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ABSTRACT

Project SEED is a U.S. nationwide program in which professional mathematicians and scientists from major universities, research corporations, and the community teach abstract, conceptually oriented mathematics to full-sized classes of elementary school children on a daily basis as an extra-period supplement to their mathematics program. The mathematicians and scientists teach the children through a Socratic group discovery format. Initial topics are chosen from high school and college algebra to reinforce and improve the students' critical thinking and computational skills. The impact of Project SEED instruction at the third-grade level in the Detroit (Michigan) Public Schools was studied. When 523 students who had received Project SEED instruction were given an evaluator-developed test of abstract algebra they achieved a mean of 9.10. This compares with a mean of 3.94 achieved by 133 comparable students who did not receive Project SEED instruction. When 302 Project SEED students were matched with an equal number of students without Project SEED instruction, SEED students out performed comparison students on all three unadjusted measures of mathematics achievement. The attitudes of 462 students in Project SEED were overwhelmingly positive, and 96% of the 25 teachers surveyed thought that the program was notably effective. The 9 principals surveyed were very positive about the program, as were the vast majority of the 267 parents surveyed. In Detroit, as in other cities studied, almost all (97.2%) of teachers said that they would like to see the program used in more classrooms. Four appendixes contain mathematics posttest questions, the student survey, the teacher surveys, and principal and parent surveys. (SLD)

Evaluation of Project SEED Detroit Public Schools 1997-98

Prepared as a component of the

National Evaluation of Project SEED

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This study reports the results of the implementation of Project SEED in the Detroit Public Schools. Students included in the treatment group (SEED) had to have at least fourteen weeks of SEED instruction. A matched comparison group was utilized in the achievement analyses. SEED students scored significantly better than non-SEED students on a test of algebraic concepts as well as on an analysis of covariance on all three mathematics subtests of the *Metropolitan Achievement Test*. Principals, teachers, students, and parents who were associated with the SEED program all responded extremely positively to a series of opinionaires about SEED. SEED instruction was generally seen to be extremely effective accompanied by high rates of student participation and enthusiasm. Among the perceived outcomes of SEED instruction were increased student interest in mathematics, improved critical thinking and problem solving skills, increased student motivation to learn, increased student self-confidence, and better understanding of mathematics. The aforementioned student performance on the Algebra test administered through this evaluation as well as increased scores on the *MAT* would seem to support these observations. Students themselves reported enjoying their Project SEED Algebra classes, believed that they had learned Algebra through their SEED classes (an observation that is backed up by empirical data), liked mathematics more because of SEED, felt that their mathematical abilities were strengthened as a result of SEED, and reported notably increased feelings of confidence about mathematics and school in general. The Detroit results were very consistent with results from four other urban districts from across the country.

Description and Purpose

Project SEED is a nationwide program in which professional mathematicians and scientists from major universities, research corporations, and the community teach abstract, conceptually oriented mathematics to full-sized classes of elementary school children on a daily basis as an extra-period supplement to their regular mathematics program. The mathematics is presented through the use of a Socratic group discovery format in which children discover mathematical concepts by answering a sequence of questions posed by the SEED instructor. Project SEED staff believe that only persons who understand mathematics in depth possess the versatility to capitalize on the unconventional and often original insights that children are capable of making in an open-ended mathematical dialogue. The initial mathematical topics are chosen from high school and college algebra to reinforce and improve the students' critical thinking and computational skills and to help equip them for success in college-preparatory mathematics courses at the secondary level. Subsequent material establishes the mathematical foundation for a number of advanced areas of study and progresses into advanced topics in abstract algebra and other areas.

Project SEED teaches entire regular elementary school classes rather than specially selected groups of students. Although Project SEED is being implemented in a number of different districts and settings, this design assumes certain implementation characteristics regardless of implementation sites. Following is a description of a typical SEED class that evaluators will expect to see regardless of site.

Project SEED is a supplementary program which is taught by the SEED specialist assigned to a given class. The teacher is present while SEED is being taught and participates in the instruction by using SEED discovery techniques. The students in the class receive regular baseline instruction in mathematics from their regular teacher. (This will either be a mathematics teacher in a departmentalized setting or the classroom teacher in a self-contained setting.) The students then receive a period of SEED instruction four days a week from the SEED specialist. The fifth period is an inservice period for the SEED specialist. In this fifth period, the students work at the direction of the classroom teacher. This work may or may not be related to the material taught in Project SEED at the discretion of the teacher, but it usually is not.

