. Louis Public Schools having large numbers of Title I students. Classes were also selected from schools that were relatively close to each other to facilitate quicker travel between schools by the classroom observers. All 30 classes in the sample used the KED program during the afternoon session.

Each KED teacher was asked to indicate at which time during the day she would be using the LAT component. Teachers were given free choice in selecting the time period but were asked to maintain this schedule throughout the school year. Most of the 30 teachers selected for the study did maintain their schedule.

Fortunately, many of the 30 teachers in the sample chose different time periods to use the LAt program. This facilitated the scheduling of observations which was developed such that each observer could, under ideal circumstances, observe three classes in one afternoon. With two observers, each of the 30 classes could thus be observed during one week (5 days).

Training of Classroom Observers

In addition to the investigator, two Evaluating Assistants of the the St. Louis Public Schools visited classrooms and rated teachers using the classroom observation rating scale. The majority of the classroom observations were conducted by the Evaluation Assistants. The observers were trained in the use and scoring of the observation rating scale.

The observers were instructed not to complete an observation rating scale form in the presence of the teacher but to complete the form immediately after leaving the classroom. Observers were told to briefly note information germane to the scales during the observation of the class but to attempt to write these notes in an outline format so as to not arouse the suspicion of the teacher.

Observers were also told to disguise the purpose of the visits by informing the teacher that the purpose was to merely obtain feedback from the teacher concerning the usability of the KED components and to determine whether or not students appeared to enjoy the materials. Teachers were never told when their classrooms would be visited.

Prior to the actual collection of the implementation data, the investigator accompanied one observer (#1) to several classes to monitor the use of the observation form. (The other observer could not attend). Initial problems concerning the use of the instrument were worked out and observer #1 subsequently monitered the use of the instrument by observer #2 during several joint observations.

Classroom Observations

Classroom observations began soon after the KED classes were

formed. Initially, observations were scheduled to enable each observer to visit each of the 30 classes. Problems were encountered during the latter part of October when classes were preparing decorations for Halloween to the exclusion of using the KED curriculum components. Also, the observers could not always devote full time to classroom observations due to other responsibilities. The initial scheduling of visits was abandoned and a new schedule was developed in which each observer was responsible for a given set of classes. The investigator served as a "roving back up" and attempted to cover each of the other observers' classes to obtain as many observations as possible.

No data was collected during the week of the Thanksgiving holiday or during the week beginning the Christmas holiday since students were busy with classroom decorations. No data was collected if a teacher was absent when the observer visited a class and a substitute teacher or the teacher's aide was using the KED components.

Circumstances were never ideal and fewer observations were conducted than initially expected. Given the unexpected contingencies of normal school operations, e.g., field trips, guest speakers, teacher absences, school events held in the auditorium, room decorating, etc., the expectation of thirty classroom observations per week was unrealistic. Another problem encountered was the amount of time required of the observer at each site. Many times teachers and principals would have questions about using the cirriculum components, supplies not delivered, and general school system gossip. In order to maintain good relationships with the teachers and principals, observers often had to spend

some additional time at each school. These types of situations often kept the observers from their next scheduled classroom visit.

In order to obtain reliability data on the implementation ratings, the observers would periodically visit classrooms together and the data from these joint visits was used to determine inter-rater reliability. In order to obtain a maximum number of visits, the data for reliability had to be gathered as efficiently as possible. Consequently inter-rater reliability was determined between the investigator and observer #1 and between observer 1 and obser 2. No inter-rater reliability was established between the investigator and observer 2.

RESULTS AND DISCUSSION

Some Preliminary Considerations

Of critical importance to the study is the validity and reliability of the measures of the independent variables i.e,, the implementation rating scales. Prior to, and throughout the study, the measures of implementation can claim only face validity. The question of predictive validity will be answered in the subsequent analyses of the data.

Inter-rater reliability of the measures was determined by correlating the ratings yielded from several joint observations. These results are summarized in Table 1. Joint observations occured between observers 1 and 2 and between observers 2 and 3. The data represents joint observations of different teachers at different times during the school year. Thus, joint observations were obtained during the use of several LAT packages but the data was combined to obtain an overall index of reliability. Percent-

ages of total agreement between observers on each of the scales is included since it is possible to have 100% agreement between observers on the ratings for a given scale and yet obtain a correlation coefficient of zero (actually r is undefined) if there is no variation between the teachers on a given scale rating. Inter-rater reliability coefficients, therefore, must be examined in the light of the extent to which raters are in agreement on scale ratings. The data presented in Table 1 indicates that the inter-rater reliability of the implementation measures, although less than optimal, does not preclude further analyses of the data.

An additional analysis of the data yielded from the joint observations was performed to determine whether or not any observers were systematically more lenient or rigorous in their ratings of teachers. A t-test (two-tailed) was performed for each of the implementation variables using the mean ratings yielded from the joint observations of observers 1 and 2, and observers 2 and 3. None of the t statistics approached significance indicating that there were no significant differences between observers.

TABLE 1

INTER-RATER RELIABILITY COEFFICIENT AND PERCENTAGES OF TOTAL AGREEMENT ON RATINGS OR THE MEASURE OF IMPLEMENTATION

	Observers 1 and 2 Joint Observations N = 4		Observers 2 and 3 Joint Observation N = 8	
Variable	r	Percent Agreement	r	Percent Agreement
Reported Preparation Time	.57	75	.11	62
Teacher Preparation	.87	75	.57	75
Time on Task	.74	25	.67	62
Following Procedures	.98	50	.87	50
Use of Materials	1.00	100	.33	62
Teacher Effectiveness	.96	75	.78	75
Student Interest	.96	75	.92	75
Extensity of Coverage	1.00	100	.64	75

Colors-Shapes-Sizes Criterion Test.

Although thirty teachers and classes were included in the study, data from only twenty-three classes (254 students) was available for the analysis of the first criterion test. For the seven remaining classes, the teachers either had failed to administer the tests, the test results were lost in the mail, or implementation data was not available.

The Colors-Shapes-Sizes Criterion Test was administered during the middle part of January, 1975, at the end of the first semester.

Students from any of the sample classes who had no CTBS Pre-Reading scores were deleted from the sample prior to the data analysis.

All data was analyzed using Version 5 of the Statistical Package for the Social Sciences. A one way analysis of variance was performed between classes on each of the variables relevant to the Colors-Shapes-Sizes package. In addition to the Colors-Shapes-Sizes Criterion Test scores, CTBS Pre-Reading data was included as was data on each of the implementation variables. These results were presented in Table 2 along with the means for each class on all variables.

The results shown in Table 2 reveal significant differences between classes on the Colors-Shapes-Sizes Test, CTBS Pre-Reading scores, and on each of the implementation variables except Reported Preparation (RPREP). The between class differences on the implementation variables lend additional support for the reliability of these measures since, were they unreliable, the scores yielded from the measures would be random and there would be no significant differences between classes.

TABLE 2

Class Means and Summary Statistics of the ANOVAS for
the Implementation Variables and the Colors-Shapes-Sizes Criterion Test.

