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AUTHOR Forbes, Roy H.
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ABSTRACT

The purpose of this study was to demonstrate the feasibility of a cost-effectiveness analysis approach. Eight instructional alternatives within three primary reading programs were studied in the Louisville Public Schools. Data collected covered program description and implementation, student characteristics, effectiveness measures, and costs. Program implementation data were used to adjust effectiveness measures. Students were grouped using characteristic data. By dividing the mean adjusted effectiveness measures by the per-pupil-program costs, a set of cost-effectiveness ratios was calculated that could be used to compare programs. The study generated information that indicates the possible feasibility of the approach. The utilization of three of the four data types suggested in determining the cost-effectiveness of instructional programs was successfully implemented. The utilization of a fourth type, implementation data, was not adequately accomplished. Therefore, the feasibility of the approach was not completely demonstrated. However, the study does suggest a high likelihood of feasibility and has pinpointed areas of implementation difficulties. Hopefully, the results of this effort, both negative and positive, will assist in the development of a cost-effective methodology that can be used by the education practitioner. (Author)

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Roy H. Forbes
Louisville Urban Education Center
675 River City Mall
Louisville, Kentucky 40202

January 29, 1975

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TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

Cost-effectiveness analysis is a management tool which can be used to generate information for decision-makers. It combines program effectiveness data with cost analysis information in a format which provides the decision-maker with data which will aid in making better and more realistic decisions.

The purpose of this study was to test and demonstrate the feasibility of a cost-effectiveness approach. The approach was designed to facilitate the utilization of cost-effectiveness technology by public school practitioners.

The utilization of programmatic information generated by the study is limited to local efforts, but the methodological information has wide application. Problems encountered in the implementation of the approach are presented to assist others interested in the application of cost-effectiveness analysis. The description of the implementation including both positive and negative results is viewed as the real worth of the study. The feasibility of the approach was not completely demonstrated, but the weak points have been identified and efforts are currently underway in the further methodological development and evaluation of the approach.

The study was performed in the Louisville (Kentucky) Public Schools. Three primary (grades 1-3) reading programs were selected for cost-effectiveness analysis. One of these programs was being implemented in six significant variations: three technical variations and two site variations.

The following three programs and eight variations were analyzed.

1. Diagnostic-Prescriptive-Individualized Instruction--Primary

    a. As operated in non-Teacher Corps schools (generally referred to as DPI)
        1.) Student cross-age tutored
        2.) Paraprofessional reading aide tutored
        3.) Both 1) and 2) used as appropriate (regular DPI program)

b. As taught in Teacher Corps schools (generally referred to as TC-DPI)
   1) Same as 1.a.1)
   2) Same as 1.a.2)
   3) Same as 1.a.3)

2. Portland-Atkinson-Dolfinger Program (generally referred to as PAD or Project Action)

3. Follow-Through (generally referred to as FT)

Descriptions of each of these programs are included in Appendix B.

PROCEDURES

Introduction

The cost-effectiveness methodology used in this study required the collection of four categories of data for each of the alternative instructional approaches under study:

1. Program description and implementation data,
2. Student characteristics information,
3. Program effectiveness measures, and
4. Costs data.

Program implementation data were used to adjust effectiveness measures. The adjusted effectiveness measures were then used to compare alternative instructional approaches. By dividing the effectiveness measures by the program costs, a set of cost-effectiveness ratios was calculated. The ratios were then used in comparing programs.

Student characteristic data were used as categories when presenting study results in the matrix format designed for utilization by decision-makers.

A detailed description of the cost-effectiveness model from which this study was adopted is presented in Appendix A.

The following paragraphs discuss the implementation of the methodology.

Program Descriptions and Implementation

Descriptive data were collected for each of the instructional programs being evaluated. Descriptions (see Appendix B) are based on each program's proposals, staff training materials, and curriculum materials. The general program model is included, as well as specifics on the instruction of reading for each program. In addition, a brief instructional description and/or interview format was written, revised, and agreed to by the administrative staff of each program for use in the program implementation monitoring. Both DPI and Teacher Corps DPI teachers responded to the same instructional description. (Copies of these descriptions and interview forms are included in Appendix C.)

In order to monitor program implementation, each teacher in the sample program was interviewed by a staff person related to this study. (Teachers were paid for the interviews. In the interview the teacher was first asked the open-ended question, "How did you teach reading to Johnny Jones during this instructional cycle?" (The name of an actual sample child from that teacher's room was used in the question.) The teacher's response was recorded verbatim, and no prompting was used by the interviewer.

Then the teacher was asked to read the one-page description of the program and state what percentage of the time she followed that model. If the response was less than 100% the teacher was asked in what way she deviated from the model. It was hoped that deviations from the model would be revealed either in the open-ended question or in response to the program description.

At the request of the program directors, another measure of degree of implementation was added. Each program has curriculum developers or staff trainers who are responsible for working with the teachers in program implementation. These people were also asked to read the program description and rate each of the teachers they supervised on degree of implementation. By obtaining both ratings, it was hoped that some balance in objectivity would be achieved.

Feasibility of Collecting Implementation Data

The interview method of monitoring program implementation entailed the use of four half-time staff members over a period of two months. The lack of flexibility in the elementary school teacher's schedule meant that a maximum of two teachers were seen in a given day by one interviewer. (The geographical distance among the 22 schools in the study also added to problems in scheduling interviews.) The interview itself only took fifteen to twenty minutes.

When the interviews were completed it became evident that neither the open-ended response nor the percentage response were effective measures of program implementation. The open-ended response produced such a variety of descriptions, even within programs, that it was impossible to compare the answers. In two of the programs, PAD and Follow-Through, the teachers expressed their procedures much more clearly and their answers were more uniform. However, within the DPI program, teacher descriptions of instruction varied greatly. These differences could easily be due to the differences in program structures since PAD and Follow-Through have a more specified, detailed approach to instruction while DPI allows teachers more individual freedom within a broad structural framework.

The percentage figure given by the teacher after reading the program description was also judged ineffective in evaluating implementation because it failed to differentiate among teachers. Over 75% of the teachers rated themselves as achieving 99-100% implementation. Those who gave themselves a lower rating generally dropped only to the 95-90% mark. The exception was in the Follow-Through program where teachers receive regular feedback from the staff trainer as to their level of implementation in exactly the same categories they were asked about during the interview, thus providing the Follow-Through teachers with a concrete basis for response. (PAD teachers also received regular feedback, but the categories were not the same as the ones used in these interviews.)

The staff trainer or curriculum specialist's evaluation of teacher implementation did differentiate among teachers within programs. The percentages ranged from 50% to 100% with most teachers falling in the 85-95% range. Since the trainer evaluations did differentiate among teachers, it was decided not to use the teacher self-evaluations and, instead, base program implementation data on trainer ratings. Because no clear breaks in the data occurred, actual percentage ratings were used on each teacher rather than a division into levels of implementation.

It is now recognized that the interview was not a very feasible method of determining program implementation. Programs that had built-in feed-back to teachers were more reliable and precise, but the problem of teacher reluctance to reveal shortcomings was always present. Even trainer ratings were susceptible to personal bias and certainly varied according to the goals of the trainer where set behavioral objectives were not required by the instructional model.

Ratings by independent observers in random classrooms over the course of the year would have been a preferable method of monitoring program implementation. However, this would have involved a total immersion into the goals, training and methods of each program. With several programs to monitor, the time and manpower needed would have been outside the scope of this study.

The variance in level of implementation suggested by even our imperfect methods leads the researchers to conclude that the disparity between the description of a program and its actual operation can be very wide. Although level of implementation is rarely included in a program's evaluation, the findings of this study imply that implementation could make a significant difference in program effectiveness. It would be worthwhile to spend the time to develop more effective methods of measuring implementation.

Sample

The sample for this study consisted of 220 second graders, and 213 third graders in four instructional programs. In the DPI program, 12 schools were randomly selected from the 26 schools in the project. Each school was then randomly assigned to one of the three treatment groups; tutor assisted, aide assisted, or regular program. In each school ten children were randomly picked from second grade and ten from third grade. The same procedure was followed for the three Teacher Corps schools in DPI, with one school being assigned to each treatment group. Although DPI was designed only for children reading a year or more below grade level, the sample was chosen from the total classroom population in the DPI schools.

For PAD and Follow-Through, no treatment groups existed within the program so all schools in each project were included in the study, i.e., three schools in PAD and four schools in Follow-Through. The random procedure was also used in selecting ten second and ten third graders for the study from each of these schools.

Student Characteristic Data

Student characteristic data were included in this study so that more refined decisions could be made concerning instructional programs. Thus, the evaluation results should not only explain which programs are most cost-effective [illegible] which programs are most cost-effective for which type[illegible]ents. Toward this goal, student characteristic data were collected in the following areas:

(1) Socio-economic
  (a) Free lunch qualification status
  (b) Median census tract income

(2) Pre-school educational attendance, e.g., kindergarten, Head Start

(3) Minority/non-minority

(4) Male/female

(5) Self-adjustment

Feasibility of Collecting Student Characteristic Data

(1) Socio-economic

(a) Free lunch status. Free lunch data were collected because this information correlates very highly with Federal income standards for poverty families and, therefore, would give a measure of socio-economic level.

No centralized records were kept by the school system on the free lunch status of students, so the information had to be obtained from individual schools.

On the whole, the data were easy to collect since local school personnel knew which children were on free lunch and which were not. The only problem came in one or two schools where almost all of the children qualified for free lunch and, therefore, less careful records were kept. However, the qualification of children for free lunch was pursued as accurately as possible.