Instruction in the SEED program will be considered in two parts, the instructional methodology of SEED and the mathematics content of the program. SEED uses a Socratic group discovery instructional methodology. The class is taught using a series of directed questions. The instructor asks questions of individuals in the class or of the class as a whole. New material is introduced gradually and the majority of classroom time is usually spent in working on application related to material previously encountered or in introducing new or reviewing previous work. This emphasis upon application and review is intended to ensure that the students have a solid foundation in previously learned material before new material is introduced.

The SEED specialist uses a number of management tools and strategies to manage the instruction in the classroom. The students are expected to respond to most of the questions and discussions in the class. The responses are given using hand signals unless the students are asked directly to respond verbally. Signals are used to indicate agreement and disagreement with the topics of discussion and to respond to questions. The purpose of the signals is to give the instructor continual feedback about student perceptions of the material, to ensure the involvement of most students in the dialogue on the material, and to maintain a degree of order in the classroom which could not be achieved using verbal responses. On the basis of the observations of SEED classes during process evaluation in other settings, the signals seem to succeed in accomplishing these purposes.

To help ensure student involvement, each student is called upon several times each period to provide answers or comments. In the event a student is not participating in the discussions, the SEED instructor will use such devices as having the student call upon another student to provide an answer or calling upon the student to provide a number for a problem. Other management tools and strategies used to keep student involvement at a high rate include having all students participate in group verbal responses to questions, having students write answers to questions on their papers and checking all or part of the papers immediately, or having all students show the answer to a question on their fingers. These methods and a number of others are all designed to keep student interest and involvement high, as well as to accomplish other instructional objectives.

To mitigate problems associated with locus of control in the classroom, the SEED instructor moves frequently in the classroom and avoids teaching and questioning from the same spot. This also helps keep students attentive since, at any moment, the instructor may be asking the next question from any part of the room. SEED classes have a higher proportion of visitors than usual, and the visitors and the teacher are utilized by the instructor. For example, the instructor might ask a visitor to call upon a student with his or her hand up to answer a question. In this fashion, the students become accustomed to visitors and enjoy sharing their knowledge with the visitors which enhances the whole experience.

The primary feature of the instructional system, however, is the set of questions asked by the SEED specialist. Almost all of the instruction is done through the use of questions. Rarely does the instructor directly tell the students anything. This is done, again, to help keep the student actively involved in the progress of the class and to avoid having the student as a passive recipient of the subject material. The instructor, in preparing for the class, thinks through the subject matter to be presented and assembles a list of sequenced questions which will be used as the basis of the questions asked of the students in class. These questions develop the content to be covered in logical and detailed sequence which is then transferred to the classroom and form the heart of SEED instructional processes.

The mathematics content in the SEED classes consists primarily of a thorough preparation in pre-algebra mathematics and beginning concepts of abstract algebra, with examples taken from the real number system. Some of the topics include properties of positive and negative numbers, the definition and properties of exponents, definition and properties of logarithms, use of the distributive law of real numbers to prove properties of positive and negative numbers, the definition and properties of additive and multiplicative identities, the definition of additive and multiplicative inverses, the definition and properties of negative exponents, the definition and application of summation and product symbols, and an introduction to mathematical series.

The purpose of this evaluation is to evaluate the impact of Project SEED instruction at the third grade level in the Detroit Public Schools on student mathematics achievement and attitude toward mathematics. Since local district cooperation is essential to the success of the program, attitudes of district teachers, administrators, parents, and participants was also determined.

Previous Studies

Dwight Shafer summarized a series of studies conducted on SEED between 1968 and 1975 (Shafer, 1975). These studies were conducted by a number of different investigators across four different states and included results from the Berkeley, California, Detroit, Michigan, San Jose, California, Columbus, Ohio, Oakland, California, Sacramento, California, Los Angeles, California, and Red Bank, New Jersey school districts. These studies included results on a number of different achievement tests as well as teacher, administrator, parent and student questionnaires. The evaluations ranged from the informal collection of achievement scores by SEED and district staff to large scale statistical analyses by external evaluators. After reviewing these studies, Shafer concluded that *the overall record of Project SEED is outstanding in the area of student achievement as measured by normed instruments as well as non-normed instruments.* Shafer also emphasized that the achievement results were particularly impressive in that the project did not teach what was being tested in mathematics but rather emphasized abstract, conceptually oriented mathematics. The principal, teacher, parent, and student questionnaires also consistently yielded positive results.