Class	N	CSS $\bar{X}$	PRE-RDNG $\bar{X}$	N OBSER.	RPREP $\bar{X}$	TPREP $\bar{X}$	TOT $\bar{X}$	FPRO $\bar{X}$	UMAT $\bar{X}$	TEFF $\bar{X}$	SINT $\bar{X}$	XCOV $\bar{X}$
1	13	60.8	41.2	3	18.33	4.67	21.67	.83	.93	5.00	5.00	.88
2	11	57.4	29.5	2	20.00	3.00	21.50	.80	.50	4.00	4.50	1.00
3	10	55.7	40.0	1	15.00	3.00	15.00	.28	1.00	3.00	3.00	.66
4	10	54.1	35.5	3	16.67	3.67	21.67	.73	.47	4.67	5.00	.83
5	11	54.0	49.7	1	20.00	5.00	12.00	----	1.00	3.00	3.00	.50
6	13	53.8	30.8	2	30.00	4.50	22.50	1.00	1.00	4.00	4.50	1.00
7	12	53.7	45.1	3	25.00	5.00	18.00	.94	1.00	5.00	5.00	1.00
8	7	52.7	36.3	3	18.33	4.67	30.00	1.00	1.00	5.00	4.67	1.00
9	12	52.0	34.3	2	20.00	5.00	20.50	.90	.91	4.50	4.00	1.00
10	12	51.9	43.7	2	22.50	2.00	15.50	.32	1.00	3.00	1.50	.33
11	15	50.8	46.7	2	15.00	4.50	17.50	.83	.90	4.50	5.00	.90
12	14	47.9	30.7	1	15.00	1.00	35.00	.00	.00	1.00	1.00	.00
13	13	46.8	41.0	2	12.50	5.00	17.50	1.00	1.00	4.50	4.50	1.00
14	5	46.6	43.4	2	12.50	2.50	22.50	.33	.50	2.00	2.50	.50
15	8	45.6	39.0	3	15.00	5.00	16.67	1.00	1.00	4.67	4.67	1.00
16	11	45.4	37.9	2	27.50	4.00	30.00	.75	1.00	4.00	4.00	.75
17	10	44.9	14.2	2	50.00	3.67	38.50	.91	1.00	4.00	4.50	.66
18	8	44.7	31.5	2	20.00	4.00	22.50	.74	.75	4.00	4.00	.66
19	10	42.4	34.1	2	15.00	1.00	22.00	.00	.50	1.00	1.00	.50
20	10	42.4	51.0	3	20.00	3.67	19.00	.74	.78	4.00	4.33	.89
21	9	40.1	13.1	3	30.00	3.33	20.00	.94	1.00	3.67	4.00	1.00
22	14	38.3	29.6	2	20.00	2.00	18.50	.25	.37	4.00	4.00	.58
23	14	36.7	30.8	2	22.50	5.00	32.50	1.00	1.00	5.00	5.00	.75
df		22/229	22/229		22/27	22/27	22/27	21/26	22/25	22/27	22/27	22/26
F		13.36***	7.85***		1.60	3.99***	2.64**	4.27**	2.43*	3.82**	7.12****	2.28*
Bartlett-Box F		5.32*	5.30*	Cochran's C		.26	.19	.25	.50*	.13	.22	.43*

*p .05
**p .001
***p .0001
****p .00001

The application of Bartlett's (1937) and Cochran's (1951) tests for homogeniety of variance revealed heterogenous variances for the Colors-Shapes-Sizes test, CTBS Pre-Reading scores, Reported Preparation, Use of Materials, and Extensity of Coverage. Both of these tests for homogeniety are also sensitive to the assumption of normality i.e., that the observations in ANOVA are sampled from normal populations (Winer, 1962). Violation of the assumption of normality, however, is of almost no importance and the effects of non-normality on the nominal level of significance of the F-test are extremely slight (Glass and Stanley, 1970).

Heterogeneous variances effect the level of significance such that the actual probability of a Type I error may be larger or smaller than the specified nominal probability (Box, 1854; Box and Anderson, 1955; Scheffe, 1959). When the n's in each cell or class are equal, however, the actual probability of a Type I error is very close to the nominal probability (Scheffe, 1959; Winer, 1962; Glass and Stanley, 1970). The twenty-three classes comprising the sample, however, differed considerably in the numbers of students contained in each class. One class had as few as five students and other classes had fourteen and fifteen students. In summarizing the findings of studies concerned with the effects of heterogeneous variances, Glass and Stanley (1970) report:

1. When the sample sizes are equal, the effect of heterogeneous variance on the level of significance of the F-test is negligible.
2. When the sample sizes and variances are unequal and fewer persons are sampled from the populations with larger variances, the probability of a type-I error is greater than α.

3. When the sample sizes and variances are unequal and greater numbers of persons are sampled from the populations with larger variances, the probability of the type-I error is less than α (p. 372), (see also, Glass, Peckham and Sanders, 1972).

Regardless of the relationship between sample size and variance, the effects of heterogeniety on the alpha (α) level of F-test tend to be slight, especially when the number of groups or samples is relatively large (Glass, et.al., 1972). Given the high levels of significance of the F ratios yielded from the ANOVA's, it is doubtful that heterogeneous variances would compromise the results except for Use of Materials and Extensity of Coverage. Since the actual alpha (α) level of the F-ratio's yielded from the ANOVA's for these two variables is $p<.02$, the significance of the between class differences is not critically affected.

Regression Analysis of the Implementation Data

Within the general model two sets of variables are operating. The CTBS Pre-Reading scores represent an initial ability variable operating at the individual student level. The implementation variables, on the other hand, operate at the teacher or class level. In order to use both sets of variables, a two step analysis was required. The first step required a regression analysis of the CTBS Pre-Reading scores on the criterion test scores. Within each class, the mean of the student

residuals was obtained and this mean residual, representing criterion test variance not accounted for by initial level of ability, was used as the dependent variable for the subsequent regression analysis using the implementation variables.

The means, standard deviations and correlations of all variables used in the regression analysis of the Colors-Shapes-Sizes test are presented in Table 3.

TABLE 3

Means, Standard Deviations and Correlations of All Variables Used in the Regression Analysis for the Colors-Shapes-Sizes Residuals (N=23)

Variable	Symbol	CSSR	RPREP	TPREP	TOT	FPRO	UMAT	TEFF	SINT	XCOV
CSS Residual	CSSR									
Reported Preparation	RPREP	-.09								
Teacher Preparation	TPREP	.22	.12							
Time on Task	TOT	-.14	.47	-.01						
Following Procedures	FPRO	.14	.34	.92	.04					
Use of Materials	UMAT	.10	.35	.73	-.20	.69				
Teacher Effectiveness	TEFF	.19	.19	.81	-.06	.86	.57			
Student Interest	SINT	.15	.19	.52	-.18	.60	.33	.65		
Extensity of Coverage	XCOV	.26	.03	.45	-.15	.49	.31	.47	-.24	
Mean		.23	20.90	3.70	22.19	.69	.81	3.81	3.50	.92
S.D.		9.07	8.06	1.29	6.69	.33	.28	1.17	1.56	.55

Most of the implementation variables show low, positive correlations with the CSS residuals with the exception of Reported Preparation and Time on Task. The implementation variables tend to show moderate to high positive intercorrelations with the exception of Reported Preparation and Time on Task. Given the high degree of interrelationship among most of the implementation variables, regression analyses of these variables on the CSS residuals would tend to yield an artificially high multiple correlation. A factor analysis was performed (principal components, varimax rotated) on the implementation variables to obtain relatively independent sets of implementation variables i.e., factors.