Although there were students in each of the four programs who were not on free lunch, the majority of the sample students did qualify. Since DPI and Follow-Through are in Title I schools, it was expected that more students would be from "poverty" families than not, and this was the case. Therefore, non-free lunch students were under-represented in the sample, making it difficult to draw conclusions about the effectiveness of programs for this type of student.

(b) Median census tract income. These data were collected by obtaining addresses of the sample children, identifying their census tract, and then extrapolating a median income figure. Addresses from the current local school records were accepted as accurate.

Although income derived from census tract information was readily obtained, the results did not prove accurate enough to include in the cost-effectiveness study. It was hypothesized that median income figures would fall in a relatively narrow range since most of the sample children were under Title I classification. However, the results indicated that a very wide-range of income was present, even within a single program's population. Several census tracts had a median income above poverty level. This was certainly in contradiction to the large number of children in those areas recorded as qualifying for free lunch.

There were no other data available that could provide an accuracy check on the census tract income figures, so it was not known whether there was an error in the data or in the data collection. Whatever the error, it was decided to exclude the median census tract income from the student characteristic data, leaving free lunch status as the indicator of socio-economic level.

(2) Pre-school Educational Attendance

The School System has a kindergarten or Head Start program in all of its elementary schools, and all students are eligible to attend. However, no centralized records have been kept on which children attended these programs or alternative private programs. Again, the data had to be collected from local schools.

If the sample second and third grade children had attended kindergarten or Head Start in the same school which they were presently attending, pre-school experience was recorded in the cumulative folders. Where this was not the case, only sporadic attempts had been made to record pre-school attendance. Also, it was not always indicated whether a non-response on a record form meant that the information was not available or that there was no pre-school experience.

When the pre-school record was incomplete, an attempt was made to contact parents to check the information. This method was also unsatisfactory since a substantial number of the parents did not have

telephones. In the end, accurate information on pre-school experience could not be obtained for sixty-five children in the sample. These children were included with the group of children known to be lacking pre-school experience.

There were also a few children who had attended private nursery school or a day-care program instead of the public kindergarten or Head Start program. These children were designated as belonging to the group with pre-school experience since they received some group socialization in an institutional setting, whether or not a readiness program was also used. No attempt was made to examine effectiveness scores in relation to the specific pre-school program which each child attended.

Presence and absence of pre-school experience was relatively even across treatment groups except in Follow-Through where only nine out of 80 students lacked pre-school experience. Since Follow-Through was conceived as an extension of the Head Start experience, such an overload on pre-school experience could be expected for this program.

(3) Minority/Non-Minority

Racial classification data were available both from the local school and Central Office records so that collecting the data presented no problems. However, the usefulness of the data was not consistent across programs. While the DPI and Teacher Corps DPI programs had a racial mixture, there was only one white student in the Follow-Through sample and only one black student in the PAD sample. This inbalance was unavoidable since the two programs happen to be located in racially isolated areas.

Thus, when student characteristics are looked at in connection with cost-effectiveness, it would be impossible to relate the advantages of PAD or Follow-Through with regard to the race of children taught. However, such a comparison of effectiveness with regard to race can be made within DPI and Teacher Corps DPI alternatives.

(4) Male/Female

Designation of students by sex was readily available from local schools and Central Office staff. There was a fairly even balance of boys and girls across all programs.

(5) Self-Adjustment

Self-adjustment measures on each of the sample students were collected using the Child Behavior Rating Scale of Russel N. Cassel (1962). The scales were designed to be completed by teachers, and they cover personal and school adjustment of the children. Teachers were paid for each form they completed; the average teacher had no more than five sample children in his or her class. The forms were completed in the two weeks following the spring achievement testing of the School System.

The teacher-completed rating was used rather than a student-completed rating due to the large amount of testing the children had already received and the problems of testing only a few children in the classroom. The rating scales were scored by the project researchers and then divided into two levels: more adjusted and less adjusted. The break was made at the 45th percentile, using a T-score conversion scale provided by the scale's developer.

Collection of results using this measure was smooth, and the teachers' comments indicated that the instrument was simple to complete. This is one of the few instruments on adjustment or self-concept for primary age children that can be completed by teachers (Buros, 1972). Its straight-forwardness and clarity seemed very satisfactory for a study of this type where many teachers were involved in filling out the instrument, and only a letter of instruction was used for guidance. A possible limitation of the CBRS is that the teacher's expectations of the child's adjustment may be measured rather than the child's actual self-adjustment.

When the rating scale results were used to divide the sample students into two levels of adjustment, students from both groups were represented in all programs although less disparity occurred in the Follow-Through program where only eighteen of the eighty sample students were in the less-adjusted group.

In general, missing data of various kinds on the children in the sample (especially test scores and pre-school attendance information) meant that late substitutions needed to be made, resulting in additional data collection work and eventually in dropping seven children from the sample. It would be suggested that this student characteristic data be collected earlier in the study so that substitutions could be made in time to collect all needed data, and/or that data be collected initially on alternative children so that substitutions and data collection would be more efficient.

Effectiveness Measures

Standardized reading tests regularly administered by the School System to all students were used as the pre- and post-tests for evaluating effectiveness. All second graders received the California Achievement Test in the spring of 1973 and the California Test of Basic Skills in the spring of 1974. All third graders received the California Test of Basic Skills in the spring of 1973 and 1974. The total reading score stated in grade equivalents was used as the effectiveness measure.

The data for grades 2 and 3 were pooled together. Since grades 2 and 3 were given different tests, the CAT and CTBS, respectively, this practice might have been expected to distort the results because of differing scales of measurement. The scores were, however, converted to grade equivalents for data analysis and should, therefore, have had comparable units of measurement in the two grades.

For the DPI program, an additional effectiveness measure collected was the number of DPI reading skills passed by each student. These data were collected from the reading specialists in each school after the last DPI instructional cycle. There are some problems with simply counting numbers of skills passed, since some skills are easier to complete and some require a longer period of study for mastery. Nevertheless, one goal of the DPI program was for each child to pass a minimum number of skills in each instructional cycle regardless of the entry level of the child.

Due to an oversight, DPI reading skill data were not available for all Teacher Corps DPI schools.

Attendance Data

One other measure was regarded as important in relation to program delivery--student attendance data. If a student was absent a high percentage of instructional days, program implementation would obviously be at a lower level than for a child who missed only a few days of school. Attendance data were collected from office personnel in each school and were also available from the Central Office. Percentage of attendance was based on a possible 152 school days, from the beginning of school to the date of the spring testing during the 3rd week of April. Students in the sample ranged from 0 days absent to 48 days absent.

Effectiveness Results

To obtain the effectiveness portion of the cost-effective ratio figure, an adjusted gain score was computed for each of the sample students. This adjusted score represented an adjustment for treatment delivery as well as level of entry into program.

BIOMED program 04R and the following formula were used to derive an adjusted gain score:

$$e_k = \text{CTB post}_k - r_a\,(\text{CTB pre}_k - \overline{\text{CTB}}\ \text{pre}) - r_i\,(PI_k - \overline{PI})$$

Where

e_k = adjusted effectiveness scores per student
CTB post_k = a student post-test score on CTBS
r_a = correlation of CTB post to CTB pre
CTB pre_k = a student pre-test score on CTBS
$\overline{\text{CTB}}\ \text{pre}$ = mean student pre-test score
r_i = correlation of CTB post to PI
$PI_k = \text{Per}_{tk} \times TD_k$
$\overline{PI}$ = average program implementation ratio

Per_{tk} = % of program implementation by teacher as based on trainer rating

TD_k = degree of program delivery found by:

$$\frac{\text{\# of days belonging (absenteeism for each student)}}{\text{total \# of days belonging (152)}}$$

This analysis yielded an adjusted effectiveness score for each student. These scores plus all other raw data were keypunched onto computer cards. A duplicate deck is available on request.

A chart representing the student characteristics on one axis and the eight program alternatives on the other axis was constructed. (See Appendix D.) Each of the resulting two hundred fifty-two cells represented a unique set of student characteristics within a program.

The students belonging to each cell were identified and their adjusted gain (effectiveness) score was placed in the cell. A mean adjusted gain score was thus computed based on the individual student scores and the cell membership.

It should be noted that each cell includes both second and third grade students. The adjusted scores relate to grade level so that a score of 2.4 translates into a reading level of second grade, fourth month. At the time of testing, the average second grader reading at national norms would score 2.8 since the test is administered in the eighth month of school.

Last year the mean reading score for a second grade student in the Louisville School System was 2.3 and the mean score for a third grade student was 3.2. Therefore, it would be expected that the composite mean score for second and third grade students would fall somewhere within this range. Since the second and third grade scores are combined, it is possible that a program or treatment could have been more effective in one grade than the other, and this would not show up in the mean scores. Although this information should provide a guideline for understanding the effectiveness ratios reported, the important point of reference is the relationship of effectiveness scores among treatment groups. The significant questions are how does program A compare with program B and program A with program C, etc.

The completed chart gave the mean effectiveness score of each of the two hundred fifty-two cells followed by the number of students (in parentheses). Since there were only 433 students in the sample (7 third-grade children could not be included because no post-test scores were available) and 252 cells, it was anticipated that there would be empty cells due to the overload on certain student characteristics as already outlined. A total of 124

cells were left empty, with the majority of the voids occurring in the Teacher Corps DPI, PAD, and Follow-Through programs which had smaller samples.

