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An Evaluation of the Precision Teaching Project

Jerilynn Dorow
Western Michigan University

AN EVALUATION OF THE PRECISION TEACHING PROJECT

by

Jerilynn Dorow

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Jerilynn Dorow

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INTRODUCTION

Since the early 1960's public schools have been a rich source of opportunities for the research and applied programs of the behavior analyst. Benefits for both groups of participants are evident. School teachers and other personnel need the principles and procedures of behavior analysis to increase their effectiveness in all aspects of the educational process. Needs were particularly apparent in instructional design and behavior management. Behavior analysis also needed direct contact with the schools to validate procedures developed primarily in the laboratory or conceptually, and for access to situations and populations for research purposes. The training of new psychologists was also an important factor in bringing the professional and academic psychologists to the schools.

Resources, both in terms of personnel and money have generally been available for work in the schools. Although local sources have been limited, funding for educational research has typically come from the federal government and appears to be increasing for the area of program validation. For example, "Prior to 1964,...no more than a few hundred thousand dollars were spent annually on educational program evaluation. But by 1970, the federal government was spending some five million dollars a year." (Cohen, Garet, 1975, p. 19). Sources reporting outcomes

of such evaluations are extensive and vary considerably in emphasis. Of particular interest for the purposes of this research are those placing an emphasis on performance-based evaluation making use of both norm-referenced and criterion-referenced achievement tests.

One particularly extensive comparison of alternative educational programs was the National Evaluation of Follow-Through, conducted by the Office of Education and Abt Associates (1977). Project Follow-Through was an elementary school sequel to Head Start and was tested using nine different instructional models for teaching disadvantaged students in 139 communities. The evaluation was based on student performance as measured by the Metropolitan Achievement Test for basic skills (word knowledge, spelling, language, and math computation), and cognitive skills (reading, math concepts and math problem solving). The report indicated that the University of Oregon Engelmann-Becker Model (Stanford Research Institute, 1976) was clearly the most effective program for improving each of the basic skills specified and measured and also in increasing students' self-esteem and achievement responsibility, the latter measured by two tests of affect. The Behavior Analysis Model of the University of Kansas (Stanford Research Institute, 1976) achieved overall second-place success for basic skills. However, it was found lacking in the technology needed to teach cognitive-conceptual skills.

Nero Associates (1975) published an extensive description of the implementation processes of eleven such programs, two of which

were not included in the national evaluation for the Follow-Through program. The specific programs varied a great deal in emphasis and procedures; from the programmed materials used by Oregon, Kansas, and Pittsburgh, to a non-graded approach (Hampton Institute), to a prepared environment (Bank St. College), an open classroom (EDC Program), a child centered program (Far West, and a program focusing on the parent and home (Florida). (Stanford Research Institute, 1976.)

The form of goals and objectives, curriculum content, teaching-learning methods, and teacher roles were program elements dictated by various sponsors. (Nero Associates, 1975.) Six programs, including Oregon and Kansas, used behavioral objectives. The others suggested general procedural and educational goals, but left the determination of specific goals to teachers, parents and children.

Curriculum content was either designated in advance, as it was in Oregon, Kansas, and Pittsburgh or determined on the basis of children's interests, needs and local resources.

The area in which the programs varied most was in teaching-learning methods and roles. In half of the programs, teachers had all, or almost all, of the responsibility for directing learning. Among these, Oregon was alone in emphasizing oral, rather than written responses. The Englemann-Becker Model is based on an adult presenting daily lessons, in reading, spelling and arithmetic, to groups of children. Concepts and skills are introduced in a

pre-planned sequence, and children's responses are systematically prompted and reinforced. In the remaining six programs, the students themselves have a significant amount of responsibility for planning and conducting their own learning; although in three of these, the environment is arranged so that the teachers retain actual control.

Another factor in determining the efficience of an educational program is the time needed to train teachers in its use, a topic central to the interest of this paper. Oregon, Kansas, and Pittsburgh, using instructional manuals, were able to train paraprofessionals for teaching in a relatively short time. Training in program approaches less operationally and behaviorally defined took two or three years. (Program sponsors from Bank St. College, Tucson, EDC-Open Educational Program, Far West.) (Stanford Research Institute, 1976).

All of the Follow-Through programs avoided introducing fragmentary reform, such as the isolated use of learning centers, or behavioral objectives. Instead, variables were integrated into a whole and complete program; backed by a set of theories about teaching and learning, and translated into practical application. (Nero Associates, 1975.)

The purpose of the present study was to apply procedures and information developed in studies such as Follow-Through, to the review and evaluation of another type of long-term educational project being conducted in a local public school setting. The

project reviewed in this study was also concerned with a broad, rather than specific, focus on teaching and emphasized the role of teacher training and on-site support as the primary method of implementation. The project also included in its content emphasis on both behavior analysis and instructional procedures and involved all levels of students Kindergarten through 12th grades.