Educational Planners and Evaluators conducted a series of studies on the impact of SEED instruction at grades 4 through 6 between 1975 and 1980 (Whalen, 1980). These studies involved seventeen school districts across ten states. Among their findings were that SEED students significantly outperformed control classes in a remarkably uniform manner, consistently showed an average mean gain of around two months' growth for each month of instruction, and worked across the entire spectrum of student achievement levels. They concluded that *Project SEED unquestionably fosters improved arithmetic skills in the vast majority of participating students* and that the summarized evaluations *provide overwhelming evidence of the ability of SEED to stimulate mathematical thinking in young children which enhances both their conceptual and computational skills.* After five years of studying the program, the evaluators called the SEED evaluation *the best results we have ever seen by any program.*

Seven more recent series of studies on the impact of SEED on student achievement and associated variables were conducted in the Dallas and Detroit Public Schools between 1982-83 and 1990-91. All studies focused on the immediate and longitudinal impact of SEED instruction on achievement in and attitudes about mathematics. All studies were conducted on students in grades 4 through 6. All studies used theoretical comparison groups. That is, each student in each of the SEED groups was systematically matched to a non-SEED comparison student. Comparison students were drawn from many District schools and thus represent many different math treatments. All matching was done in the year prior to exposure to SEED. Variables used in the matching process were gender, ethnicity, grade, socioeconomic status as indicated by free or reduced lunch, busing status, and mathematics achievement levels.

Series 1. The first study of SEED in the Dallas Public Schools was conducted in 1982-83 and examined the impact of one semester of SEED instruction ion mathematics achievement and attitudes at the fourth or fifth grade level. Project SEED was implemented in eleven schools. According to the evaluation report (Mendro, 1983), the program was well managed and produced significant impact on student self-concept and achievement in mathematics.

Series 2. A second series of studies conducted in Dallas examined the impact of one semester of SEED instruction on mathematics achievement and attitude. Six different SEED groups drawn from the schools studied under Series 1 and their respective theoretical comparison groups were compared relative to post-SEED achievement trends in mathematics and enrollment in higher level mathematics courses. The design was set up so that each study was replicated within the design. Analyses were performed on two separate and distinct groups of fourth, fifth, and sixth graders, each being followed for a period of five years. Further replication studies were accomplished by examining the immediate impact of SEED instruction on student achievement in the year that SEED was offered, thus examining the impact of SEED on a group of students that did not exhibit the sample mortality of the five-year longitudinal groups.

In the case of this series of studies, SEED students were exposed to regular math plus SEED instruction, while comparison students were exposed only to regular math. Thus, part of the treatment was additional exposure to mathematics (45 minutes). Longitudinal group sizes ranged from 32 to 87. Short-term group sizes ranged from 245 to 295. Initial groups were chosen in 1982-83 and 1983-84.

The results of this second series of studies suggested strong and consistent immediate impact of SEED instruction on mathematics achievement as measured by the *Concepts, Problem Solving, Computation*, and *Total* sections of the *Iowa Tests of Basis Skills (ITBS)*. These improved scores were generally present at least one year after students had been exposed to SEED. The results also suggested greater impact of SEED on the achievement of lower socioeconomic students. In addition, former SEED students clearly took higher percentages of advanced courses than did their matched comparisons. (Webster and Chadbourn, 1988).

Series 3. The third series of studies conducted in Dallas examined the achievement trends of students who were enrolled in SEED three semesters: one in the fourth grade in 1984-85, one in the fifth grade in 1985-86, and one in the sixth grade in 1986-87.