In Figure 1, the mean effectiveness scores according to the dimensions of pre-school experience and self-adjustment are presented for each program. These two characteristics were combined since they are factors which a school system might attempt to improve or change.

FIGURE 1

Mean Effectiveness Scores According to Pre-School Experience and Self-Adjustment

Programs

	DPI	TC-DPI	PAD	FT
K, SA_1	2.6/66	2.5/14	3.1/14	3.6/54
K, SA_2	2.5/60	2.8/20	2.7/15	3.4/17
NK, SA_1	2.4/53	2.3/12	2.3/20	3.2/8
NK, SA_2	2.3/55	2.5/14	2.1/10	2.1/1
Total N =	234	60	59	80

Key: K = Pre-school
NK = No pre-school
SA_1 = More self-adjusted
SA_2 = Less self adjusted

Looking at the observed differences, matching K, SA_1 against NK, SA_1, and K, SA_2 against NK, SA_2, it is apparent that pre-school experience has a positive effect on the reading achievement of students with the same level of self-adjustment across all four treatment groups. Pre-school experience had a very large effect on achievement in the PAD program. It is difficult to make valid comparisons of pre-school effects in the Follow-Through program since so few students lacked pre-school experience.

On the other hand, the self-adjustment ratings of students seem to bear less consistent relationship to program effectiveness. In DPI and PAD, more-adjusted students have a slight edge, but in Teacher Corps DPI it is actually the less-adjusted students who do better. In PAD the more-adjusted students do somewhat better than less-adjusted students. Again, it is difficult to compare effectiveness in Follow-Through since the ratio of more-adjusted to less-adjusted students is 62 to 18, but indications are that more-adjusted students do better.

Although there is little a school system can do about characteristics of race, sex, and socio-economic status of their students, it is interesting to note program effectiveness with regard to these characteristics. This might be particularly useful when a system is concerned about a particular type of student, say low-income, white boys, and wants to find a program to fit their needs.

Figure 2 presents the relationship between sex and program effectiveness for each program.

FIGURE 2

Mean Effectiveness Scores According to Sex

	DPI			TC-DPI				
	Aide	Tutor	Regular	Aide	Tutor	Regular	PAD	FT
Male	$2.6/_{49}$	$2.3/_{43}$	$2.3/_{46}$	$2.2/_{7}$	$2.4/_{13}$	$2.5/_{11}$	$2.7/_{32}$	$3.2/_{37}$
Female	$2.6/_{30}$	$2.4/_{36}$	$2.4/_{30}$	$2.4/_{13}$	$2.8/_{7}$	$3.0/_{9}$	$2.7/_{27}$	$3.5/_{43}$
Total N =	79	79	76	20	20	20	59	80

The DPI program alternatives produced only small differences between male and female; however, in Teacher Corps DPI all the alternatives worked better for the girls. PAD had exactly the same effectiveness for girls and boys, while Follow-Through was more effective for girls than for boys.

Figure 3 presents the relationship between race and effectiveness scores for each program.

FIGURE 3

Mean Effectiveness Scores
According to Race

	DPI			TC-DPI				
	Aide	Tutor	Regular	Aide	Tutor	Regular	PAD	FT
White	$2.3/_{21}$	$2.5/_{18}$	$2.2/_{37}$	$2.4/_{12}$	------	------	$2.7/_{58}$	$2.9/_{1}$
Black	$2.7/_{58}$	$2.3/_{61}$	$2.5/_{39}$	$2.4/_{8}$	$2.6/_{20}$	$2.7/_{20}$	$2.1/_{1}$	$3.4/_{79}$

As the report previously pointed out, it is not possible to compare PAD and Follow-Through with regard to race since there was only one black student in the PAD sample and only one white student in the Follow-Through sample. Teacher Corps DPI alternatives are also not comparable for the same reason. However, in DPI, blacks did better in the aide and regular groups and whites did better in the tutor group.

Figure 4 presents the final student characteristic comparison, that of effectiveness with socio-economic status as based on free lunch qualification.

FIGURE 4

Mean Effectiveness Scores
According to Free Lunch Status

	DPI			TC-DPI				
	Aide	Tutor	Regular	Aide	Tutor	Regular	PAD	FT
Free Lunch	$2.5/_{57}$	$2.3/_{49}$	$2.4/_{62}$	$2.4/_{16}$	$2.5/_{18}$	$2.7/_{20}$	$2.4/_{34}$	$3.4/_{62}$
No Free Lunch	$2.9/_{22}$	$2.4/_{30}$	$2.4/_{14}$	$2.5/_{4}$	$2.6/_{2}$	------	$3.0/_{25}$	$3.5/_{18}$

For DPI and Teacher Corps DPI, socio-economic status makes little or no difference to program effectiveness except in DPI aide, where higher income students do much better. Higher income students also do better in the PAD program, but only slightly better in Follow-Through.

If we discard student characteristics altogether, and look only at the program variations within DPI and Teacher Corps DPI, the following overall results can be observed (Figure 5).

FIGURE 5

Total Mean Effectiveness Scores
In DPI and Teacher Corps DPI

	DPI			TC-DPI		
	Aide	Tutor	Regular	Aide	Tutor	Regular
$\bar{X}$ effec. score	$2.6/_{79}$	$2.3/_{79}$	$2.4/_{76}$	$2.4/_{20}$	$2.6/_{20}$	$2.7/_{20}$

Again relying on observed differences, within DPI the alternative of using reading aides was more effective than either the tutor or regular alternatives. The regular program alternative, i.e., the use of aides and tutors (or neither), was slightly more effective than the use of only tutors.

In Teacher Corps DPI the regular alternative was more effective than the use of aides or tutors by themselves. Of these two alternatives, the use of tutors was more effective than the use of aides. It should be noted that each of the Teacher Corps alternatives represents only one school. Thus, treatment effects could be tied to a unique situation within a school.

Figure 6 shows the total mean effectiveness scores for each of the four programs.

FIGURE 6

Total Mean Effectiveness Scores by Program

	DPI	TC-DPI	PAD	FT
Mean Effectiveness Scores	$2.4/_{234}$	$2.6/_{60}$	$2.7/_{59}$	$3.4/_{80}$

The Follow-Through alternative is observed to be the most effective of any other method in the sample. In fact, Follow-Through's 3.4 effectiveness score is a full year or more ahead of DPI tutor, DPI regular, DPI total, and Teacher Corps aide, and is six to seven months ahead of the reading effectiveness scores of Teacher Corps DPI total, PAD, and the remaining alternatives.

The second effectiveness measure which was examined was the number of DPI reading skills students in each treatment group passed. This measure, of course, does not involve PAD or Follow-Through.

Figure 7 shows the mean number of DPI skills passed by students in the sample in DPI and Teacher Corps DPI during the school year.

FIGURE 7

Mean Number of DPI Skills Passed by Sample Students in 1973-1974

	Aide	Tutor	Regular
DPI	98.7/ 79	112.1/ 79	92.8/ 76
Teacher Corps DPI	120.9/ 20	---*	127.6/ 20

*information not collected in this school

The students in the two Teacher Corps groups where data were collected (aide and regular) passed more skills than students in any of the DPI alternatives. Within Teacher Corps the regular group passed more than the aide group. Within DPI the regular group passed the fewest number of skills and the tutor group passed the most. It should be noted again that merely counting DPI skills has limitations as some skills are easier to master than others.

It is interesting to look at the performance of the DPI treatment groups on both of the effectiveness measures, number of DPI skills passed and adjusted gain scores. On both, Teacher Corps DPI came out higher overall than DPI. Within DPI the tutor alternative had the highest mean of skills passed, whereas that treatment was the lowest of the three alternatives on reading effectiveness scores. Of the two groups where data were collected in Teacher Corps DPI, the regular group did best on both effectiveness measures.

Costs

The budgets for each of the programs being studied were the base documents for securing cost information. Actual expenditures for each program were collected after the close of the fiscal year. School System accounting records were used in determining program costs.

Cost data pertaining to expenditures which were assumed to be equivalent for all programs were not collected. Examples of costs which are not included are central office administrative costs, utilities, custodial services, facility maintenance, principals' salaries, general fund school office expenses, and fringe benefits.

Thus, costs reported are comparable costs and are not the true costs of the programs.

Teacher costs vary among programs due to the School System's salary index which takes into consideration experience and level of training in determining salaries. An average teacher salary was used in computing program costs. Actual classroom size in each program was used to determine per pupil teacher costs which also accounts for variations between programs.

Although teachers were not directly involved in the program activities 100% of their time, the cost of teachers was not prorated. The rationale for including the total cost is based on the System's top priority placed on the instruction of reading; reading instruction is expected to be an integral part of the total instructional program.

Aide costs differ in DPI and Teacher Corps DPI because DPI aides were in the program for the full year while Teacher Corps DPI aides were not.

Figure 8 shows the per pupil costs which were computed for each program alternative.

Figure 8

Per Pupil Costs for Each Program Alternative

NOTE: Costs do not include factors which are comparable for all programs, e.g., central office general administrative costs.

	DPI			TC-DPI				
	Regular	Aide	Tutor	Regular	Aide	Tutor	PAI	FT
Basic Program Costs	$237.63	$237.63	$237.63	$237.63	$237.63	$237.63	$152.81	$448.61
Additional Program Costs	------	------	------	$147.17	$147.17	$147.17	------	------
Teacher Salaries	$316.06	$316.06	$316.06	$288.91	$288.91	$288.91	$315.78	$327.26
Aide Costs	$ 42.22*	$ 84.44	------	$ 25.38*	$ 50.76	------	------	------
Tutor Costs	$ 60.13*	------	$120.26	$ 60.13*	------	$120.26	------	------
Total Per Pupil Cost	$656.04	$638.13	$673.95	$759.22	$724.47	$793.97	$468.59	$775.87

*50% of per pupil costs

Cost Effectiveness Results

Interim results, i.e., program implementation, student characteristics and effectiveness measures, were described in the previous section.