The varimax rotated factors matrix for the implementation variables is presented in Table 4. Three major factors were

yielded from the analysis.[2] The variables loading on Factor 1 were Teacher Preparation, Following Procedures, Use of Materials and Student Interest. The factor appears to reflect the teachers' personal involvement and attention to detail in the implementation process. Factor 2 contains the variable Extensity of Coverage of the objectives. Factor 3 contains the variables Reported Preparation and Time on Task and appears to reflect the teachers' time involvement in implementations. After conversion to standard scores, the relevant variables were combined yielding the three variables used in the regression analysis.[3]

TABLE 4

Varimax Rotated Factor Matrix of the Omplementation Variables for the Colors-Shapes-Sizes Criterion Test

Variable	Factor 1 (Personal Involvement)	Factor 2 (Coverage)	Factor 3 (Time Involvement)
Reported Preparation	.24	-.11	.79
Teacher Preparation	.74	.14	-.08
Time on Task	-.13	.17	.66
Following Procedures	.97	.11	.18
Use of Materials	.69	.06	.06
Teacher Effectiveness	.89	.06	.02
Student Interest	.67	-.59	-.03
Extensity of Coverage	.39	.85	.07

The results of the regression analysis (hierarchical inclusion) are presented in Table 5. The multiple correlation was not significantly different from zero ($R = .35, F_{3,19} = .88$) indicating that the factors of implementation had no relationship to the class mean residuals of the Colors-Shapes-Sizes test.

[2]Due to matrix singularity an inverted matrix could not be obtained. Consequently the initial estimates of the communalities were obtained fror the maximum off-diagonal elements of the correlation matrix.

[3]Matrix singularity precluded the derivation of actual factor scores.

TABLE 5

Regression Analysis of the Colors-Shapes-Sizes Mean Residuals Using the Implementation Factors Derived from the Factor Analysis

Variable	df	F	R^2(diff)x100	Beta
Extensity of Coverage	1/21	1.45	6.05	-.25
Personal Involvement	2/20	1.09	4.84	.21
Time Involvement	3/19	.28	1.28	-.11
R_2= .35	3/19	.88		
R^2= .12				
Constant = -.34				

Directions Criterion Test

Of the original thirty teachers and classes, data from only fourteen classes (157 students) were available for the ANOVA and correlation analysis for the second criterion test. Many classes are not represented due to a lack of implementation data resulting from teachers' completion of the Directions package sooner than anticipated. Although the LAT program guidelines suggest use of the Directions package for four to five weeks, many teachers had completed the package in two to three weeks. A few teachers, however, spent as much as five to six weeks completing the lessons.

The class means and summary statistics for the univariate analyses of variance for the Directions and CTBS Pre-Reading Tests and each of the implementation variables are presented in Table 6. Significant differences between classes were found for the Directions Criterion Test, CTBS Pre-Reading subtest, and all of the implementation variables except Reported Preparation, and Use of Materials. The implementation data was obtained from a total of twenty-one productive observations. The mean number of productive observations per teacher was 1.5 (S.D. = .51).

TABLE 6

Class Means and Summary Statistics of the ANOVAS for the Implementation Variables and the Directions Criterion Test

CLASS	N	DIR $\bar{X}$	PRERDNG $\bar{X}$	N OBSER.	RPREP $\bar{X}$	TPREP $\bar{X}$	TOT $\bar{X}$	FPRO $\bar{X}$	UMAT $\bar{X}$	TEFF $\bar{X}$	SINT $\bar{X}$	XCOV $\bar{X}$
1	11	41.0	49.7	2	15.0	3.0	20.0	.64	.66	4.00	5.00	.83
2	13	39.0	30.8	1	----	3.0	15.0	.75	----	4.00	4.00	1.00
3	13	37.4	41.2	2	10.0	5.0	23.0	.92	1.00	5.00	5.00	1.00
4	9	36.6	50.8	2	20.0	5.0	20.0	.90	.83	5.00	5.00	1.00
5	12	36.3	43.7	2	17.5	4.0	35.0	.71	.66	5.00	5.00	1.00
6	11	36.0	45.3	2	40.0	5.0	22.5	.84	1.00	5.00	5.00	1.00
7	4	36.0	37.3	2	17.5	5.0	25.0	.88	1.00	4.50	4.50	1.00
8	9	34.7	35.9	1	15.0	3.0	15.0	.00	----	4.00	5.00	.33
9	10	34.4	36.0	1	15.0	3.0	25.0	.60	----	3.00	3.00	1.00
10	12	33.8	34.2	1	10.0	5.0	21.0	----	----	5.00	4.00	----
11	12	33.3	41.2	1	15.0	5.0	20.0	1.00	1.00	5.00	5.00	1.00
12	14	30.5	29.6	1	10.0	3.0	13.0	.42	1.00	3.00	3.00	.50
13	10	30.2	18.6	2	15.0	5.0	22.5	1.00	.83	5.00	5.00	1.00
14	7	29.4	39.9	1	20.0	5.0	20.0	1.00	----	4.00	5.00	1.00
df		13/133	13/133		12/7	13/7	13/7	12/7	8/7	13/7	13/7	12/7
F		5.38****	5.05****		.92	4.49*	3.71*	9.12**	2.41	9.41**	8.79**	6.48**
Bartlett Box F		2.67**	6.63***	Cochrans C		1.00**	.60**	.37		1.00**	1.00**	1.00**

*p .05
**p .001
***p .0001
****p .00001

Tests for homogeniety revealed heterogeneous variances for all of the variables except Following Procedures. Given the relatively high levels of significance of the F ratios, it is unlikely that heterogeniety would adversly affect the results except perhaps, for Teacher Preparation and Time on Task. The actual alpha levels of the F ratios for these two variables are $p<.03$ and $p<.04$ respectively. Overall, the ANOVA's for the implementation variables again lend support for the reliability of the measures.

As with the Colors-Shapes-Sizes Test, a regression of the Directions scores on the CTBS Pre-Reading scores was performed to yield residuals. Class mean residuals were computed to be used as the dependent variable in the regression analysis.

The means, standard deviations and correlations of all variables used in the regression analysis for the Directions residuals are presented in Table 7.

TABLE 7

Means, Standard Deviations and Correlations of All Variables Used in the Regression Analysis for the Directions Residuals (N=14)

Variable	Symbol	DIR	RPREP	TPREP	TOT	FPRO	UMAT	TEFF	SINT	XCOV
Dir. Residual	DIR									
Reported Preparation	RPREP	-.03								
Teacher Preparation	TPREP	-.35	.28							
Time on Task	TOT	.08	.17	.33						
Following Procedures	FPRO	-.12	.22	.78	.36					
Use of Materials	UMAT	-.45	.11	.44	-.46	.20				
Teacher Effectiveness	TEFF	.10	.26	.78	.42	.57	-.07			
Student Interest	SINT	.10	.35	.52	.26	.33	-.36	.74		
Extensity of Coverage	XCOV	.12	.30	.59	.57	.89	-.09	.49	.21	
Mean		-.12	16.92	4.21	21.21	.74	.89	4.39	4.54	.90
S.D.		2.91	7.72	.97	5.38	.28	.15	.74	.75	.22

Table 7 reveals that most of the implementation variables show moderately high, positive intercorrelations with the exception of Use of Materials which has negative correlations with Time on Task, Teacher Effectiveness, Student Interest, and Extensity of Coverage. None of the correlations between the implementation variables and the class mean residuals are very high and several are negative.