Project SEED had been implemented in three special schools , called Learning Centers, since the 1984-85 school year. Although the schools had many special programs and arrangements, they were primarily designed to raise student achievement levels in reading. Classes were self-contained and the homeroom teacher generally taught all subject areas except music and art. Instructional treatment in mathematics represented an extra 45-minutes of SEED instruction per day for four days a week. Comparison students had mathematics instruction by either self-contained teachers or mathematics specialists for 60-minutes per day. SEED students had instruction by self-contained teachers (non-mathematics specialists) plus the instruction by SEED instructors. These were the best comparisons that were available, since all students in the special schools had SEED.

As in the series of studies outlined as Series 2 of this investigation, comparison groups were selected from groups of students similar to those who received SEED instruction. The same selection criteria were used as were used in Series 2 of the investigation except, of course, the comparison groups matched the characteristics of the Series 3 SEED students.

Two major questions were examined. First, were the post-SEED instructional achievement trends of SEED students different from those of comparison students who were not exposed to SEED? This question was examined separately using the *Math Concepts, Math Problem Solving, Math Computation*, and *Math Total* scores on the *ITBS*.

Second, given that the schools studied were Learning Centers and had many special arrangements over other schools, the same type of longitudinal analysis was done on reading. The case for a treatment effect of Project SEED would be greatly enhanced if math trends among Center students were more positive than reading trends. The reading subtest of the *ITBS* was used for this analysis. In addition, SEED data bases were established so that SEED student achievement as well as mathematics course selection versus that of comparison students could be analyzed over succeeding years.

The cohort samples for this series of studies required four years of test data. There were 517 SEED and 517 comparison students. The samples were one hundred percent Black and Hispanic, and seventy-nine percent on free and reduced lunch. Their pre-1984 achievement levels ranged from the first to the tenth decile.

The results of this series suggested an immediate impact of SEED at the fourth grade level on mathematics achievement. This impact increased at grade 5 and further accelerated at grade 6. Thus, students who entered the fourth grade about even with their peers left the sixth grade about one-half year ahead of their peers in *Problem Solving* and almost one year ahead in *Concepts*. In addition, they were at or above grade level in *Concepts*, *Computation,* and *Total Math* scores.

Both the SEED and comparison samples had Spring, 1984, mean scores of 3.33 in Reading. During the succeeding three years of instruction, the SEED sample advanced to a mean score of 5.98 while the comparison sample advanced to a mean score of 5.55. Thus, the SEED sample gained 2.65 grade equivalent units in reading while the comparison sample gained 2.22 grade equivalents in reading. Compare this to a mean gain of 3.18 grade equivalent units in mathematics for the SEED students versus 2.36 grade equivalents for the comparison group. (Webster and Chadbourn, 1988).

Series 4. The fourth series of studies conducted in Dallas replicated the Series 2 studies plus added an additional outcome variable, a criterion-referenced test entitled the *Survey Tests of Essential Elements/Learner Standards (STEELS)*. This series of studies also examined retention rates, enrollment in higher level mathematics classes, withdrawal rates, and long-term impact of SEED. Four different samples were used. These samples included: students who had SEED instruction in the Learning Centers in grades 4-6 in 1985 through 1988; students who had SEED instruction in the Learning Centers in grades 4-6 in 1986 through 1989; follow-up of students who had one semester of SEED in 1982-83 or 1983-84 as well as Learning Center students who had three semesters of SEED in 1984-87.

This series of studies on SEED took an in-depth look at the impact of SEED instruction on mathematics achievement as measured by the *ITBS* and *STEELS* and on student attitudes toward mathematics as measured by the enrollment of students in advanced math courses. Most of the students in the SEED group were also Learning Center students, thus introducing an intervening variable into the process of interpreting the results. Analyses of Learning Center Reading achievement were conducted to provide some measure of the impact of the Centers independent of SEED. Early non-Center SEED groups were also studied for this purpose.

Although the primary focus of this series of investigations was to examine the impact of Project SEED in the Learning Center environment, part of the study focused on non-Learning Center students who had only one semester of SEED in the fourth, fifth, or sixth grade. Although the achievement impact of this strategy appeared to wash out after two years, former SEED students still appeared to enroll in more higher level math classes, withdraw from the District less, and be retained fewer times than did their matched comparison groups.