Figure 9 provides the cost-effectiveness ratios for each program alternative. Ratios are computed by dividing the mean effectiveness measure by program cost. The higher the ratio, the more cost-effective the alternative.

FIGURE 9

Cost-Effectiveness Ratios

DPI			TC-DPI				
Aide	Tutor	Regular	Aide	Tutor	Regular	PAD	FT
.00407	.00341	.00366	.00331	.00327	.00356	.00576	.00438

The most cost-effective reading approach was the PAD program. The least cost-effective was the Teacher Corps DPI program alternative which used tutors only. (The reader is referred to the following section of this report for a discussion of the utilization of this data.)

Conclusions

The study was designed to test and demonstrate the feasibility of an approach for determining the cost-effectiveness of instructional programs. The approach was to collect, process, and analyze four categories of information: descriptive and implementation data, student characteristics, effectiveness measures, and costs.

Program implementation data were collected by interviewing teachers and staff trainers participating in the programs. This was not a satisfactory method for obtaining data. If resources had been available for collecting data using an observation/monitoring approach, more useful information may have been obtained.

Student characteristic data relating to socio-economics, race, sex, pre-school experience, attendance, and self-adjustment were collected. Self-adjustment data were collected by teachers completing a Child Behavior Rating Scale; an instrument completed by the students may have provided more useful and possibly more accurate data, but limited study resources constrained the utilization of a student-completed instrument. Some pre-school experience records were not complete, and it was not possible to determine for 15% of the students in the sample if they had had any formal pre-school learning experiences. Socio-economic information was collected by determining the free lunch status of each student.

The student characteristic data did not prove to be as useful as hoped, but did demonstrate the positive effects of pre-school educational experiences.

Effectiveness measures were standardized achievement test scores and the number of skills mastered as measured by criterion-referenced tests in DPI. Standardized test scores were obtained from school records. The number of skills mastered was obtained from program records.

Comparable cost data for each program were obtained from the official school system accounting records. No attempt was made to collect true program costs. (As noted previously, true costs would include all program costs. Comparable costs exclude those costs which would be equivalent across the programs.)

Cost-effectiveness ratios suggest that the Portland-Atkinson-Dolfinger (PAD) program was the most cost-effective of the approaches studied, while Follow Through appears to be the most effective.

The Teacher Corps program and the program which trained and provided tutors for the DPI program have goals which address needs beyond those of the reading programs being studied. No attempt was made to prorate the costs of these supportive/complementary programs. The reading cost-effectiveness should not be the only data used in analyzing the value and effectiveness of these programs.

There were three major factors which the study did not take into consideration in collecting, processing, and analyzing data. First, PAD and DPI were in their first and second years of operation, respectively. Both were experiencing some start-up problems. Follow-Through was in its fifth year of operation. The maturity of program operation may be a crucial factor in analyzing program effectiveness, i.e., Follow-Through may have had an advantage over the other two programs. The second factor which was not included was the scope of program operation. PAD and Follow-Through operate in three and four schools, respectively. DPI has been implemented in 26 schools. The relatively massive scope of DPI may be a complementary factor which effects the early successes of the program. The third factor which may have affected the standardized test scores for PAD students was the number of times standardized achievement measurement instruments were administered during the year. The multiple use of standardized tests may have helped develop test taking skills in PAD students. However, DPI and Follow-Through students were systematically tested using criteria referenced instruments and this activity may have helped develop test taking skills similar to those of the PAD students. Hence, it is difficult to determine the comparative effect of this factor.

These factors and previously summarized implementation problems must be considered in utilizing the findings of this study in the decision-making process. (Study-generated information has been used in the decision-making process by School System administrators.)

The study generated information which indicated the possible feasibility of the approach. The utilization of three of the four data types suggested in determining the cost-effectiveness of instructional programs was successfully implemented. The utilization of the fourth type, implementation data, was not adequately accomplished. Therefore, the feasibility of the approach was not completely demonstrated. However, the study does suggest a high likelihood of feasibility and has pinpointed areas of implementation difficulties. Hopefully, the results of this effort, both negative and positive, will assist in the development of a cost-effective methodology which can be utilized by the education practitioner.

Bibliography

Buros, Oscar Krisen, ed., Seventh Mental Measurements Yearbook, Vol. 1 (Highland Park, N.J.: Gryphon Press, 1972) p. 101-103.

Cassel, Russell N., The Child Behavior Rating Scale (Western Psychological Services: Los Angeles, 1962).

Forbes, Roy H., Cost-Effectiveness Analysis: Primer and Guidelines. Educational Technology. March, 1974.

Cost-Effectiveness Analysis: Primer and Guidelines

Roy H. Forbes

Cost-effectiveness analysis provides a conceptual framework for analyzing the cost and effectiveness of educational programs. When properly implemented, cost-effectiveness analysis provides the decision-makers with data related to the:

- cost of achieving program objectives;
- over-all effectiveness of a program in achieving its objectives, and
- program effectiveness with subgroups of students.

This information is valuable in planning new programs and in determining if existing programs should be expanded, continued, modified or deleted. The purpose of this primer and set of guidelines is to familiarize the educator with the concept of cost-effectiveness and provide him with adequate direction so that he may utilize this technique. Cost-effectiveness analysis does not make decisions. This remains the responsibility of the educator. Cost-effectiveness analysis simply provides the decision-maker with data which will aid him in making better and more realistic decisions.

Cost-effectiveness should not be confused with cost-benefit analysis. Many writers use these terms synonymously; however, for the purposes of this article, a clear distinction is made between these two concepts. Effectiveness is a measure of the achievement of program objectives. For example, if an objective of a human relations program is that 35 percent of all students successfully completing the program will subsequently volunteer for social service, then the effectiveness of the program can be measured by the number of students volunteering. Effectiveness is a measurement of program success in achieving stated objectives.

Cost-benefit is an analysis of the cost and the resulting monetary benefits of one or more programs or program components. For example, a cost-benefit analysis of a vocational education program would attempt to identify all monetary benefits resulting from the program. Some benefits are easily identified, e.g., potential increased earning power and the resulting increase in income tax revenue. However, other benefits become more difficult to measure, e.g., possible decrease in welfare expenditures, possible decrease in losses due to criminal acts and benefits associated with cultural contributions of time and resources. Cost-benefit analysis is normally more difficult to measure than cost-effectiveness analysis. The effectiveness measure is usually more easily identified and obtainable than measurement of benefits. It is more difficult to define the scope of a cost-benefit study. The scope of a cost effectiveness study is determined by the stated objectives of the program components which are to be analyzed.

Roy H. Forbes is with the J. Graham Brown Education Center, Louisville, Kentucky.

Cost-Effectiveness Elements

There are four essential elements that should be considered in a cost-effectiveness analysis:

- program descriptions,
- student characteristics,
- effectiveness measures, and
- costs.

Program descriptions. A program description should include the following items:

- program objectives—including anticipated outcomes;
- program plan—the implementation and operational activities of the program,
- program history;
- resource requirements,
- resource availability, and
- external constraints, e.g., community pressures.

The statement of the objectives is the most important part of a program description. The objectives of the program should be stated in measurable terms. Behavioral objectives tend to simplify the process for determining the effectiveness of the program, but they are not entirely necessary. Expressive objectives, if stated in *measurable terms*, can also be used.

A description of the implementation and operating plan of a program should include the following factors:

- list of program tasks, i.e., activities required to implement and operate the program, and
- personnel responsibilities, i.e., identify personnel responsible for performing program activities.

If the program is operational and no major changes in the operation of the program are planned, then the implementation of the program would be considered as historical data. However, if the program has not been completely implemented, then the implementation plan should be presented as current data. The implementation and operating plan are needed as process data. If, as in most cases, the effectiveness measure is related to the impact the program has on students, e.g., student achievement, then data pertaining to program process become extremely important. For example, by comparing the plans for the imple-

mentation and operation of a program with historical data representing the actual implementation and operation of a program, it is possible to determine if the measured effectiveness of the program results from the program designed to achieve specified objectives or a program whose objectives have been altered through the implementation and operating process.

This information is extremely important in the analysis of cost-effectiveness data. To achieve the stated objectives of a program, a process must be designed and implemented. If this process is not adequately designed to address each of the programs' objectives, and if the process is not efficiently implemented, then the cost-effectiveness analysis of the program should include the consideration of these process idiosyncrasies and their effect on the attainment of program objectives.

As indicated in the previous discussion, historical data pertaining to the implementation and operation of a program are important in cost-effectiveness analysis. Successes and failures of the process should be noted.

Historical and current operational data are used with cost and effectiveness measures in determining the over-all value of the program and reaching decisions for program improvement, alterations and deletions. Program plans and historical data may be verbally described. However, these should also exist in outline form, either as a flow diagram or in sentence outline.

The next two factors which should be included in a program description are resource requirements and their availability. Resources needed for the implementation and operation of the program should be listed. The availability of resources should be discussed. Program constraints resulting from supply deficiencies, state-of-the-art development lag and geographical and societal factors should be included in the description of program resource requirements and availability.