Problems of multicolinearity precluded a meaningful regression analysis and again required a factor analysis of the implementation variables. Two factors were yielded from the analysis and the variables and factor loadings are presented in Table 8.[4]

Table 8

Varimax Rotated Factor Matrix of the Implementation Variables for the Directions Criterion Test

Variable	Factor 1 (Personal Involvement)	Factor 2 (Attention to Detail)	Factor 3 (Use of Materials)
Reported Preparation	.30	.18	.03
Teacher Preparation	.72	.54	.42
Time on Task	.22	.51	-.46
Following Procedures	.37	.82	.20
Use of Materials	-.03	.04	.93
Teacher Effectiveness	.82	.35	-.06
Student Interest	.88	.01	-.29
Extensity of Coverage	.18	.98	-.11

The variables loading on Factor 1 were Reported Preparation, Teacher Preparation, Teacher Effectiveness, and Student Interest. The factor appears to reflect the teachers' overall personal involvement. Factor 2 contains the variables Time on Task, Following Procedures and Extensity of Coverage and appears to reflect the teachers' attention to detail. Factor 3 contains the variable Use of Materials.

[4]Due to matrix singularity an inverted matrix could not be obtained. Consequently the initial estimates of the communalities were obtained from the maximum off-diagonal elements of the correlation matrix.

After conversion to standard scores, the relevant variables were combined[5] yielding the three variables used in the regression analysis.

The results of the regression analysis (hierarchical inclusion) are presented in Table 9. The multiple correlation was not significantly different from zero ($R=.35, F_{2,11}=.77$) indicating that the combined implementation variables had no relationship to the class mean residuals of the Directions Test.[6]

TABLE 9

Regression Analysis of the Directions Mean Residuals Using the Implementation Factors Derived From the Factor Analysis

Variable	df	F	R^2(diff)x100	Beta
Personal Involvement	1/12	1.57	11.58	.34
Use of Materials	2/11	.09	.73	-.08
R= .35	2/11	.77		
R^2= .12				
Constant = -.14				

Blends Criterion Test

Data from only thirteen classes (121 students) was available for the ANOVA and regression analysis of the Blends Criterion Test. Six teachers failed to submit the Blends test scores and no implementation data was available for five classes. The implementation data that is available is based on a total of twenty-three productive observations. The mean number of productive observations per teacher was 1.8 (S.D.=.69).

The class means and summary statistics for the univariate analyses of variance for the Blends and CTBS Pre-Reading Tests

[5]Matrix singularity also precluded the derivation of fac tor scores thus requiring simple rather than weighted combinations of relevant variables.

[6]The tolerance level of Attention to Detail was insufficient for inclusion in the analysis.

TABLE 10

Class Means and Summary Statistics of the ANOVAS for the Implementation Variables and the Blends Criterion Test

CLASS	N	BLND $\bar{X}$	PRERDNG $\bar{X}$	N OBSER	RPREP $\bar{X}$	TPREP $\bar{X}$	TOT $\bar{X}$	FPRO $\bar{X}$	UMAT $\bar{X}$	TEFF $\bar{X}$	SINT $\bar{X}$	XCOV $\bar{X}$
1	10	24.8	35.5	1	15.0	4.00	14.0	.50	.50	3.00	4.00	1.00
2	8	23.5	31.5	3	18.3	4.67	18.3	.68	.63	4.33	4.67	.92
3	13	22.4	30.8	2	25.0	5.00	19.0	.83	1.00	5.00	5.00	1.00
4	10	22.3	36.0	1	10.0	4.00	20.0	1.00	1.00	4.00	4.00	1.00
5	8	22.2	37.1	3	11.7	4.00	11.7	.21	.50	4.00	4.67	.36
6	4	21.5	37.2	2	12.5	5.00	21.5	.71	.83	5.00	5.00	.83
7	11	21.1	40.3	1	15.0	5.00	20.0	1.00	.66	5.00	5.00	1.00
8	12	20.4	41.2	2	15.0	5.00	24.0	.92	.83	5.00	5.00	.75
9	12	20.0	43.7	2	7.5	4.00	18.5	.83	.75	4.00	4.00	.50
10	10	18.9	33.6	1	10.0	3.00	16.0	.50	1.00	3.00	4.00	1.00
11	11	18.4	37.9	2	15.0	3.00	25.0	.73	1.00	3.00	3.00	.50
12	7	18.0	39.9	1	15.0	5.00	20.0	.62	1.00	5.00	4.00	1.00
13	5	18.0	52.0	2	17.5	5.00	21.5	.64	1.00	5.00	5.00	1.00
df		12/108	12/108		12/10	12/10	12/10	12/9	12/8	12/10	12/10	12/9
F		4.68**	3.61**		3.12*	1.93	1.50	1.66	1.61	2.18	2.10	1.18
Bartlett Box F		1.99*	1.06	Cochrans C		.48*						

*p .05

**p .0001

and the implementation variables are presented in Table 10. Significant differences between classes were found for the Blends and CTBS Pre-Reading tests and for Reported Preparation. Tests for homogeniety of variance revealed heterogeneous variances for the Blends test and Reported Preparation. Heterogeniety would not compromise the results for the Blends test but might negate the effects shown for the implementation variable since the actual alpha levels for this variable is only $p < .04$.

The lack of between class differences for the implementation variables does not necessarily indicate unreliability of the measures in this instance since the teachers had probably become thoroughly familiar with the teacher's guides and program components. Given the teachers' length of exposure to, and usage of, the program, a concommittant decrease in variation in implementation might be expected. The means and standard deviations of the implementation variables across the Colors-Shapes-Sizes, Directions, and Blends packages are presented in Table 11. The data in Table 11a is based on all teachers having implementation data for any of the respective packages, thus, some teachers are not represented across all packages. Inspection of the standard deviations of the implementation variable across packages reveals decreased variation across all packages for all of the variables except Use of Materials and Extensity of Coverage. The variation in Extensity of Coverage remains fairly stable while the variation in Use of Materials, although greater for the Blends package than for the Directions package, shows more variance in the Colors-Shapes-Sizes package than in the other packages.

TABLE 11a

Means and Standard Deviations of Implementation Variables Across the Colors-Shapes-Sizes, Directions and Blends Packages for Teachers Having Implementation Data on the Respective Packages.

	Colors-Shapes-Sizes		Directions		Blends	
Variable	Mean	S.D.	Mean	S.D.	Mean	S.D.
Reported Preparation	21.10	10.32	16.92	7.72	14.42	4.44
Teacher Preparation	3.84	1.35	4.21	.97	4.36	.75
Time on Task	22.12	7.28	21.21	5.38	19.19	3.70
Following Procedures	.74	.34	.74	.28	.71	.22
Use of Materials	.83	.30	.89	.15	.82	.20
Teacher Effectiveness	4.00	1.21	4.39	.74	4.26	.83
Student Interest	4.06	1.24	4.54	.75	4.41	.63
Extensity of Coverage	.80	.28	.90	.22	.84	.23
N (Teachers) =	23		14		13	

TABLE 11b

Means and Standard Deviations of Implementation Variables Across the Colors-Shapes-Sizes, Directions and Blends Packages for Teachers Having Implementation Data on All Packages.