The results of this series of studies suggested that SEED instruction in the Learning Centers contributed substantially to increased mathematics achievement as measured by the *ITBS* and *STEELS*, increased enrollment in higher level mathematics courses, lowered grade retention and District withdrawal rates, a cumulative impact on mathematics achievement, that is, longer exposure to SEED (up to three semesters) appeared to accelerate measured mathematics achievement growth, and, retention of mathematics gains for at least two years after exposure to just one semester of SEED. (Webster and Chadbourn, 1989).

Series 5. The fifth series of studies conducted in Dallas replicated the Series 4 studies and followed up students who had been included in the Series 1 and Series 2 studies to determine longitudinal impact on mathematics achievement and enrollment in higher level mathematics courses. Eight different samples were used to implement three different studies.

The first was a study of students who were exposed to one, two, or three semesters of SEED instruction in the Centers culminating in the Spring of 1990. These students were compared with their matched comparison groups on the *ITBS Math Total, Concepts, Problem Solving* and *Computation* subsets, as well as the *STEELS Mathematics* test. All comparisons were significant, $p \leq .01$, in favor of the SEED groups.

The second study was a longitudinal follow-up of these students who had three semesters of SEED in the Centers in 1984-87, 1985-88, or 1986-89. These students were compared with their matched comparison groups on the *Math Total, Concepts*, *Problem Solving*, and *Computation* subsets of the *ITBS*. The results of this study replicated the finding of a cumulative impact on mathematics achievement of increasing semesters of SEED (up to three), of continued mathematics achievement impact up to two years after SEED instruction was completed, and of more SEED students enrolling in higher level mathematics courses.

The third study completed the follow-up of students who had had one semester of SEED in a non-Learning Center environment in 1982-83 or 1983-84. These students enrolled in more higher level mathematics courses than their matched comparisons. (Webster and Chadbourn, 1990).

Series 6. The sixth series of studies conducted in Dallas replicated Series 5 studies and extended the follow-up of grade 4-6 Center students to the tenth grade. Once again, SEED students demonstrated increased mathematics achievement levels as well as improved mathematics achievement up to four years after exposure to SEED (Webster and Chadbourn, 1991).

Series 7 The seventh series of studies were conducted in the Detroit Public Schools from 1991 to 1993 in Ferry, Marsh, Burns, Keiden, Sanders, Fitzgerald, Greenfield Park, Holmes (A.L.), Bellevue, Hutchinson, Campbell, Scripps, and Priest schools. In all comparisons, students who had been exposed to Seed for one semester outperformed matched comparison students on all mathematics subtests of the *California Achievement Test (CAT)*. In addition, students who were exposed to two semesters of SEED instruction outperformed students exposed to one semester of SEED instruction on all mathematics subtests of the *CAT*. Principals, classroom teachers, and parents of SEED students rated SEED teaching methods as extremely effective, student enthusiasm and participation in the program as excellent, and listed student benefits from the program as including improved critical thinking, listening, and problem-solving skills, increased motivation to learn, increased academic confidence and self-esteem, and increased performance in the regular mathematics program (Webster, 1993).

Summary. In summary, two national studies and seven series of studies in Dallas and Detroit at the grades 4-6 levels provide an in-depth look at the impact of SEED instruction on mathematics achievement as measured by a number of standardized achievement tests, and on student attitudes toward mathematics as measured by the enrollment of students in advanced math courses as well as by a series of surveys. The results are very consistent. The two national studies document increased mathematics achievement related to exposure to SEED as well as a number of other attitudinal effects. The studies conducted in Dallas and Detroit support the findings of the national studies.

Specifically, the results of the studies in the Learning Centers in Dallas suggested that SEED instruction in the Learning Centers contributed substantially to increased mathematics achievement as measured by the *ITBS* and *STEELS*, increased enrollment in higher level mathematics courses, a cumulative impact on mathematics achievement (longer exposure to SEED appeared to accelerate measured mathematics achievement growth), and retention of mathematics gains for at least four years after exposure to SEED.

Although the primary focus of the series of investigations in Dallas was to examine the impact of Project SEED in the Learning Center environment, several studies in Dallas and Detroit focused on non-Learning Center students who had only one semester of SEED in the fourth, fifth, or sixth grade. In both Dallas and Detroit there was significant impact on mathematics achievement after only one semester of SEED instruction that was still present after two years and, where studied, former SEED students enrolled in more higher level math classes than did their matched comparison groups. In addition, students exposed to two semesters of SEED in a non-Learning Center environment outperformed students exposed to one semester of SEED. In all cases surveys of parents, teachers, and administrators were very positive toward SEED.