Project Background

Data for comparing behaviorally based teaching strategies with other methods have been collected over the past four school years in a small rural Michigan school system. The data consists of scores from Science Research Associates norm-referenced achievement tests administered to grades one through four, in May of 1974, 1975, 1976, and 1977. Test scores were used as one of the measures of effectiveness of a four year experimental effort to conduct an on-going inservice program for teachers in the systematic use of behavioral procedures in classroom instruction. Teachers volunteered as project participants. The program was created through the cooperation of the Department of Psychology at Western Michigan University and School Administrators, with endorsement by the local district School Board.

The Project (as it will hereafter be called), was funded for three years as a performance contract, by Title III monies through the Michigan State Department of Education. Funding for each

subsequent year was contingent upon the preceding years success, as measured by student gains on the SRA achievement tests. The target populations for 1973-74 and 1974-75 were those students with pre-test scores below grade level for 2nd through 4th graders and one grade equivalent below grade level for 5th through 12th graders. During these first two years, incentives available to participating teachers included:

a. Reimbursement for college tuition incurred for enrollment in the on-site weekly seminar on teaching technology, conducted by the university professor who served as director of training; and

b. Up to $1,500 if their individual performance contract was totally successful, as evidenced by extraordinary academic gains made by their students.

In 1975-76, monetary support from the local school system allowed the target population to be expanded to include additional grades and subject areas. Incentives were then based on the performance of all students, grades K through 12; and Project teachers had the option of using performance gains measured by SRA achievement tests, and/or objectives-referenced tests made under the supervision of the Project director and an independent evaluator. Payment was made to fourteen of sixteen teachers, and as was expected, objectives-referenced tests proved to be a more sensitive measure of achievement than norm-referenced achievement tests.

When Title III funding ended for 1976-77, the local district monetary incentives were discontinued and other incentives for teacher participation were established by the local system. Instead of extra pay, Project teachers received incentives such as being excused from attending monthly district inservices and having materials produced on the Project substituted for the development of objectives-referenced teaching units required as a regular part of instructional development by the administration.

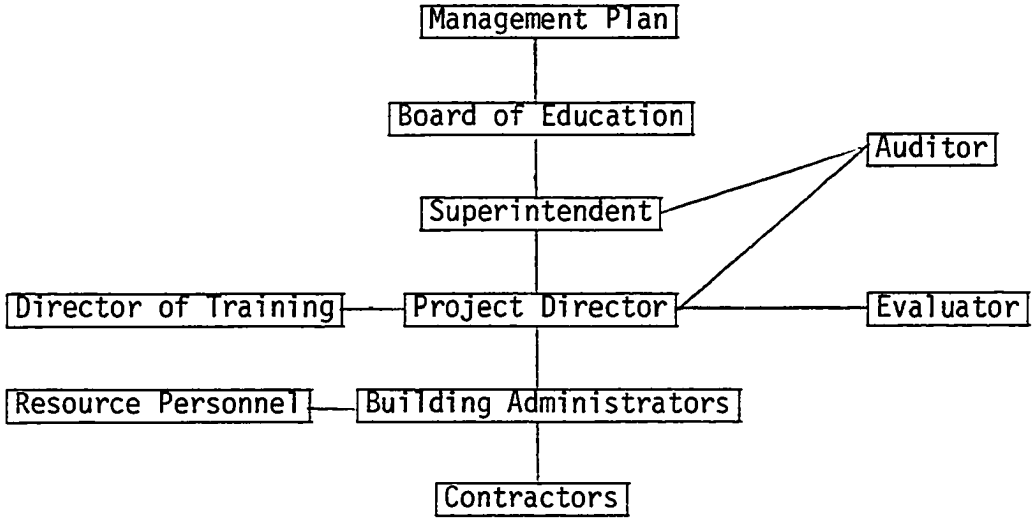
Although the Project has been described by several different names over the years (Teacher Accountability Through Behavior Analysis, Teacher Developed and Tested Positive Based Learning Systems, and currently, A Teacher Developed Precision Teaching Program), its activities have remained relatively stable. Teachers joining the Project attend a year-long weekly Inservice Training Seminar on the systematic use of learning principles in classroom management and individual teaching. Graduate credit is granted to teachers who complete the required readings and demonstrate mastery via quizzes and implementation of instructional methods in their classes. After teachers have completed a year in the Project, they attend the seminar once a month to discuss their current projects.

All Project teachers must complete two classroom teaching projects during the school year, related to two of the skill areas taught in the Seminar. First year Project teachers usually work on classroom management procedures emphasizing positive motivation

and incentives for student learning; and the development of teaching units with tests and instructional procedures based on behavioral objectives. Other skill areas explored are the design and development of self-paced learning sequences which are student performance based, evaluation and modification of instruction through collection and use of student performance measures, Parent - student - school behavioral contracting for academic activity and methods for measuring and changing individual student's behavior. Descriptions of Projects demonstrated to be effective are published annually in a booklet entitled "Teacher Projects". (Farris, Note 1). Classroom management procedures are described in another booklet, "Classroom Programs", (Farris, Note 2) which uses a procedure similar to flow-charting called state diagramming. State diagramming enables a teacher to analyze problem areas in the daily routine and to logically incorporate incentives and feedback for work completed. (Snapper, Knaff, Kushner, 1970).