	Colors-Shapes-Sizes		Directions		Blends	
Variable	Mean	S.D.	Mean	S.D.	Mean	S.D.
Reported Preparation	17.50	3.87	17.20	2.45	14.52	5.73
Teacher Preparation	3.73	1.63	4.00	1.00	4.57	.54
Time on Task	19.09	2.69	21.43	6.90	19.24	3.80
Following Procedures	.71	.40	.71	.35	.72	.26
Use of Materials	.88	.19	.86	.18	.87	.19
Teacher Effectiveness	3.67	1.30	4.28	.76	4.57	.53
Student Interest	3.50	1.56	4.57	.79	4.52	.50
Extensity of Coverage	.83	.26	.90	.25	.80	.27
N (Teachers) = 7						

The data in Table 11b is based on teachers having implementation data for all three packages. Decreases in variance across packages are revealed for Teacher Preparation, Following Procedures, Teacher Effectiveness and Student Interest. Variation in Use of Materials and Extensity of Coverage, remains relatively stable while the variation in Reported Preparation and Time on Task shows erratic trends across packages. The data in Table 11b, however, may be suspect due to the relatively small sample (N=7

teachers) and may yield a somewhat distorted view of the overall implementation trends. The evidence does reveal, however, a tendency for teachers to become more homogeneous in their implementation of the program components.

Regression Analysis

The means, standard deviations and correlations of all variables in the regression analysis for the Blends residuals are presented in Table 12.

TABLE 12

Means, Standard Deviations and Correlations of All Variables Used in the Regression Analysis of the Blends Residuals (N=13)

Variable	Symbol	BRESID	RPREP	TPREP	TOT	FPRO	UMAT	TEFF	SINT	XCOV
Blends Resid.	BRESID									
Reported Preparation	RPREP	-.01								
Teacher Preparation	TPREP	.00	.50							
Time on Task	TOT	-.49	.19	.23						
Following Procedures	FPRO	-.04	.10	.32	.69					
Use of Materials	UMAT	-.47	.14	-.05	.62	.35				
Teacher Effectiveness	TEFF	-.17	.41	.94	.36	.39	.15			
Student Interest	SINT	.15	.39	.80	-.05	.13	-.22	.78		
Extensity of Coverage	XCOV	.03	.38	.38	.07	.29	.30	.26	.27	
Mean		-.49	14.42	4.36	19.19	.70	.83	4.25	4.42	.83
S.D.		2.15	4.44	.75	3.70	.22	.19	.83	.63	.23

Table 12 shows that the majority of intercorrelations among the implementation variables are moderate to high positive. Four of the implementation variables show negative correlations with the Blends residual means. The moderately high, negative correlations between Time on Task and Use of Materials with the Blends residuals may suggest that students tend to become less enthusiastic about the content and length of daily lessons. This may be expected since the Blends package content is mainly a synthesis of the content of the preceeding packages.

The varimax rotated factor matrix for the implementation variables is presented in Table 13. Three factors were yielded from the analysis. The four variables loading most highly on

Factor 1 are Teacher Preparation, Reported Preparation, Teacher Effectiveness and Student Interest. This factor appears to reflect the degree of personal involvement of the teacher. The variables loading most highly on Factor 2 are Time on Task, Following Procedures and Use of Materials. This factor appears to reflect teachers' attention to detail. Factor 3 contains the variable Extensity of Coverage.

TABLE 13

Varimax Rotated Factor Matrix of the Implementation Variables for the Blends Criterion Test

Variable	Factor 1 (Personal Involvement)	Factor 2 (Attention to Detail)	Factor 3 (Coverage)
Reported Preparation	.39	.10	.38
Teacher Preparation	.96	.12	.22
Time on Task	.11	.99	-.05
Following Procedures	.22	.63	.12
Use of Materials	-.17	.64	.33
Teacher Effectiveness	.91	.30	.11
Student Interest	.86	-.14	.15
Extensity of Coverage	.19	.13	.74

As with the previous factor analyses, matrix singularity required the use of the highest off-diagonal elements in the correlation matrix to obtain the initial communality estimates and precluded the derivation of actual factor scores. The results of the regression analysis are presented in Table 14.[7] The multiple correlation was not significantly different from zero ($R=.42, F_{2,10}=1.09$). Thus the Blends implementation factors are not significantly related to the class mean residuals of the Blends test. The negative beta weight obtained for the vactor Attention to Detail may indicate that students tend to become bored with the content of

[7]The tolerance level for Personal Involvement was insufficient for inclusion in the regression analysis.

the Blends package. This probably reflects a relative redundancy of content since the Blends package is a synthesis of the content of the preceeding packages.

TABLE 14

Regression Analysis of the Blends Mean Residuals Using the the Implementation Factors Derived From the Factor Analysis

Variable	df	F	R^2(diff)x100	Beta
Attention to Detail	1/11	2.07	15.8	-.44
Coverage	2/10	.25	2.1	.15
R_2= .42	2/10	1.09		
R^2= .18				
Constant = -.49				

Most of the variance in student achievement across all three criterion tests can be attributed to initial differences in ability as measured by the CTBS Pre-Reading subtest.

Some Serendipitous Results

At the end of the school year participating KED teachers were given a questionnaire to elicit feedback on the curriculum components of the KED program. A copy of this questionnaire is presented in Appendix II.

The questionnaire was designed to obtain information on some variables that could mediate implementation of the LAT components of the KED program. Generally, these variables may be divided into demographic variables (i.e., years of teaching experience and presence or absence of a teacher's aide), and "reaction" variables (i.e., reactions to the teacher's guides, manipulatives, directions for using components, etc.). Questions related to the LAT program were scored and these scores were correlated with the overall mean scores on the implementation variables for twenty-one teachers for whom data was available. For this sample of teachers, the implementation data was based on eighty-three productive observations across packages. The mean number of productive observations per teacher was 3.95 (S.D.=1.60). The implementation means for all but five of the teachers are based on observation data obtained across at least two of the three packages.

Since bivariate normality was not observed for these variables, Kendall rank-order correlations were computed and these intercorrelations are presented in Table 15. Inspection of Table 15 reveals that most of the intercorrelations among the implementation variables are moderate to high positive and significantly different from zero. Exceptions may be noted for Reported Preparation and Time on Task.