No description would be complete without a discussion of external constraints which affect the design and operation of the program. For example, local labor unions often influence the size and scope of vocational programs. Also, community groups are becoming more active in their concern for quality education. Although both of these factors normally have positive effects, the role which they play in the design and operation of educational programs should be identified and described.

Student characteristics. The second element which should be considered in a cost-effectiveness analysis is the set(s) of student characteristics used to describe the program's target population. Student characteristics could be listed as one of the items of a program description. However, its importance in cost-effectiveness analysis dictates that it be listed separately. Examples of student characteristics data are: chronological age, standardized achievement test scores, self-concept, personality, sex, grade, personal preference, e.g., goals, expectancies, etc., and socio-economic level, e.g., parents' income and education level, housing, etc.

Student characteristics data should be considered when comparing the cost and effectiveness of educational programs. Making decisions based on cost-effectiveness data without relating effectiveness and costs to student characteristics is not wise.

For programs which serve a small target population it may be desirable to collect characteristics data on all students. In other cases, a sample of student characteristics would be sufficient for an analysis. There are no hard and fast rules. The important factor is that no cost-effectiveness study should be considered complete unless the characteristics of the students being served are considered.

Student characteristics and program descriptive data are often not sufficiently considered in cost-effectiveness analysis. The name of the analytical technique may be responsible for placing emphasis on the cost and effectiveness aspects, but the descriptions of the programs being evaluated and the characteristics of the students are equally important factors.

Effectiveness measures. If the objectives of the program have been stated in measurable terms, then effectiveness is a measure of the level of achievement of the objectives. Instructional programs are often defined in terms of terminal and intermediate (enabling) objectives. In these cases, the effectiveness of the program would be measured in terms of the terminal objectives.

Objectives may also be measured in clusters. For example, a machine shop student may be measured on his over-all performance on the lathe instead of the teacher trying to measure separately each lathe operation. Therefore, the effectiveness measure would be related to modules of instructional objectives.

The general criterion for selecting an effectiveness measure should be the reliability and validity of the measuring instrument, with the most important aspect being content validity, i.e., the measurement of the achievement of the stated program objective.

Although it is not recommended, cost-effectiveness analysis can be performed even though program objectives have not been stated in measurable terms. For example, two alternative reading programs may be compared on the basis of cost and effectiveness without having stated program objectives. However, it would be necessary to make assumptions about the objectives of the program. One assumption would be that the programs are designed to improve reading

levels. Therefore, a reading test could be given to the students and the resulting scores used as an effectiveness measure.

Plans for the collection of unanticipated outcome data also should be developed. Although the effectiveness of the program is measured via objectives, it is necessary to include in the analysis data describing unanticipated program outcomes which relate to the over-all effectiveness of the program.

The selection of an effectiveness measure and an understanding of all the explicit and implicit assumptions related to the selection of the effectiveness measure are important basic steps in any cost-effectiveness analysis.

Costs. The final element in a cost-effectiveness study is the program cost. This element is purposely listed last. It is the easiest of the elements to grasp conceptually and often receives too much emphasis at the expense of the other three elements, especially the program descriptions (objectives) and the student characteristics data.

Although conceptually simple, the data collection and categorization of costs often become complex. There are many ways to classify costs of educational systems. This article will discuss three classification schemes for the purpose of developing the rationale for the data collection procedures suggested for use in cost-effectiveness analysis.

The first scheme consists of two dichotomous classifications: individual-society and measurable-nonmeasurable. The expenditures authorized by the local school board are an example of a measurable societal cost. This is the cost of education with which taxpayers are becoming more concerned. These costs include the capital and operating funds needed for providing local educational opportunities. These expenses are referred to as measurable individual costs. They may include transportation, if bus service is not provided by the school system, and personal school supplies, e.g., paper, pencils, notebooks, lunch money, etc. The loss of earning power by students attending high school is considered by some writers to be an individual cost. Attempts have been made to assign monetary values to this "lost" income, thereby making it a measurable cost. However, the economic effect on wages and employment opportunities if all high school students become part of the job market is not reliably predictable, therefore, this "cost" should be considered as nonmeasurable. An example of a nonmeasurable societal cost is the financial results of the misuse of funds due to poor planning.

The procedures suggested for use in cost-effectiveness analysis are limited to investigating only measurable societal costs.

Measurable societal costs may be classified as direct or indirect. Direct costs are those expenditures incurred in providing educational opportunities, e.g., salaries (instructional and administrative), supplies, textbooks, buildings (construction and maintenance), repairs, utilities, heat, debt service, employee benefits, etc. These are the items which are listed in the school system's budget. Indirect costs are those expenses considered to be related to the operation of the school system but which do not appear on budget requests. A prime example is the "loss" of tax dollars which results when school buildings occupy land which would have a high tax assessment. Some cost-effectiveness techniques suggest that indirect costs should be estimated and included in the total costs of the school system. For cost-benefit analysis, as previously described, this may be relevant. However, these indirect costs need not be considered in cost-effectiveness analysis.

The costs suggested for analysis in a cost-effectiveness study—direct measurable societal costs—may be classified as either capital or operating costs. For purposes of cost-effectiveness analysis, capital costs may be defined as those expenditures related to the planning and implementation of educational programs. Included in this cost category are initial program planning, building, building renovation, acquisition of equipment and non-expendable materials, special training and orientation programs, administrative and/or instructional personnel or services in excess of the planned operational level and other costs related to the planning and implementation phase of a program. Similar costs associated with the implementation of changes to existing programs are also considered to be capital costs.

Operating costs include those items associated with the operation of a program, e.g., salaries, supplies, transportation (if provided by the school system), heat, utilities, employee benefits, debt service, custodial services, etc.

Capital costs may be amortized and added to the operational costs to determine a total program cost. Again, this process may be useful in cost-benefit analysis, but the cost-effectiveness analysis suggested in this article does not require this step. Capital cost, with amortization rate data, and operating costs may be kept separate. This latter method is recommended.

One more level of cost categorization needs to be explained. This categorization is concerned with the assignment of costs to specific programs. Three types of cost assignments are recommended: direct assignable, prorated per student and prorated per space. Instructional salaries, supplies and textbooks can be directly related to specific programs. But the costs of administering the school system and the heating of school buildings must be mathematically prorated* to assign costs to specific programs.

*Proration guidelines are available from the author upon request.

A case can be made for comparing only those costs which can be charged directly to specific programs. This is supported by the concept of relevant cost comparisons when performing cost-effectiveness analysis. This concept states simply that there is no need to consider those costs which would be equally prorated to the programs or components being investigated. For example, assume that a decision must be made between two alternative methods for achieving the same set of program objectives. Each alternative services the same number of students and requires the same amount of space utilization. Nondirect assignable operation costs are determined by prorating on a per student or per space basis. Therefore, in the assumed case, these prorated costs would be equal. Since the addition of this amount to both sets of costs would not alter their ranking, this arithmetic exercise becomes academic. The direct assignable cost would provide the cost data needed for a decision.

In summary, the types of cost data recommended for collection are capital and operating costs which are direct measurable societal expenditures.

The following procedures are recommended for use in the collection of cost data. The accounting classification structure presented in this discussion is intended to be only an example. It should not be used by systems which have different accounting structures unless the system's structure does not provide necessary coding flexibility to collect program and subprogram data. Cost-effectiveness procedures should be altered to fit into the accounting and budgeting systems of the school. The accounting and budgeting system should not be built around the cost-effectiveness procedures. Of course, the optimum procedure is a planning-programming-budgeting system designed for a school system with the cost-effectiveness analysis function as one of its features.

A manual prepared by the Division of Research and Development, Department of Education, Commonwealth of Massachusetts, describes accounting and budgetary procedures for vocational education costs. The codes suggested in this document provide the flexibility necessary for identifying program and subprogram costs. For example, 2314-33-1,100 identifies a teaching salary for the accounting and computing subprogram of the vocational day school office occupations program. This level of coding is necessary only for direct assignable costs. Costs which are prorated or treated as overhead cost do not require this degree of specificity in the assignment of codes. For example, the code assigned to an expenditure related to the heating of the building is 4120. Short codes are assumed to have digits omitted to the right of the code which appears.

If more detail is needed, it is possible to add additional code fields to the right of the fields already suggested. For example, if the instructional objectives of the accounting and computing subprogram are divided into three modules and it was desirable to collect cost data at the module level, then the code 2314-33-1,100-001 may be used to identify the teaching salary expense assigned to the first instructional module.

It is also theoretically possible, and with an automated accounting system feasible, to extend the system to provide cost data for the following analysis.

> Students are given several alternative methods of achieving an instructional objective. The instructional alternatives include a regular classroom/instructor learning experience, a programmed text, a computer assisted instructional sequence and a learning lab experience. Each of these alternatives requires a different set of resources and hence each alternative has a unique cost element. If a cost-effectiveness analysis is performed to determine which of these instructional alternatives should be provided, it would be necessary to have cost data broken down to the instructional alternative level.

However, it is not necessary to maintain the above level of detail unless the students are provided with instructional alternatives. The level of detail which is desirable is a function of:

- the instructional methods used, e.g., traditional, individualized instruction, etc.,
- the approach employed in the stating of instructional objectives, e.g., behavioral stated objectives, expressive objectives, clusters (modules) of objectives, etc.; and
- the method used for prorating expenses.