Participating teachers are assisted in identifying specific needs in the classroom, and in developing projects which meet those needs, by graduate psychology students from Western Michigan University. These project staff people, called "resource personnel", earn credit for meeting with their assigned teachers for approximately ten hours per week. They are under the supervision of the Project's Director of Training and meet with him in weekly staff meetings to review and plan teacher training activities. Project teachers meet with the Director of Training on an individual basis when

consultation is desired. The diagram below is the organizational plan of the original Project.



The Precision Teaching Project was originally one of 116 educationally innovative programs that was state and federally funded to operate in Michigan. The voluntary financial support by the local system, the continued cooperation between the University and School Administrators, and most important, the sustained interest of teachers, attests to the value of the program as perceived by people involved. Previous evaluations by Effective Feedback, Inc. of Ann Arbor, Michigan verified the greater-than-expected academic gains made by the Project's target students. It is important that the Project's directors and participants continue to receive feedback on the effects of the Project on students. Elliot Richardson, while Secretary of Health, Education and Welfare, commented in an interview that the primary purpose of

evaluation is "to establish the worth or merit of a program in order to provide data useful in making decisions" (Evaluation 1, Fall 1972, pg. 9).

The scope of evaluation has expanded such that in 1971, the California legislature passed the Stull Bill; a mandate for the evaluation and assessment of the performance of certified personnel of school districts in that state. Although the bill recommends some general evaluation guidelines, which include "assessment of certificated personnel competence as related to the standards of expected student progress" (King, Jordan, 1972, pg. 74), the task of establishing a uniform system of evaluation for teachers and other professional staff is the responsibility of the local school boards.

School boards have several alternative procedures for evaluation, none of which are totally satisfactory. Ratings of performance on a scale from one to ten are frequently used, but haphazard. Even highly structured observation methods require subjective judgements when deciding on the behaviors to be observed, and then if they are present, has the teacher performed them satisfactorily? Only student performance can reveal this, but measuring achievement presents more problems. James Popham stated in Educational Evaluation: "Norm-referenced achievement tests are unlikely to contain a sufficient number of items measuring important concepts, such items having been eliminated because student's tendencies to respond to them correctly yields

insufficient variance." Yet the recently popular criterion-referenced tests must be tailored to each instructional program if the tests are to be truly sensitive and an improvement over norm-referenced tests. Currently there is no way of knowing how closely any published test matches instruction, but any valid achievement test will uncover gross educational deficiencies in basic skills. For these reasons, and because of the lack of feasible alternatives, norm-referenced achievement test scores were used in the present evaluation.

As stated in most books concerned with evaluation, (Evaluation Research - Methods of Assessing Program Effectiveness (Weiss, 1972), Social Experimentation - A Method for Planning and Evaluating Social Intervention (Rieken, 1974), each evaluation requires the planning of a unique method that fits the needs and limitations of the program under study.

Evaluations of Title I and Title III Projects often lacked suitable control groups, and sometimes even pre-test data were not available. This situation left evaluators with few alternatives, necessitating the use of local and/or national norms in order to compare the performance of Title I and Title III Project children with the means of the larger groups.

Fortunately the present evaluation of the Precision Teaching Project benefited by the presence of comparable control group, and data for the same group of students were available for four consecutive years. Previous evaluations of the Project compared

Project gains in grade and subject area with District gains. The evaluator pointed out that the group data are roughly comparable but not precise, since prescores and postscores for the District are not matched. The question posed in the previous evaluation was: "Has achievement of participating students been raised as a result of Precision Teaching techniques?" (quotation's mine). The question that the present evaluation attempts to answer is: "Has achievement of students of teachers participating in the Project been raised more than that of students of non-participating teachers?"

METHOD

Subjects and Setting

The subjects for the study were 31-33 elementary school students from Grades 1 through 4. The number of subjects decreased due to absence on 4th grade post-test dates. Seventeen subjects were male, all were Caucasian. The setting was the elementary school in a small, rural Michigan village.

Dependent Variable

The data were the SRA norm-referenced achievement tests for Grades 1 through 4. Grades 1 and 2 were tested with the Primary I edition, third grade was tested with Primary II, and the Blue edition was used in Grade 4. The tests were designed to measure academic progress and include "questions representative of the most common instructional goals" (Science Research Associates, 1972, pg. 3) in reading, language, and math. The combined scores of these three subject areas constitute the composite score used in the present analysis.

Administration of the tests takes place annually, in late May. Scores are reported in a variety of ways; as percentiles, stanines, decile profiles, grade equivalents, and as expanded standard scores called Growth Scale Values. Growth Scale Values are represented on a single, equal interval scale covering all forms of the text in each subject area. Growth Scale Values were used

in the present evaluation, as they permit continuous measurement from Grade 1 to Grade 12, free from inconsistencies caused by changes in norms. The use of Growth Scale Values permits the following of educational progress across several grades and thus permits transition to different test forms. For example, a Growth Scale Value of 175 represents the same comparative performance rating for Grade 2 as it does in Grade 10.