TABLE 15

Kendall Rank-Order Correlations Between the Implementation Variables and Variables Characterizing Demographic Properties and Teacher Reactions to LAT Program Components. (N=21)

Variable	Symbol	RPREP	TPREP	TOT	FPRO	UMAT	TEFF	SINT	XCOV	KEXP	AIDE	LORG	LSTR	LSEQ	CLAR	EFOL	NMAN	UFMN	HAND	INTR
Reported Preparation	RPREP																			
Teacher Preparation	TPREP	.06																		
Time on Task	TOT	-.01	.13																	
Following Procedures	FPRO	.16	.69**	.18																
Use of Materials	UMAT	.42**	.35*	.11	.41**															
Teacher Effectiveness	TEFF	.09	.80***	.13	.65***	.24														
Student Interest	SINT	.12	.77***	.09	.63***	.18	.85***													
Extensity of Coverage	XCOV	.30*	.55***	-.05	.66***	.49**	.58***	.51***												
Kndg. Experience (yrs.)	KEXP	-.05	-.09	-.09	-.09	-.17	.01	.00	.04											
Presence of Teachers Aide	AIDE	.39	.33*	.27	.17	.05	.32	.36*	.19	.13										
Reactions to Teachers' Guides																				
Lesson Organization	LORG	.02	-.02	.36*	.19	.01	.07	.10	.01	-.12	.33									
Lesson Structure	LSTR	.09	.12	-.09	.20	.13	.15	.16	.19	.01	.23	.33								
Lesson Sequence	LSEQ	.27	.16	-.09	.20	.08	.12	.23	.15	-.11	.20	.20	.37*							
Clarity of Directions	CLAR	.24	.32*	.39*	.38*	.36*	.31*	.24	.41*	-.34*	.35	.34	.15	.30						
Ease of Following Dir.[1]	EFOL	----	----	----	----	----	----	----	----	----	----	----	----	----	----					
Reactions to Manipulatives																				
Number of Manipulatives	NMAN	.12	.61***	-.10	.51**	.26	.65***	.63***	.54**	.07	.15	-.01	.10	.18	.21	----				
Usefulness of Manipulatives	UFMN	-.02	-.12	.29	.04	.05	-.07	-.09	-.13	-.19	.00	.33	-.11	-.28	-.21	----	-.24			
Handleable	HAND	.28	.23	-.19	.22	.18	.27	.29	.33*	.22	.23	-.09	.69***	.26	-.14	----	.31	-.07		
Interesting	INTR	.28	.26	.20	.41*	.27	.27	.30	.31	.10	.21	.29	.11	.41*	.00	----	.12	.46*	.32	
Reaction to Teacher Training																				
Self-Confidence	CONF	-.16	.14	.18	-.07	-.19	.16	.08	-.14	-.02	-.06	-.04	.16	.38*	.12	----	.07	-.28	.11	.07

*p .05
**p .01
***p .001

[1]Ease of Following Directions has no variance thus cannot correlate with any variable

Of the demographic variables, Kindergarten Experience (KEXP) shows low, negative correlations with most of the implementation variables but these correlations are not significantly different from zero.

Presence of a Teachers Aide (AIDE) shows low positive correlations with all of the implementation variables and these intercorrelations are significantly different from zero for Teacher Preparation and Student Interest. Apparently the presence of a teachers aide enables teachers to more adequately prepare for LAT lessons which, in turn, may relate to student interest in the lessons.

Under the heading Reactions to Teachers' Guides (Table 15) — are variables characterizing teachers' reactions to the organization (LORG), structure (LSTR), and sequence (LSEQ) of LAT lessons, clarity of directions (CLAR), and ease with which directions could be followed (EFOL). Most of the intercorrelations between these variables and the implementation variables are low positive but not significantly different from zero. An exception may be noted for Clarity of Directions (CLAR), however, which has correlations greater than chance expectations with all of the implementation variables except Reported Preparation and Student Interest. In addition, Lesson Organization shows a better-than-chance correlation with Time on Task. Thus teachers who perceive the lessons as being well organized tend to spend more time on the lessons and teachers who perceive the directions as being clear and unambiguous tend to manifest a uniformly higher degree of implementation.

The negative correlation between Clarity of Directions and Kindergarten Experience suggests that the more experienced teachers tend to view the directions as being unclear or ambiguous.

Under the heading Reactions to Manipulatives are those variables characterizing teachers' reactions to the number (NMAN) and Usefulness (UFMN) of the manipulatives, whether or not the manipulatives were hard or easy to handle (HAND), and were interesting (INTR) to the students. Number of Manipulatives shows moderate positive correlations (beyond chance) with all of the implementation variables except Reported Preparation, Time on Task, adn Use of Materials. The variable Usefulness of Manipulatives (UFMN) shows very low, negative correlations with most of the implementation variables but none of these correlations are beyond chance. Handleable (HAND) shows moderately low, positive correlations with most of the implementation variables but these correlations are not beyond chance except the correlation with Extensity of Coverage. Teachers' perceptions of the students' interest (INTR) in the manipulatives also shows moderately low, positive correlations with all of the implementation variables but these correlations also are not beyond chance except for Following Procedures.

Under the heading Reaction to Teacher Training is the variable Self-Confidence (CONF) which indicates the extent to which teachers were confident of their ability to use the LAT program as a result of the LAT inservice training. None of the correlations between Self-Confidence and the implementation variables, however, are significantly different from zero.

Caution should be exercised in attempting qualitative interpretations of correlations between the questionnaire variables and the implementation variables since the questionnaire variables have face validity only and there is no evidence of the reliability of the measures. In addition, the correlations may be suspect due to the restricted range problem since most questionnaire variables were scored on a two or three point scale.

Summary Discussion

Preliminary Considerations and Limitations

An obvious limitation of the study is that neither teachers nor students were randomly sampled or randomly assigned to the KED classes. In the context of this study, however, the sample may be considered somewhat representative of a larger population of inner-city kindergarten teachers and Title I eligible students.

A further limitation is that any effects on student achievement resulting from the interaction of the BRL Math, DUSO, or regular kindergarten curriculum programs with the LAT program are uncontrolled. It is assumed that any such interaction effects are uniform across classes or negligible.

The relatively few productive observations of the teachers (especially for the Directions package) also fosters a cautious interpretation of the results of the study.

Summary

The results show, however, that there are significant differences between classes in student achievement of the LAT

program objectives as measured by the first three criterion tests. The results also showed that, except for the Blends analysis, classes were significantly different from each other on the implementation variables thus lending additional support for the reliability of the implementation measures. Although the assumptions of homogeneity of error variance and normality were violated for most of the one-way analyses of variance, it is unlikely that such violations would negate the significance of the between class differences given the relatively low alpha levels yielded from the F tests.

Inspection of the means and standard deviations of the implementation variables across packages for seven teachers having complete data revealed, that as the school year progressed, these teachers spent less actual time in preparation for lessons but appeared to be better prepared for the lessons. This may be a result of increased experience in using program materials. These teachers also become more effective and more homogeneous in maintaining student attention and eliciting student responses (Teacher Effectiveness) and their students appeared to manifest more interest in the lessons (Student Interest).

An analysis of the teacher questionnaire data revealed that the presence of a teachers aide was positively related to Teacher Preparation and Student Interest, indicating that the presence of an aide may enable teachers to more adequately prepare for lessons which might subsequently affect student interest in the lessons.

Teachers who indicated that the directions in the teachers' guides were clear and unambiguous tended to manifest higher scores on most of the implementation variables. Teachers who indicated that the lessons were well organized also tended to spend more time on task.

The negative correlations between years of kindergarten experience, perceived clarity of directions, and preparation suggest that the more experienced teachers may perceive some ambiguity in the directions and show less overall preparation for the lessons. This may suggest a "resistence to change" phenomenon as noted by Gross, et. al. (1971) especially considering that kindergarten experience showed negative correlations (though not beyond chance) with most of the implementation variables.