The amount of cost data to be collected for a cost-effectiveness analysis is dependent upon the following two questions: (1) Are the cost and effectiveness comparisons to be based on direct assignable costs or on direct assignable plus prorated costs? If the former is selected, then it is not necessary to collect costs which would be prorated. However, this choice implies that either the prorated costs are approximately equal for the programs (or program parts) being compared or that this difference in overhead costs will be accounted for using other means during the analysis of the data. If the latter method is selected, then it is necessary to collect data which will be prorated. It may be determined that the number of students to be served by the programs will remain constant, but that the space requirements vary. In this case it would be appropriate to collect direct assignable cost data and the cost data which are prorated per space for a relative cost comparison. (2) Are both capital and operating costs to be compared? If the cost-effectiveness analysis is to be used in

reaching decisions pertaining to selections of new programs or major changes to existing programs, then capital costs must be considered. However, if decisions are to be made pertaining to operational programs or parts of programs, then it may not be necessary to consider capital costs.

Depending upon the answers to the above two questions, the amount of data to be collected can vary between a minimum of the direct assignable program (or part of a program) operational costs to a maximum effort requiring the collection of all capital and operating cost of the school system. The answers to these two questions are dependent upon the plan and purpose of the cost-effectiveness analysis.

Data Analysis

Although the discussion of data analysis is presented following the description of the data collection processes, it should be pointed out that activities of the analysis procedures occur both before, during and after data collection. Data analysis can be divided into three phases: planning, monitoring and analyzing. The planning activities should precede the collection of data. Monitoring of data occurs during the collection process and the analyzing of the data occurs after data collection is complete.

Planning. Planning for a cost-effectiveness analysis does not differ generically from other planning processes. The first step is to define the goals and objectives of the analysis. The purpose and scope must be defined. The goals should describe the purpose and the scope should be identified by the objectives. The critical questions to be raised in defining goals and objectives are

- What prompted the need for a cost-effectiveness analysis?
- Which programs (or parts of programs, e.g., alternative instructional methods) will be analyzed?
- Are there any constraints - implied or explicit - placed on the analysis?
- How will the resulting data analysis be used in reaching decisions?

The answers to these questions will provide the data needed for designing the goals and objectives of the cost-effectiveness study.

The next step is to define the anticipated outcomes of the cost-effectiveness procedure. This does not mean that the results of the analysis will be anticipated. "Outcomes" refer to the types of data that will be available to the decision maker as a result of the analysis. The need for certain "outcomes" should be explicit in the statement of the objectives of the analysis.

The third step in the planning process is to identify the data requirements and analytical techniques which will provide the anticipated outcomes. Data requirements for each of the four elements essential in a cost-effectiveness analysis should be determined.

Program descriptions, as previously discussed, are a *must*. These descriptions would contain the program objectives which, in turn, would lead to the identification of the effectiveness measure(s). Instruments for collecting effectiveness data could then be identified or designed and tested.

The requirement for student characteristics data is very subjective. An example of the importance and use of the data may best dramatize the need. Assume a cost-effectiveness analysis is being conducted to determine if one of several instructional alternatives for achieving a set of objectives should be deleted. The objectives are well defined and appropriate effectiveness measurement instruments have been selected. The cost of each alternative method has been derived. Alternative "B" has a relatively high cost when compared with alternative "A." The effectiveness measure indicates that the mean student achievement is higher for alternative "A" than for alternative "B." The following figure illustrates these relative results:

	Alternative	
	A	B
Cost	1.0	2.5
Effectiveness	1.7	1.0

The relative comparison indicates that alternative "A" both costs less and has a better rate of achievement than alternative "B." Without any student characteristics data, the choice may be to delete alternative "B." However, an examination of student achievement and student characteristics through an aptitude treatment interaction research model (Cronbach, 1967) may indicate that certain types of students achieve significantly better with alternative "B" than with alternative "A." This adds valuable data for use in the decision process. The decision may be to keep both alternatives instead of deleting alternative "B."

The level of cost data required is also a function of the purposes of the cost-effectiveness analysis. For example, if new educational programs are being planned and if student characteristics and effectiveness data can be simulated, then it may be the goal of the study to perform a cost-effectiveness analysis for all subprograms within the designed program. Since the program would be new, the capital expenditures would be appreciable. Therefore, they should be included in the cost study. All operational costs would also be included. Costs assignable directly to subprograms would be identified. Assuming variations in the number of students each subprogram would

serve and the amount of space required for each subprogram, all overhead (nondirect assignable costs) expenses would be prorated. This example would require a maximum cost data collection.

An example where the capital costs would not necessarily have to be collected follows. Assume the existence of space, trained personnel and equipment which could be used for several alternative programs, such that the implementation and/or operation of any of the alternatives would not require any additional capital expenditure. It would not be necessary to consider capital costs even though the programs require the available capital resources. The cost-effectiveness analysis should consider only the relative costs—the operational costs—of the alternative programs. It would not be necessary to collect cost data for capital resources—these have been assumed to be equal.

The minimum level of data collection, i.e., collecting only direct assignable operating costs, could result from the following situation. Assume that two alternative instructional methods are being compared by their cost-effectiveness. Assume that each method serves the same number of students and requires the same amount of space. Also assume that no new capital expenditures are required. The only costs which would be relevant to the analysis would be the direct assignable operational costs.

During the planning stage of a cost-effectiveness analysis it is necessary to identify the data requirements. These requirements vary depending on the objectives of the analysis. There are no explicit guidelines for determining data requirements. The above discussion was intended to introduce some of the factors which should be considered.

Also included in the third step in planning for a cost-effectiveness study is the selection of analytical techniques to be used in the analysis. The comparison of costs and effectiveness is not complex. An example of comparing two alternatives was previously presented in the discussion pertaining to student characteristics data requirements. Instead of using a relative scale, the actual costs and effectiveness measures could be used. The main disadvantage in using "relative" costs is that the public and school board members are accustomed to discussing per pupil costs based on total expenditures. Costs which are not total costs but are only that portion considered necessary for a cost-effectiveness comparison may prove to be confusing.

The plans for a cost-effectiveness study should also include approaches for achieving staff participation in the implementation of the process. The successful use of cost-effectiveness techniques is strongly dependent upon the quality of the data used in the analysis. The data quality is determined by its availability and the persons responsible for collecting the data. The availability of data is a factor which can be determined by the person responsible for planning the analysis and he can make the necessary planning adjustments.

The collection of student characteristics and cost data normally requires the involvement of a few individuals, i.e., the guidance counselor and finance officer. However, the collection of effectiveness measures and program descriptions can involve many individuals. Hence, the planning for the active participation of these individuals must include approaches for developing a strong understanding and appreciation for the concept of cost-effectiveness analysis.

Some approaches which could be used in achieving the above goal are:

- inservice training sessions which use practical problems as examples of how cost-effectiveness analysis can be used;
- involvement of key staff members in a decision-making process which necessitates the use of cost-effectiveness analysis; and
- demonstration by administrators that cost-effectiveness can be used to reach better decisions in the planning and operation of the school.

Planning the data analysis portion of a cost-effectiveness study should occur prior to data collection.

Monitoring. The analysis task which occurs simultaneously with data collection is the monitoring activity. Steps should be taken to ensure that the most reliable data possible are collected. Any problems which occur and assumptions made during the data collection phase should be explicitly recorded.

Analyzing. The final phase of the data analysis procedures occurs following the data collection and categorization process. The analytical techniques planned are executed. The data and analytical results are then presented for utilization by the decision-makers.

Cost-Effectiveness Decisions

Cost-effectiveness analysis does not make decisions. It provides the decision-maker with data which will aid him in making better and more realistic decisions. The decision process remains the prerogative of those persons responsible and accountable for the planning and operation of the educational system.

Process Summary

The described cost-effectiveness approach is summarized by listing process activities. These activities are listed in the normal order that they initially occur. Many of the activities are iterative, i.e., they are refined following the completion of subsequent activities; therefore, the following list should not be considered as a "once through" checklist.

- Determine goals and objectives of the analysis
- List anticipated outcomes
- Determine analytical techniques to be used
- Identify general data requirements
- Plan staff participation
- Collect program descriptive data (including program objectives)
- Identify effectiveness measures
- Identify or design and test effectiveness measurement instruments
- Determine student characteristic data requirements
- Determine cost data requirements
- Identify data sources
- Plan data collection
- Data collection and categorization (including monitoring of data quality)
- Data analysis
- Data utilization for decision-making

This process will provide data pertaining to the costs and effectiveness of programs designed to achieve stated objectives. But this, alone, will not provide data for determining the social responsiveness of the educational system. Cost-effectiveness analysis of instructional programs which are not based on the community's social and economic needs will only give information on how well the *wrong* things are being achieved. Cost-effectiveness analysis is a "means" by which educators can improve the responsiveness of the educational system; it should not be an "end" for the educational administrator. □

Selected Readings

Cronbach, L.J. How Can Instruction be Adapted to Individual Differences? In R.M. Gagné (Ed.) *Learning and Individual Differences*. Columbus, Ohio: Charles E. Merrill, 1967.

Eisner, E.W. Instructional and Expressive Educational Objectives: Their Formulation and Use in Curriculum. *AERA Monograph Series on Curriculum Evaluation*. Washington, D.C.: AERA, 1969.

Forbes, R.H. A Technique for Analyzing the Costs of an Educational Program Based on Behavioral Stated Instructional Objectives. Unpublished Ed. D. dissertation, University of Massachusetts, 1970.

Kaufman, J.J., and M.V. Lewis. *The Potential of Vocational Education: Observations and Conclusions Based on a Study of Three Selected Cities in Pennsylvania*. University Park, Pennsylvania: The Penn State University, The Institute for Research on Human Resources, 1968.