The use of percentiles or grade equivalents was considered irrelevant since this evaluation is not comparing scores with national norms, but with scores within the school itself. In addition, no attempt was made to obtain a truly representative sample, according to age, race, sex or other factors. For these reasons, normative standing was disregarded in this study.

Procedure

The present study used a non-equivalent control group design with pre-test and post-test measures. The units for analysis were individual students non-systematically assigned to classrooms. Since such non-systematic assignment cannot be considered the random assignment necessary to determine if partitioning treatment and control groups according to 1st grade teacher would be necessary in order to control for pretreatment differences affecting the dependent variable. Another problem in using analysis of variance was the very small sample sizes involved in most comparisons.

Two-factor analysis of variance was used on 33 pre-test scores to determine the presence of pretreatment differences, and on 33 gain scores obtained after 2nd grade, in order to determine a treatment effect in the presence of pretreatment differences. Each factor contained two levels: Factor 1, Level 1 were students taught by 1st grade teacher A; Factor 1, Level 2 were students taught by 1st grade teacher B; Factor 2's levels specified the experimental and control groups. Because pretreatment differences (in results obtained by 1st grade teachers) were discovered, all scores were similarly partitioned when describing and when testing for educationally important differences.

Using descriptive statistics and testing for educationally important differences in gain scores, it was possible to compare the gains of 4th graders who had received 0, 1, 2 or 3 years of precision teaching. An educationally important difference was considered to be one-fourth of a standard deviation for the grade in question. This criterion is recommended by Becker (1976) in his book: Evaluation of Instruction, and was one of the criterion used for significance in the National Evaluation of Project Follow-Through.

Values of the Independent Variables

Varies from 0 to 3 years, depending on the number of years a student was taught by a teacher participating in the Project.

Values of Dependent Variable

Expressed in Growth Scale Values, standard scores that remain consistent in meaning, across grade levels and test forms. Using Growth Scale Values permits the computation of gain scores.

Sequence of these Values

Eight combinations of years and grades taught by Project teachers were evaluated.

Criterion for Changing the Independent Variable

Students were not assigned to classrooms from one year to the next in any systematic way. Students who did not work well together were informally assigned to separate classrooms the succeeding year.

RESULTS

Data are reported for all subjects in terms of Growth Scale Values which, as stated earlier, are expanded standard scores. Pre-scores were obtained after the first grade, post-scores were obtained after the fourth grade.

In order to determine the existence of pretreatment differences, the control group and the treatment groups were each partitioned according to the first grade teacher. Neither first grade was given the independent variable in this study. First grade teacher A's students obtained a mean Growth Scale Value of 166, students in teacher B's first grade had a mean Growth Scale Value of 133.88. The two factor analysis of variance indicates that the difference in these pretreatment means was significant at the 0.18 level. There was no significant pretreatment difference between what would later be treatment and non-treatment groups, which supports the contention that assignment to treatment was non-systematic.

Based on these results, Factor 1 consisted of non-homogeneous levels, while levels of Factor 2 were for practical purposes homogeneous. Therefore, although using one-way analysis of variance on levels of Factor 2 could be somewhat justified, this would still not control for possible pretreatment differences according to 1st grade teachers. In an attempt to control for this, treatment and control groups were partitioned by 1st grade teachers, but no pattern is evident in the results.

There was a significant difference (.007 level) in gains achieved at the end of 2nd grade by students from the two first grade classes. Gains attributed to Factor 1, first grade teacher, were separated from those attributed to Factor 2, the independent variable. Teacher B's students achieved greater gains, so that by the end of second grade, post-test scores showed no significant differences in the performances of the original first grade classes. An alternate explanation for gains attributed to Factor 1, Level 2, is a regression of low scores towards the mean (Campbell, Stanley, pp. 10-12). That this gain is actually a regression artifact must be considered when assignment is not random. Gains made by students in the Project 2nd grade were significantly higher (.007 level) than those made by the non-Project 2nd grade. Regression probably need not be considered here as neither pretreatment group mean was significantly lower than the other.

In order to determine the presence of educationally important differences among 4th graders who had received varying amounts of Precision Teaching, the mean gains of the particular treatment and control groups in question were subtracted, the lower from the higher, and that sum divided by 62.38. The divisor is the standard deviation from the composite fourth grade Growth Scale Value, blue level, form E. If the divident equalled .25 or more, the difference in gains is educationally important, using a criteria of one-quarter standard deviation.

Only educationally important results were reported, blank cells in Tables 2 through 10 represent non-significant differences between comparison groups.

A plus (+) indicates that the group with more years of Precision Teaching had higher gains than the comparison group.

A minus (-) indicates that the group with less Precision Teaching achieves greater gains than the comparison group. (See Appendix for actual numbers representing educationally important differences. For example, 1. represents one standard deviation, and .25 equals one-quarter standard deviation.)

The possibility of regression toward the mean must be considered in every comparison where sizable differences in pre-test scores exist. The true amount of gain is in question, and the possibility of regression could only be ruled out by random assignment to treatment groups.