Although the questionnaire can claim only face validity and most of the reactive variables are measured only on a two or three point scale, the data suggest that the teachers' perceptions of some facets of the program are related to certain facets of implementation.

In summary, the results show that teachers did vary in their implementation of the LAT program but that the variation in implementation was not related to class acievement. Most of the variance in student achievement was due to variance in initial ability.

It is critical in the evaluation process that variations in degree of implementation be characterized. The use of classroom observation with implementation rating scales can provide

a methodology for the specification of variations in implementation. In the absence of information about variations in implementation, the evaluator/researcher assumes any or all of the following:

1) the educational program and its discrete elements are a configuration of a "stand alone" product and, hence, "teacher-proof" or
2) teacher variation in implementation is negligible in its effects on student outcomes, or
3) is not an important variable or variable set to consider, or
4) teacher variation in implementation is a random variable whose effects can be minimized by appropriate random sampling procedures across a large number of teachers and classes.

The first assumption is certainly questionable since the teacher, at least in this study, has been shown to be a powerful mediating variable in relation to the usage of a program. Currently there is a lack of sufficient evidence to provide blanket support for assumptions two and three. The fourth assumption requires a considerable amount of expenditure and effort in the evaluation process, and may be impractical for labs, R&D centers and school systems engaged in curriculum development and/or evaluation.

In specifying variations in implementation and isolating critical implementation variables, the evaluator can provide feedback to the developer or inservice centers concerning which facets of the implementation of a program need special emphasis or

require modification to enhance optimal usage and achieve maximum impact.

Suggestions for Further Research

The critical element in research on the effects of teacher variation in implementation is obtaining suitable measures of implementation. Within this context, the major problem is that of developing measures applicable to a variety of curriculum programs to enhance useability. Although it can be argued that curriculum programs represent unique configurations of lessons and materials, teacher usage of such programs ought to be characterized by variables that transcend individual programs. The teacher implementation variables used in the present study may be considered to have wide applicability (for programs having at least some structure) but some of the measures seem to lack precision. For example, Teacher Preparation, Teacher Effectiveness, and Student Interest are imprecise even though most of the scale points for each are defined. The imprecision of these variables lies in their treatment as unitary variables having no specifically defined sub-components. For example, Teacher Preparation could acquire more precision by defining it in terms of sub-categories like availability of materials, frequency of referring to teacher's guide, and fluidity of transition from topic to topic. Each sub-component could be measured by a rating scale or frequency count (for number of referrals to the teacher's guide) and the summation of the component scale scores would by the score for Teacher Preparation. A variable like Teacher Effectiveness may acquire more precision by actually noting the number

or percentage of students exhibiting attenuation responses and offering (via hand-raising) to respond to respond to pertinent questions or volunteering to participate in activities.

Although the variable Following Procedures was specifically defined as the percentage of specified procedures actually followed by a teacher in her presentation of lesson content, more precision could be obtained by focusing on discrete teacher behaviors suggested by the procedures to be followed in the presentation of the lessons. To this end, the work of Bellack et. al. (1966), Smith and Meux (1962), and Hudgins (1971) concerned with teacher "moves" would be germane. Further specification of teacher behaviors could accomplished by considering the results of the teacher verb-sorting studies by Miller et. al. (1967), Johnson (1969), and Wiley (1969) which demonstrated that from fifty to eighty verbs could characterize teacher classroom activity in the context of facilitating student learning. The lessons of more structured curriculum programs could be examined to determine which teacher verbs most characterize the procedures to be followed (e.g., demonstrate, display, illustrate, lecture, etc.) and the score for Following Procedures would be based on teacher interaction with program components relative to the relevant teacher-behavior verbs. Deviations from recommended procedures could be readily characterized by noting which other verbs reflect such deviations and this data could be sued to determine which alternate behaviors, if any, have significant effects. (Assuming that Following Procedures itself has a significant effect).

A further line of research should focus on variables that mediate reacher implementation. Such variables may be classified under general headings of preparation variables (e.g., quality of inservice training), setting variables (e.g., availability of support services like curriculum specialists, teacher aides, in-service trainers, administrators' interest in the program, etc.), and other teacher characteristics (especially personality variables and self-confidence). Such research would be beneficial in the development of general models of implementation encompassing a wide range of variables that could mediate student achievement of curriculum and program objectives. Such studies would obviously require large numbers of schools and other resources, but the rigors of scientific inquiry and the obligation to provide quality education demands that such research be undertaken to adequately specify the effects of the implementation of innovative curriculum programs.

Although the implicit assumption is that high levels of teacher implementation of a program should result in high levels of studetn achievement of a program's objectives, rigorous implementation of a relatively structured program could result in students being treated as "Pawns" rather than "Origins". Since the "Origin-Pawn" variable is related to academic achievement (deCharms, 1976) and the relative amount of freedom in a situation may induce more Origin or more Pawn feelings (deCharms, 1972), forcing students and teachers to act in a predetermined manner (e.g., high levels of teacher implementation) may in fact serve to hinder student acquisition of program objectives.

Such a relationship between the level of program structure, teacher implementation, and student achievement, if it exists, has serious implications for curriculum developers and may demand a reconceptualization of the role of curriculum programs in the teaching-learning process.

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APPENDIX II

LAT CLASSROOM OBSERVATION FORM AND INSTRUCTIONS

LAT-LEVEL A

Observation Form

Date of Observation _____

Teacher _____

School _____

Aide _____

Name of LAT _____

Title of LAT Lesson _____

Objectives for this lesson (indicate objective number(s) _____

1. Time on lesson

   a. Time lesson begins _____

   b. Time lesson ends _____ Total time (a-b). _____

Teacher Implementation

2. Teacher prepardness for LAT lesson

   1 2 3 4 5

3. Correct following of procedures as specified in the teacher's guide.

$$\frac{\text{Actual Number of Procedures Followed}}{\text{Total Number of Procedures Specified for the Lesson}} = \_\_\_\_\_$$

4. Proper use of LAT materials

Materials	Suggested for Lesson (✓)	Used (1) Not Used (0)	Used Properly(1) Used Improperly(0)
Let's Start			
Teacher's Objects Box			
Simple Objects Transparencies			
Let's Start Audio Tape			
Colors			
Student Activity Book			
Colors Audio Tape			
Colors Objects Box Items			
1) Objects of different colors			
2) Color blocks			
3) Food coloring & containers			
Color Picture Cards of Real Objects			
Clearly Colors Transparency			
Correct & Incorrect Color Cards			
Shapes			
Student Activity Book			
Shapes Audio Tape			
Plastic Shapes			
Shapes Picture Cards A			
Shapes Picture Cards B			
Shapes-Colors Transparency			
Clearly Shapes Transparency			
Shapes of Things Picture Cards			

Materials	Suggested for Lesson (✓)	Used(1) Not Used(0)	Used Properly(1) Used Improperly(0)
Blends			
Teachers Guide			
Activity Book for Children			
Color & Shape Bingo Game			
Geometric Shapes Box			
Audio Tape - Let's Talk			
Actions			
Action Picture Cards			
Action Transparencies			
Animal Action Picture Cards			
Action Audio Tape			
Student Activity Book			
Clearly Action Transparency			
Action Sequence Cards			
Functions			
Functions Objects Box			
Uses and Objects Cards			
"How Do We Use It" Cards			
Audio Tape			
Doing & Using Picture Cards			
Puzzle Pieces			
Touch & Feel! Materials			
Student Activity Book			