Kraft, R.H.P. *Cost-Effectiveness Analysis of Vocational-Technical Education Programs*. Tallahassee, Florida: Educational Systems and Planning Center, The Florida State University, 1969.

Quade, E.S. *Cost-Effectiveness: An Introduction and Overview*. Santa Monica, California: The Rand Corporation, 1965.

Appendix B

Program Descriptions

The DPI reading program was formulated by the teachers and the staff of the Louisville Public Schools and went into effect in the Fall of 1972. The school system made a major commitment to improve the level of reading in its schools and devised a Diagnostic-Prescriptive-Individualized Primary Reading Program under Title I auspices. An outline of the basic DPI program, followed by an explanation of the instructional variations within the program, is given below. This outline is taken directly from the DPI handbook as revised in June, 1973.

The DPI Reading Program is based upon the assumption that a child will learn most easily and effectively if his learning strengths and weaknesses provide the basis for his instruction. In order to do this, the first step is the clear definition of the student's learning strengths and weaknesses, or a diagnosis. Then instruction is prescribed for the pupil, based on the diagnostic data. The next step is the individualization of the student's instruction giving attention to each student's interests, abilities, and achievement level.

The strategy of the DPI Program involves six major elements:

1. The concentration of resources will be on the primary grades and kindergarten. In these grades, the program requires total commitment to a developmental rather than a remedial reading program and will involve approximately 120 classrooms.

2. For the reading instruction and language development time block, from 8:30 to 11:30 a.m. daily, there must be a pupil-adult ratio of 8-1. This ration will be achieved through the use of supportive personnel in each classroom. The supportive personnel includes para-professional reading aides and secondary cross-age tutors (SCAT).

3. Introduction of diagnosis and prescription of individual students in reading is an instructional process. There will be three-week instructional cycles which include diagnosis, prescription, individualized instruction, monitoring and feedback.

4. The development of multi-approach program streams in each primary classroom will develop the capability for individualized instruction. The specific techniques, materials, and methodology of the reading instruction will be determined by the individual school.

5. There will be an increase in the amount and type of instructional and technical expertise available directly to classroom teachers and principals in the area of reading. Specifically, a Reading Specialist and Monitoring Technician will be assigned to each ten DPI classroom teachers for continuous assistance. The Central Office Reading Curriculum Specialists will be available continuously. Criterion-referenced instructional objectives for reading skills on various levels will provide the basis for program streams and the three-week instructional cycles.

6. Quality in-service programs geared to the needs of teachers and principals will be developed.

The overall objective of the DPI program is a reduction of one-half of the deficiency between 1971 post-test scores on the Total Reading Score of the CTBS and grade expectancy. This was to be achieved by spring, 1974, as measured by the Total Reading Score CTBS.

Individual objectives for each child are set forth in the prescription for a three-week cycle and involve reaching a designated skill level. These cyclical criterion-referenced tests will be utilized in the evaluation of program effectiveness.

All DPI programs follow the model as described above. However, alternative methods of individualizing instruction are used which have cost differences. The instructional alternatives within the DPI program are described below.

Alternative 1: Regular DPI This title refers to the program precisely as described in the attached DPI outline. Regular DPI utilizes aides or tutors or both, or neither, to meet the reading needs of the individual child. The type of help given is decided by the DPI teacher and reading specialist and the pattern of help may be changed to meet the needs of the child.

Alternative 2: Aide Tutored DPI - The instructional plan remains the same with the exception that an aide is assigned to the student to supply individual assistance. In this alternative only aides provide individual instruction; tutors will not be used. Aides are involved in a training institute prior to their involvement in DPI classrooms and receive additional training during the school year. (See description of training for aides.)

TRAINING INSTITUTE FOR READING AIDES

Purpose

The purpose of the D. P. I. Training Institute for reading aides is to give necessary reading skills to paraprofessionals so that they can effectively offer supplemental services to students on a one-to-one or small group basis.

The reading aides will be expected to know reading skills and corresponding instructional techniques for their role in the D. P. I. Primary Reading Program.

Organization

There will be approximately 130 reading aides participating in the institute. The training staff will consist of two professional and two paraprofessional positions.

Duration

The training will operate in two phases. The first phase will be held during the first two weeks of the school year. During this period, the reading aides will report to the training institute daily for intensive preparatory experiences. The second phase of the training institute will begin following the initial two week period and continue throughout the school year. Small groups of reading aides will be cycled through this phase periodically for continuous training.

Provision in this on-going training institute will be made for aides that are new to the program as replacements.

Design of the Training Institute

There are five major reading skill components. They are organized into the following units of skill development for which modules have been prepared:

Pre-Reading Skills
Perception Skills
Comprehension Skills
Word Recognition Skills
Study Skills

These components are made up of module clusters of varying lengths. Reading aides are to progress through the modules at their own rate of speed.

Alternative 3: Student Cross-Age Tutored DPI - The instructional plan remains the same, but a junior high school tutor is assigned to supply individual assistance to the DPI student. In this alternative, only tutors will provide individual instruction; aides will not be used. Tutors are trained under the Emergency Secondary Aid Act, a federally funded program, and they must meet set standards in reading before they can tutor. The DPI program pays the tutors an hourly wage for their services.

Alternative 4, 5, & 6: Teacher Corps DPI - These alternatives will be examined under the three models previously described: regular DPI, cross-age tutored DPI, and aide-tutored DPI. The instructional model remains the same, but the costs are different since the classroom teachers are trained and supervised under the Teacher Corps program.

The overall objectives of Teacher Corps include the following:

1. Achievement of more relevant educational programs in local schools.
2. Collaboration between the universities and the school district in the development of experimental programs to meet individual pupil needs.
3. Improve achievement of pupils in reading and mathematics.
4. Foster teacher initiative.
5. Improve pupil attitudes and interpersonal skills.
6. Create racially balanced faculties.
7. Expand and strengthen in-service programs.
8. Develop procedures to achieve equilibrium between curriculum continuity and local school autonomy in a decentralized organization.
9. Improve and increase communication and feedback at all levels.
10. Improve assessment of students entering teacher education programs.
11. Develop more effective means of preparing new teachers.

There are also two reading programs in the Louisville Schools which utilize other types of instructional methods. Since these programs have different budgets and different approaches to reading, they were used as comparisons to the various DPI alternatives.

Follow-Through - The Louisville Follow-Through Program is operative in four schools and in a total of thirty-one first, second, and third grade classrooms. The program follows the University of Kansas model for Behavior Analysis Classrooms. In the Kansas model, instructional objectives are defined and then the skills of individual children are diagnosed to determine the discrepancy between the goals and the present skill of each child. The token exchange system is used to reinforce the child's motivation to learn and to succeed.

The University of Kansas provides training in the procedures of Behavior Analysis through workshops, in-service courses, and consultation. As local personnel become proficient in operating the program, the role of the university decreases and new staff are locally trained.

A Behavior Analysis Follow-Through classroom has the following characteristics:

1. Classes are team taught. There is a lead teacher, a teacher assistant, and two parent aides.
2. To insure a smooth classroom operation, a period is set aside each day for team planning sessions.
3. Planning, formal instruction, and back-up activities are the three parts of a daily classroom schedule.
4. Classes use curriculum materials that: describe the behavior the child will be capable of at the end of the sequence; require frequent responding by the child; contain clear criteria for a "correct" response; allow for individual rates of progress; and provide for periodic testing of achievement gains.
5. Class schedules alternate instruction with token exchange activities. The periods of instruction should gradually increase in length during the year.
6. Discipline is maintained by ignoring inappropriate behavior while providing heavy and frequent reinforcement for desirable behavior. Behavior which cannot be ignored because it is too dangerous or disruptive is handled through use of the Time-Out procedure.

Lead teachers and training staff set the following instructional goals in reading for Follow-Through children for the 1973-74 school year.

1. Children will maintain a specified rate of progress through the programmed material. Eighty percent of the children in ninety percent of the classrooms will be on target throughout the 1973-74 school year.
2. Children will acquire the skills specified in the programmed materials. Eighty percent of the children in ninety percent of the classrooms will acquire functional reading and math skills.
3. Children will demonstrate ability to use the reading skills they have acquired. The median child will perform at or above grade level in reading in May, 1974, (as measured by the California Test of Basic Skills and the Wide-Range Achievement Test).

The Portland-Atkinson-Dolfinger Project (P.A.D.)- The final instructional alternative to be evaluated under the cost-effectiveness model is known by the P.A.D. acronym. The project name represents the schools in which the instructional model is used. The project is funded under a grant from the U. S. Department of Justice - Law Enforcement Assistance Administration.

Project P.A.D. is an attempt to reverse the students' experiences of failure and transform them into success and achievement utilizing a theoretical model which emphasizes a developmental sequence of behavior characterized by successively more complex organization and demonstration of skills.

A second assumption of P.A.D. is that failure to develop basic skills, such as reading, and failure to adapt to the school environment as indicated by poor attendance are critical variables in the development of dysfunctional and maladaptive behaviors. Thus, it is hoped that successful development of basic skills will help to reverse the emergence of such dysfunctional behavior.

A final assumption is that behavior is learned, maintained and supported by the consequences it generates. Thus, changing a child's behavior involves changes in the consequences of his present behavior and shaping new behavior based on the skills a child possesses. Changing teacher behavior toward a child should, then, change the child's behavior.