When comparing groups with 1, 2, or 3 years in Project classrooms with the two groups whose teachers never participated in the Project, students from Project classes gained more in seventeen out of nineteen comparisons. In both cases where the non-Project groups made greater gains, the A child who received Precision Teaching in the 4th grade only was the subject for comparison.

In all five comparisons of students with 2 or 3 years of Precision Teaching versus students from 1st grade A who received Precision Teaching in 2nd grade only, the students with more

Table 1
Test Scores Expressed in Growth Scale Values

1st Grade Teacher		Values of the Independent Variable							
		0	2nd gr.	3rd gr.	4th gr.	2nd & 3rd grs.	3rd & 4th grs.	2nd & 4th grs.	2, 3, & 4th grs.
	$\overline{X}$ Pre	176.6	175.5	185	171	181	67	173.6	
A	$\overline{X}$ Post	264.6	264.5	283	229	270	183	269	
	Gain	88.	89.	98.	58.	89.	116.	95.4	
	n	5	2	1	1	1	1	5	
	$\overline{X}$ Pre	149.5	35	161	142	56	128	154	133
B	$\overline{X}$ Post	231	217	294	292.5	260	269	280	286
	Gain	81.5	182	133	150.5	204	141	126	153
	n	2	2	2	2	1	2	3	1

Table 2
Educationally Important Differences Between Control Group A and 1, 2 or 3 years of Precision Teaching

Values of the Independent Variable

	0	2nd gr.	3rd. gr.	4th. gr.	2nd and 3rd. grs.	3rd and 4th grs.	2nd and 4th grs.	2, 3, & 4th grs.
1st Grade Teacher A	X			-		-		X
1st Grade Teacher B	X	+	+	+	+	+	+	+

Table 3
Educationally Important Differences Between Control Group B and 1, 2 or 3 years of Precision Teaching

1st Grade Teacher A	X		+	-		+		X
1st Grade Teacher B	X	+	+	+	+	+	+	+

Table 4
Educationally Important Differences Between Precision Teaching 2nd Grade A and 2 or 3 years of P. T.

1st Grade Teacher A	X	X	X	X	+			X
1st Grade Teacher B	X	X	X	X	+	+	+	+

Table 5
Educationally Important Differences Between Precision Teaching 2nd Grade B and 2 or 3 years of P. T.

Values of the Independent Variable

	0	2nd gr.	3rd gr.	4th gr.	2nd and 3rd grs.	3rd and 4th grs.	3rd and 4th grs.	2, 3, & 4th grs.
1st Grade Teacher A						-	+	
1st Grade Teacher B						-	-	-

Table 6
Educationally Important Differences Between Precision Teaching 3rd Grade A and 2 or 3 years of P. T.

1st Grade Teacher A					-	+		
1st Grade Teacher B					+	+	+	+

Table 7
Educationally Important Differences Between Precision Teaching 3rd Grade B and 2 or 3 years of P. T.

1st Grade Teacher A					-	-	+	
1st Grade Teacher B					+			+

Table 8
Educationally Important Differences Between Precision Teaching 4th Grade A and 2 or 3 years P. T.

Values of the Independent Variable

	0	2nd gr.	3rd gr.	4th gr.	2nd and 3rd grs.	3rd and 4th grs.	3rd and 4th grs.	2, 3, & 4th grs.
1st Grade Teacher A					+	+	+	
1st Grade Teacher B					+	+	+	+

Table 9
Educationally Important Differences Between Precision Teaching 4th Grade B and 2 or 3 years of P. T.

1st Grade Teacher A					-	-	-	
1st Grade Teacher B					+		-	

Table 10
Educationally Important Differences Between 3 Years of Precision Teaching and 0, 1 and 2 years of P. T.

1st Grade Teacher A	+	+	+	+	+	+	+	
1st Grade Teacher B	+	-	+		-		+	

exposure to Project teachers gained more.

Students from 1st grade B, whose 2nd grade teacher only, participated in the Project, gained more than three groups of students who received 2 years of Precision Teaching, and more than 1 child who received 3 years of Precision Teaching. The children from 1st grade A, whose teachers for 2nd and 4th grade were Project teachers, did gain more however.

Groups from both first grades who had a Project teacher in 3rd grade only, gained more than those coming from first grade A, who had Precision Teaching in 2nd and 3rd grade. The group from 1st grade teacher B who had a Project teacher in 3rd grade only, also gained more than the group from 1st grade A with Precision Teaching in the 3rd and 4th grade. Of the eight remaining groups receiving 2 or 3 years of Precision Teaching instead of in 3rd grade only, all eight made greater gains.

All eight comparisons using both 1st grades A and B, who received Precision Teaching for 2 or 3 years, gained more than the students from 1st grade A who received Precision Teaching in the 4th grade only.

In four comparisons using 1st grade B, who received Precision Teaching in the 4th grade made greater gains than those who had received Precision Teaching for two years. Only students from 1st grade B who received Precision Teaching in 4th grade only.