Classification

Audio Tape _____ _____ _____

Student Activity Book _____ _____ _____

Picture and Game Cards _____ _____ _____

Instructo Activity Kit _____ _____ _____

Best Word Book Ever _____ _____ _____

Total Score $\left(\frac{\text{Number of Objectives actually covered}}{\text{Number of objectives in lesson}}\right) =$ ____

5. Teacher effectiveness in maintaining student attention and elicitation of student responses.

1 2 3 4 5

6. Student interest toward the lesson.

1 2 3 4 5

7. Extensity of coverage $\left(\frac{\text{Number of objectives actually covered}}{\text{Number of objectives in lesson}}\right) =$ _____

8. Reported preparation time for lesson (in minutes)_____

Instructions for Use of the LAT Level A

Classroom Observation Form

The observation form should be completed immediately after observing the class. Nothing on the form is to be written during the class session or in the presence of the classroom teacher.

If, at any time, a teacher should ask the purpose of the observation(s), you are to indicate that you are observing the class to see how the students react to the materials i.e., if the students enjoy the lessons, like to participate, and to obtain teacher feedback concerning the usability of the LAT packages and materials.

When observing a class, be sure you have a copy of the teachers guide currently being used. Determine which lesson the teacher is presenting and carefully follow the lesson content and procedures.

Demographic data:

These items are self-explanatory

Item 1: Time on lesson

Indicate the time (to the nearest minute) the lesson began (a), the time the lesson ended (b) and the total time b-a. If the teacher began the lesson before you had arrived, ask her (at the end of the lesson) when she had begun.

Item 2: Teacher preparedness for LAT lessons

Score:

1 - If the teacher has obviously made no preparation for the lesson, the materials are not readily available and the teacher must literally read from the manual throughout the lesson.

2 - For situations between 1 and 3.

3 - If the teacher is somewhat prepared for the lesson, has some of the materials at hand and occasionally refers to the teacher's guide.

4 - For situations between 3 and 5.

5 - If the teacher is obviously well prepared for the lesson, has all the materials at hand and can present the lesson smoothly without having to refer to the teacher's guide.

Item 3. Correct following of procedures as specified in the teacher's guide.

Scoring:

For each of the LAT lessons, several procedures are specified in the Teachers Guide. The score for following procedures is computed by determining the actual number of the recommended procedures that were followed in the lesson and dividing the total number of procedures that were specified for the lesson. For example, if seven procedures are listed for a given lesson and the teacher follows four of the procedures, the score would be 4/7 or .57.

Item 4. Proper use of LAT materials

Scoring:

Place a check (✓) by those materials that are supposed to be used during the particular lesson. Indicate (by using 1 or 0) whether or not each of the suggested materials were or were not used. Also indicate (by using 1 or 0) whether or not each of the materials were or were not used according to the recommended procedures specified in the teacher's guide. The total score is computed as follows:

(a) Compute the total possible score e.g., if three materials were to be used in the lesson (according to the teacher's guide) the total possible score would be 6 (i.e., one point each for usage and proper usage for 2 points per material).

(b) Compute the actual score e.g., if two of the three materials were used and used properly, the actual score would be 4.

(c) The total score is 4/6 or .66.

Item 5: Teacher effectivness in maintaining student attention and elicitation of student responses.

Score:

1 - If the teacher does not have the attention of most of the students and there is almost no student participation or response.

2 - If the teacher does not have the attention of the majority of the students and there is little student participation or response.

3.- If the teacher has the attention of some of the students and can elicit some student response and maintains some student attention throughout the lesson.

4 - If the teacher has the attention of the majority of the students and maintains a farily high level of response and participation throughout the lesson.

5 - If almost all of the students appear interested in the lessons, enjoy the activities and volunteer to participate.

Item 6. Student interest towards the lesson

Score:

1 - If most of the students appear bored or do not pay attention to the lesson and activities.

2 - For situations between 1 and 3.

3 - If some of the students appear interested in the lessons, enjoy the activities and volunteer to participate.

4 - For situations between 3 and 5.

5 - If most of the students appear interested in the lessons, enjoy the activities and volunteer to participate.

Item 7: Extensity of coverage

Scoring:

Some LAT lessons are desinged to cover a single objective while other lessons may cover two or three objectives. The score for extensity of coverage is obtained by dividing the number of

objectives actually covered in the lesson by the number of objectives that should have been covered. For example, if the teacher should have covered three objectives (as indicated in the teacher's guide) and actually covered only one objective, the score would be .33.

Item 8: Reported preparation time for lessons.

After the teacher has completed the LAT lesson, ask her now much time she typically devotes to preparing for LAT lessons.

APPENDIX III

K.E.D. PROGRAM TEACHER QUESTIONNAIRE

K.E.D. Teacher Questionnaire

1. Name: _____

2. Location of KED class(s) AM _____ School

   PM _____ School

3. How many years experience have you had (to the nearest 1/2 year):

   a) Teaching kindergarten prior to the KED program) _____ years

   b) teaching in the KED program _____ years

   c) teaching in other grades including years listed under (a) _____ years

5. Do you have an aide for your

   a) AM KED Class _____ yes _____ no

   b) PM KED Class _____ yes _____ no

9. Please circle the letter preceding each phrase which explains why some children in your class(s) did not benefit from the KED program (if you think some children did not benefit sufficiently from the program).

   a. immaturity

   b. physical handicaps (i.e., poor vision or hearing)

   c. class size too large for individual attention

   d. content too advanced

      (specify which component _____ LAT _____ DUSO _____ BRL)

   e. content did not hold children's interest

      (specify which component _____ LAT _____ DUSO _____ BRL

   f. short attention span

   g. some children transferred in too late to venefit from the program

   h. other - (please specify) _____

_____

_____

10. For each of the following, circle the term which best reflects your reactions to the LAT teacher's guides.

a. The lessons and content are:

well organized adequately organized not well organized

b. The lessons are:

too structured well balanced too flexible

c. The directions are:

clearly written adequately written unclear or ambigous

d. The lessons and content are:

well sequenced reasonably sequenced poorly sequenced

e. The procedures are usually:

easy to follow difficult to follow

13. In each row below, circle the term which best reflects your reaction to the LAT components.

a. Too many right amount too few

b. The components are (very useful somewhat useful unnecessary)

c. The components are (easy to handle difficult to handle)

d. The components are (durable flimsy)

e. The components are (very interesting somewhat interesting not interesting) to the students.

19. How helpful were the practice tests accompanying the LAT packages in preparing your students for the LAT Mastery Criterion Tests?

a) very helpful

b) somewhat helprul No response

c) unnecessary for my students

20. Was the LAT inservice adequate in preparing you to use the LAT materials?

____a) yes ____b) no If not, how could it be improved?

_____

_____

_____

23. As a result of the inservice, how confident were you in your ability to properly use each of the following KED curriculum components?

LAT ____a) very confident ____b) confident ____c) not very confident

DUSO ____a) very confident ____b) confident ____c) not very confident

BRL ____a) very confident ____b) confident ____c) not very confident