The theoretical model is transferred to the school program in grades 1-6 through the following intervention plan:

1. Individualized criteria-referenced instruction in reading and math.
2. A consistent time and space management system.
3. Positive motivation system.
4. A data based decision-making system.
5. A "staff trainer" concept.

Appendix C

DPI MODEL

To teach reading to (name of child) the DPI teacher follows the diagnostic-prescriptive model for individualizing instruction. The prescription is written after informal observations have been considered and after the diagnostic data has been compiled and analyzed by the reading specialist. Together, the DPI teacher and reading specialist write a prescription for (name of child).

The following general guidelines are followed by the teacher for formulating the prescription:

1. Selection of realistic objectives for the student.
2. Selection of the best modality for learning and then matching materials to that modality.
3. Selection of materials appropriate to the student's age and instructional and interest levels.

The written prescription includes:

1. The activities to be taught in conjunction with the core program. This includes new skills.
2. The skills to be reviewed or emphasized in the classroom through individualized assignments.
3. The skills to be drilled by supplemental personnel.

The DPI teacher has many ways available to teach and review the prescribed skills. However, everyday the student is scheduled to spend some time in three kinds of groupings: large group instruction, small group instruction, and individual study. The length of time spent in each activity is scheduled according to the individual needs of the students.

INTERVIEW FORMAT - DPI TEACHERS

Name _____
School _____
Grade _____

1. How did you teach reading to _____ during this instructional cycle?

2. Do you have help in your classroom _____Yes _____No.
If yes, what kinds of help do you directly supervise or plan for. (Distinguish from help the reading specialist is responsible for.)

   a. How do you use this help.

   b. How many times a week and how long during the day would a child get this help.

3. Please read the following general description of the DPI teacher's role in teaching reading. What percentage of the time does your teaching follow this model _____%.
How does what you do differ from this description?

INTERVIEW FORMAT - FOLLOW-THROUGH TEACHERS

Name _____

School _____

Grade _____

1. How did you teach reading to _____ during this instructional earn period?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

2. When you consider your teaching of reading to the children in your class, what percentage of the time:

Are the children on task _____
Are on-task contacts made _____
Do contacts contain praise _____
Are tokens paired with praise _____
Do contacts with prompts also contain descriptive praise _____
Are no disapprovals given _____

How does what you do differ?

_____

_____

_____

_____

_____

Program Description

PROJECT ATKINSON, DOLFINGER, PORTLAND

The classroom component of Project Atkinson, Dolfinger, Portland consists of five basic components: an individualized curriculum, a classroom model, the use of positive reinforcement, the use of P.T. charts, and the availability of a staff trainer.

CURRICULUM

The project has supplied a number of published materials for use by the classroom teachers in reading. These materials are to help the teacher individualize his or her curriculum as much as possible. In reading, the basic materials are Sullivan Programmed Reading (Grades 1-3). Teacher made and other published materials may be used as long as they are referenced and related to the basic materials.

CLASSROOM MODEL

The classroom model is simply a way for teachers to work with smaller groups of students rather than the entire class. The model refers to the use of the activity centers and the wheel. It also involves the use of a consistent time schedule for every classroom to aid the teacher in time management and implementation of the different curriculum pieces.

POSITIVE REINFORCEMENT

This refers to setting a positive atmosphere for the classroom through positive verbal or non-verbal methods or the setting of specific expectations. Positive reinforcement is used both for behavior control and academic motivation.

USE OF P.T.

This refers to taking one minute samples of students reading from word lists correlated to the reading programs. The data is then put on a P.T. chart. It is used as a diagnostic and record keeping system,

THE STAFF TRAINERS

The staff trainer works with teachers on an ongoing basis during the year on implementation of the four basic components of the project. They are housed in the school, and assigned to work with particular teachers, primarily in the following ways: supplying of materials; giving support; providing classroom interventions; and giving feedback.

INTERVIEW FORMAT - PAD TEACHERS

Name _____
School _____
Grade _____

I. How did you teach reading to _____ during the first Sullivan morning wheel time?

II. 1. Please read the Curriculum section of the program description and answer this question: During your first reading wheel, what % of the time is this statement accurate? _____%

2. Please read the Classroom Model section of the program description and answer this question: During your first reading wheel, what % of the time is this statement accurate? _____%

3. Please read the Positive Reinforcement section of the program description and answer this question: What % of the time during your first reading wheel do you utilize this style of interaction? _____%

4. Please read the P.T. section of the program description and answer this question: In your class, what is the average number of P.T. times per child per week? _____ times

5. Please read the Staff Trainer section of the program description. Rate whether the staff trainer appropriately meets your needs in the following areas on a scale of 1 to 7 with 1 being not appropriate and 7 being very appropriate.

Supply of materials	1 2 3 4 5 6 7
Giving support	1 2 3 4 5 6 7
Providing classroom interventions	1 2 3 4 5 6 7
Giving feedback	1 2 3 4 5 6 7

APPENDIX D

MEAN EFFECTIVENESS SCORES

Student Characteristics		DPI Aide	DPI Tutor	DPI	TC Aide	TC Tutor	TC	PAD	Follow Through
FL K	SA_1 MW	2.7(1)	1.9(1)	2.4(3)	2.2(2)	-----	-----	2.2(2)	-----
FL K	SA_1 FW	-----	2.8(2)	2.2(2)	1.9(2)	-----	-----	2.8(6)	-----
FL K	SA_1 MB	3.2(1)	2.4(5)	2.5(9)	2.0(1)	2.7(2)	-----	2.1(1)	3.4(10)
FL K	SA_1 FB	2.9(4)	2.1(7)	2.7(6)	3.0(2)	2.7(1)	2.4(1)	-----	3.8(20)
FL K	SA_2 MW	2.1(1)	-----	2.0(3)	-----	-----	-----	2.2(4)	-----
FL K	SA_2 FW	-----	2.6(1)	1.8(1)	2.6(1)	-----	-----	1.9(1)	-----
FL K	SA_2 MB	2.5(9)	2.2(8)	2.1(3)	2.0(2)	2.0(4)	-----	-----	3.1(14)
FL K	SA_2 FB	2.6(4)	1.8(3)	2.2(2)	2.7(1)	2.8(2)	-----	-----	3.2(10)
FL NK	SA_1 MW	2.4(5)	2.5(2)	2.5(5)	-----	-----	-----	3.0(5)	-----
FL NK	SA_1 FW	2.0(3)	2.0(1)	2.5(5)	2.7(2)	-----	-----	2.4(9)	2.9(1)
FL NK	SA_1 MB	2.4(7)	2.4(6)	2.4(4)	-----	2.4(1)	2.6(9)	-----	3.6(3)
FL NK	SA_1 FB	3.1(4)	2.6(3)	2.0(1)	-----	-----	3.2(7)	-----	3.5(1)
FL NK	SA_2 MW	1.6(1)	-----	2.0(7)	2.7(2)	-----	-----	2.1(4)	-----
FL NK	SA_2 FW	2.2(3)	2.2(2)	2.3(4)	1.6(1)	-----	-----	1.9(2)	-----
FL NK	SA_2 MB	2.3(8)	2.3(8)	2.3(5)	-----	2.6(5)	2.0(2)	-----	2.5(1)
FL NK	SA_2 FB	2.7(6)	-----	2.9(2)	-----	3.0(3)	2.6(1)	-----	2.0(2)
NFL K	SA_1 MW	2.7(3)	-----	1.9(1)	-----	-----	-----	3.8(4)	-----
NFL K	SA_1 FW	-----	3.2(3)	-----	1.9(1)	-----	-----	3.3(5)	-----
NFL K	SA_1 MB	3.2(4)	2.1(2)	2.4(1)	-----	2.7(1)	-----	-----	3.3(4)
NFL K	SA_1 FB	-----	2.5(7)	2.8(4)	2.2(1)	-----	-----	-----	3.8(7)
NFL K	SA_2 MW	-----	2.6(3)	2.1(1)	-----	-----	-----	2.5(6)	-----
NFL K	SA_2 FW	-----	2.0(2)	-----	-----	-----	-----	-----	-----
NFL K	SA_2 MB	2.9(4)	2.2(2)	2.8(2)	-----	-----	-----	-----	3.2(4)
NFL K	SA_2 FB	3.2(2)	2.0(2)	-----	2.2(1)	2.5(1)	-----	-----	3.7(2)
NFL NK	SA_1 MW	2.7(1)	-----	1.8(1)	-----	-----	-----	2.9(4)	-----
NFL NK	SA_1 FW	2.1(2)	-----	2.2(2)	2.7(1)	-----	-----	3.1(3)	-----
NFL NK	SA_1 MB	3.8(3)	2.7(2)	-----	-----	-----	-----	-----	3.2(1)
NFL NK	SA_1 FB	2.9(1)	2.2(2)	-----	-----	-----	-----	-----	-----
NFL NK	SA_2 MW	-----	2.0(1)	2.1(1)	-----	-----	-----	2.6(2)	-----
NFL NK	SA_2 FW	2.1(1)	-----	1.7(1)	-----	-----	-----	2.0(1)	-----
NFL NK	SA_2 MB	2.7(1)	2.1(3)	-----	-----	-----	-----	-----	-----
NFL NK	SA_2 FB	-----	2.7(1)	-----	-----	-----	-----	-----	-----

KEY

FL = Free Lunch
NFL = No free lunch
K = Pre-school
NK = No pre-school
SA_1 = More self-adjusted
SA_2 = Less self-adjusted
M = Male
F = Female
B = Black
W = White

Note: Numbers in parentheses indicate N.