The single student that received three years of Precision Teaching gained more than 10 out of 12 groups with 0, 1 and 2

years of Precision Teaching. The student gained less than the groups from 1st grade B who received Precision Teaching in 2nd or 4th grade respectively.

DISCUSSION

The central goal of this research was to determine the comparative effects of Precision Teaching and traditional teaching on the academic gains made by elementary level students. The results show fairly consistently that the more Precision Teaching students receive, the greater their academic gains.

This was true in seventeen out of nineteen comparisons between students receiving no Precision Teaching versus those receiving one, two or three years of Precision Teaching versus those receiving one, two or three years of precision Teaching. However, in 16 of those 19 comparisons, the experimental groups began with lower pre-test scores, making regression towards the mean a possible explanation for the greater gains of the experimental group.

In seven out of nine comparisons between those who received Precision Teaching in one grade, and those who never had a Project teacher, students having had Precision Teaching made greater gains. Those who came from first grade teacher A and had a Project teacher in fourth grade only, did not make greater gains than two of the groups who received no Precision Teaching. In six of those nine comparisons, the possibility of regression is present.

In twenty-three of the twenty-eight comparisons between students having one Project teacher versus those having two Project teachers, the students receiving more Precision Teaching gained

more. Again, the possibility of regression exists in 21 of the 28 comparisons.

In five of five comparisons between first grade A recipients of Precision Teaching in second grade only, and those receiving two years or more, the latter made greater gains.

The overall results favor the Precision Teaching Project, but regression towards the mean must be considered as an alternate explanation for these results. However, the variability in a) the amount of effort expended by individual Project teachers, b) their prior experience in the Project, c) the Project area on which they worked, and d) the carryover of Project ideas to non-Project teachers are all undoubtedly factors contributing to the inconsistencies found.

A case in point regarding a, b, and c above, the fourth grade for the 1976-77 year was taught by two different Project teachers, both new to the Project. The first semester teacher worked on classroom management, the second semester teacher concentrated on self-paced learning of basic skills. The latter subject area would likely have greater impact on achievement test scores.

Interaction between Project and non-Project teachers often resulted in non-Project teachers adopting ideas and methods used by the Project teachers.

The inevitable weakness of this type of study is the non-random selection of Project teachers. Due to the optional nature of participation it is possible that teachers who join, and

especially those that participate for more than one year, are initially more enthusiastic, innovative teachers. Yet some teachers may join the Project because they are having trouble teaching and managing their class. On the other hand, some teachers may have joined to earn the monetary incentives available during the Project's first three years. Still other teachers may be receptive but prefer not to commit their time and energy to the Project tasks over an extended period of time.

The small sizes of the comparison groups can also be a strong point of the research. In many cases we have the advantage of comparing the gains of two individuals. Sometimes a problem with very small samples is the difficulty involved in matching pairs of individuals for the purpose of comparison. However, the uniformity of the community in which the Project was implemented reduces the likelihood of significant educational environmental differences between the subjects.

The findings of the present study are supported by previous evaluations of the Project, done by an independent evaluator in 1974, 1975 and 1976. (Chapman, 1976).

These evaluations also used the results of annual SRA testing to compare the gains of Project students to the district gain. The district gain included the Project Students and all others at grade level. As that author stated, the district gains were based on group averages without matching pre- and post-tests for each student as was done for the Project students. The gains were

roughly comparable, but the district gains were not as precise.

In all eight comparisons made in 1976, the Project students made greater gains. As some subject areas are not included in the SRA tests, it was not possible to compare gains of Proejct and non-Project students. The gains of these Project students were measured by objective-referenced pre- and post-tests, constructed by the teachers as part of the Project activities. Sixteen Project teachers contracted for incentive payments based on greater than expected student gains, as measured by SRA testing, objective-referenced testing, or both. Fourteen teachers earned incentive pay in 1976. In 1974, ten of thirteen Project teachers received payments. Nine of thirteen Project teachers earned incentive pay in 1975, when a higher gain criterion was set.

Because of the longitudinal nature of the present research, it is necessary to rely on the previous evaluation to determine the degree of Project-emphasized skills demonstrated by the teachers. That evaluator reported that interviews and teacher materials observed indicated that all of the teachers acquired and used the instructional techniques that the Project teaches.

The current evaluator spent the final year included in the study on-site, as a resource person to three teachers. Although there was considerable variation in the effort expended by each teacher, each teacher adopted some of the behaviors stressed by the Project. In the evaluator's subjective judgement, each teacher exhibited positive changes in her teaching style, especially

in the area of positive reinforcement of desirable student behaviors.

The two most common ways of teaching teachers new teaching and learning principles are to conduct on-site training workshops and inservices, or to teach them the material through a continuing education university course. Precision Teaching combines and adds to these two approaches a third procedure. In order to successfully implement the procedures and principles learned in class, teachers may need assistance, typically not available with university coursework. In addition, the teacher who is working full time and taking a night class frequently sets up a situation in which minimal behavior is emitted. They read the books, listen to lectures, take quizzes, and may have little energy to apply what they are learning to their own teaching. On the other hand, most inservices require little participation and provide no review for what is taught. In the Project, most "lectures" are one to one, directly related to their classrooms, frequent, and short. During contact with resource people, teachers also have the opportunity to ask questions and receive feedback on their in-class efforts. This helps ensure success and continued use of what is learned.

In the evaluation of Project Follow-Through, Nero Associates found that active demonstrations in the setting where new procedures were to be implemented was most effective. Training was enhanced by utilizing observation instruments and feedback, an area that

has not been explored by the Project. Project resource personnel and trainers for Follow-Through programs function in a consultant role, visiting classrooms, giving feedback, assisting with the day-to-day problems of teaching, demonstrating techniques of the programs approach.

In the implementation of Follow-Through, teacher trainers were hired by the local districts. The trainers were selected from the teaching staff to train six to ten teachers. Trainers in such positions have the advantage of being accessible, and an "inside" advocate for the program approach. The position of resource personnel for the Project differed from that of Follow-Through trainers, but since resource persons arranged to meet with teachers at the teachers convenience, accessibility was ensured. Likewise, the need for an "inside" advocate is unnecessary when the teachers participate voluntarily, and don't feel outside pressure. And, most of the teachers remain in the Project even after receiving college credit for the first year of participation, becoming inside advocates themselves. Another reason for the success of Schoolcraft is the two way dialogue between university people and school staff. Student school psychologists and the teachers are able to validate in the applied setting what they learn formally. This allows school psychologists to develop confidence in the recommendations they make.

Many theses have been generated and conducted at the Project site. Teachers and school psychology students have an opportunity

to collect data on many aspects of instruction and to draw conclusions about the effectiveness of a treatment with their specific population.

In summary, the Precision Teaching Project has benefited elementary school students, teachers and graduate psychology students. The fact that four evaluations including the present one, have all found positive results, supports this conclusion. Of course, the methodology necessary to after-the-fact evaluation limits the generalizeability of the results. "Quasi-experiments, and any statistical computations we may make with their results, have no rigorous probabilistic basis" (Anderson, 1976, pg. 3). On the other hand, this is the only evidence we have thus far, and it is better to make use of what information we do have than to ignore it as "non-empirical" and to make policy decisions based on no data whatsoever.

If the Precision Teaching Project was implemented in other sites, with similar results, we would possess the cross-validation that the Follow-Through evaluation model and that Direct Instruction achieved. Future research along these lines would need to carefully control such variables as a) random assignment to treatment group, b) amount of teaching experience, c) the Project subject area worked on, d) carry-over to non-participating teachers, and e) the selection effect that the optinal nature of participation creates. It may be possible to control for e, by randomly selecting one-half of the teachers wishing to participate and

including the remaining teachers in the study as a control group. In this way, the control teachers would presumably possess the same "volunteer" quality that the Project teachers have.

REFERENCES

Abt Associates. Education as experimentation A planned variation model. (Vol. IV). Boston: Abt Associates, 1977.

Anderson, Richard B. Follow Through: Testing One Model of Evaluation and Several Models of Compensation. Abt Associates, Inc., Cambridge, Mass., Office of Education, (DHEW), Wash., D.C., April, 1976 (ERIC Document Reproduction Service No. ED120 238).

Campbell, Donald T., Stanley, Julian C. Experimental and Quasi-Experimental Design for Research. Chicago: Rand McNally, 1966, pg. 10-12.

Chapman, Rueben. Final Evaluation Report, Precision Teaching Project, Schoolcraft Community Schools, July 9, 1976.

Cohen, David K., Michael S. Garent. Howard Educational Review, Vol. 45, No. 1, Feb., 1975, "Reforming Educational Policy with Applied Social Research." pg. 19.

Evaluation, 1, Fall 1972, pg. 9

King, Bob; Jordon, Wayne; Personnel, Fresno County Department of Education, Fresno, Calif. June, 1972, pg. 74.

Nero Associates, Follow Through. A description of Follow Through sponsor implementation processes. Portland, OR: Nero and Associates, Inc., 1975.

Ricken, Henry W. Social Experimentation - A method for Planning Evaluating Social Intervention. New York: Academic Press, 1974.

Science Research Associates, Inc. Using Test Results: A Teacher's Guide. Pg. 3., Chicago, Palo Alto, SRA Inc., 1972.

Snapper, A. G., Knapp, J.Z., Kushner, H.D., Mathematical Description of Schedules of Reinforcement. In W. N. Schoenfeld (Ed.) The Theory of Reinforcement Schedules. New York: Appleton-Century-Crafts, 1970, pp. 247-275.

Stanford Research Institute. Follow Through Program Sponsors. Menlo Park, Calif., Bureau of Elementary and Secondary Education (DHEW/OE), Wash. D.C., April, 1976. ERIC Document Reproduction Service No. ED 080 494).

Weiss, Carol H., Evaluation Research - Methods of Assessing Program Effectiveness. Englewood Cliffs, N.J.: Prentice Hall, 1972.

APPENDIX I

Table 2
Educationally Important Differences Between Control Group A and 1, 2 or 3 years of Precision Teaching

	Values of the Independent Variable							
	0	2nd gr.	3rd gr.	4th gr.	2nd and 3rd. grs.	3rd and 4th grs.	2nd and 4th grs.	2, 3, & 4th grs.
1st Grade Teacher A				$-.48\ \sigma^{-2}$		$+.45\ \sigma^{-2}$		
1st Grade Teacher B		$+1.5\ \sigma^{-2}$	$+.72\ \sigma^{-2}$	$+1\ \sigma^{-2}$	$+1.86\ \sigma^{-2}$	$+.85\ \sigma^{-2}$	$+.61\ \sigma^{-2}$	$+1.04\ \sigma^{-2}$

Table 3
Educationally Important Differences Between Control Group B and 1, 2 or 3 years of Precision Teaching

1st Grade Teacher A			$+.26\ \sigma^{-2}$	$-.38\ \sigma^{-2}$		$+.55\ \sigma^{-2}$		
1st Grade Teacher B		$+1.6\ \sigma^{-2}$	$+.83\ \sigma^{-2}$	$+1.1\ \sigma^{-2}$	$+1.96\ \sigma^{-2}$	$+.99\ \sigma^{-2}$	$+.71\ \sigma^{-2}$	$+1.39\ \sigma^{-2}$

Table 4
Educationally Important Differences Between Precision Teaching 2nd Grade A and 2 or 3 years of P. T.

1st Grade Teacher A					$+1.6\ \sigma^{-2}$			
1st Grade Teacher B					$+1.25\ \sigma^{-2}$	$+.83\ \sigma^{-2}$	$+.59\ \sigma^{-2}$	$+1.03\ \sigma^{-2}$

Table 5

Educationally Important Differences Between Precision Teaching 2nd Grade B and 2 or 3 years of P. T.

	Values of the Independent Variable							
	0	2nd gr.	3rd. gr.	4th gr.	2nd and 3rd grs.	3rd and 4th grs.	3rd and 4th grs.	2, 3, & 4th grs.
1st Grade Teacher A						$-1.06\ \sigma^{-2}$	$+1.39\ \sigma^{-2}$	
1st Grade Teacher B						$-.66\ \sigma^{-2}$	$-.90\ \sigma^{-2}$	$-.47\ \sigma^{-2}$

Table 6

Educationally Important Differences Between Precision Teaching 3rd Grade A and 2 or 3 years of P. T.

1st Grade Teacher A					$-.29\ \sigma^{-2}$	$+.28\ \sigma^{-2}$		
1st Grade Teacher B					$+1.55\ \sigma^{-2}$	$+.69\ \sigma^{-2}$	$+.45\ \sigma^{-2}$	$+.88\ \sigma^{-2}$

Table 7

Educationally Important Differences Between Precision Teaching 3rd Grade B and 2 or 3 years of P. T.

1st Grade Teacher A					$-.66\ \sigma^{-2}$	$-.27\ \sigma^{-2}$	$+.60\ \sigma^{-2}$	
1st Grade Teacher B					$+1.07\ \sigma^{-2}$			$+.32\ \sigma^{-2}$

Table 8
Educationally Important Differences Between Precision Teaching 4th Grade A and 2 or 3 years P. T.

Values of the Independent Variable

	0	2nd gr.	3rd gr.	4th gr.	2nd and 3rd grs.	3rd and 4th grs.	3rd and 4th grs.	2, 3, & 4th grs.
1st Grade Teacher A					$+ .5\ \sigma^{-2}$	$+ .93\ \sigma^{-2}$	$+ .60\ \sigma^{-2}$	
1st Grade Teacher B					$+ 2.34\ \sigma^{-2}$	$+ 1.33\ \sigma^{-2}$	$+ 1.1\ \sigma^{-2}$	$+ 1.52\ \sigma^{-2}$

Table 9
Educationally Important Differences Between Precision Teaching 4th Grade B and 2 or 3 years of P. T.

1st Grade Teacher A					$- .98\ \sigma^{-2}$	$- .55\ \sigma^{-2}$	$- .88\ \sigma^{-2}$	
1st Grade Teacher B					$+ .86\ \sigma^{-2}$		$- .39\ \sigma^{-2}$	

Table 10
Educationally Important Differences Between 3 Years of Precision Teaching and 0, 1 and 2 years of P. T.

1st Grade Teacher A	$+ 1.04\ \sigma^{-2}$	$+ 1.03\ \sigma^{-2}$	$+ .88\ \sigma^{-2}$	$1.52\ \sigma^{-2}$	$+ 1.03\ \sigma^{-2}$	$+ .59\ \sigma^{-2}$	$+ .92\ \sigma^{-2}$	
1st Grade Teacher B	$+ 1.39\ \sigma^{-2}$	$- .47\ \sigma^{-2}$	$+ .32\ \sigma^{-2}$		$- .83\ \sigma^{-2}$		$+ .43\ \sigma^{-2}$	