A number of more recent studies on the impact of SEED have been conducted in the Alameda Unified School District (Alameda Unified School District, 1997), the Dallas Public Schools (Chadbourn, 1995; Dryden and Chadbourn, 1996), and the Philadelphia Public Schools (Latham, 1992). Results were strikingly similar to those reported above. The Alameda Unified School District study reported a 20% or greater gain for SEED students over matched comparisons on that system's standardized test. The Chadbourn study reported SEED students outperforming matched comparison students in 41 of 45 comparisons on a nationally standardized test of mathematics and that regular mathematics teachers of SEED classes believed strongly that SEED instruction encourages learning through discovery, emphasizes higher order thinking skills, and is effective for both high and low scoring students. The Latham study reported *unbelievably* high rates of student response opportunities and positive teacher-pupil interactions as well as *remarkably* high levels of student on-task behavior. Finally, the Dryden study concluded that the SEED group maintained above norm-level performance for the past ten years and drew the obvious conclusion that students learn what they are taught. SEED focuses on conceptual mathematics and students learn conceptual mathematics.

Study Description

As previously stated, the purpose of this study is to evaluate the impact of Project SEED instruction on mathematics achievement and attitudes toward mathematics at the third grade level in the Detroit Public Schools. This study is part of a national study of the Impact of SEED instruction in five urban school districts (Camden, West Contra Costa, Dallas, Detroit, and Indianapolis).

The Theoretical Comparison Group

In the field of practical evaluation it is often impossible to implement true experimental designs. The concept of randomly assigning students to treatments is repugnant to most educators, particularly in situations where it is perceived that one group of randomly assigned students will be deliberately withheld from what is often believed to be an effective educational treatment. Thus the problem of identifying appropriate comparison groups is crucial to the interpretability of results. The literature is replete with warnings of the threats to the validity of experiments involved in comparing non-randomly assigned intact groups.

All of the initial comparisons in this series of studies utilize theoretical comparison groups. Each student in each of the experimental groups (SEED) was systematically matched to a comparison student. These comparison students were drawn from District schools that were also matched to SEED schools and thus represent many different math treatments. The one thing that the comparison students and schools that they were drawn from all have in common is that they have not been exposed to SEED. All matching was done in the year prior to exposure to SEED. Variables used in the matching process at the school level were:

1. percentage Black students

2. percentage Hispanic students
3. percent students on free or reduced lunch
4. percent limited English proficient
5. mean *Math Total* pretest score
6. mean *Reading Comprehension* pretest score

It is important to note that the number of SEED and comparison schools do not have to be the same since the actual matching is done at the student level. Equal numbers of students did not have to be drawn from the same comparison schools as were drawn from SEED schools. For this reason, an attempt was made to make the composite of comparison schools as much like the composite of SEED schools as possible. The achievement analyses on the *Metropolitan Achievement Tests* (*MAT*) were a little more complex than anticipated because the student data for all of the comparison schools were not available making the matching process less successful and requiring more sophisticated analysis. Variables used to match SEED and comparison students were:

1. *Reading Comprehension* pretest score
2. *Math Total* pretest score
3. socioeconomic status as indicated by free or reduced lunch
4. ethnicity
5. gender
6. grade (previous and current year)

Limitations

SEED represents double mathematics exposure for those students who are enrolled. Over the years a series of studies have been designed to isolate the effects of double mathematics exposure by utilizing a comparison group for SEED that employs two periods of mathematics instruction. As of this date, we have not found a school that has been willing to implement two periods of mathematics instruction without SEED. Perhaps the fact that, in this era of accountability, no one is willing to implement two periods of mathematics instruction without SEED provides an answer to this query.

A second limitation is that SEED staff have provided training to a number of teachers outside of the classes actually receiving SEED instruction. This has probably aided these teachers in facilitating more effective mathematics instruction and reduced the apparent treatment effect of SEED.

Sample

For purposes of drawing treatment and comparison groups, two levels of sampling were used. The first involved matching at the school level. Table 1 shows the experimental and control schools used in the study. The study was originally designed to include students from all of the schools in the table, however the unavailability of some data and later adjustments to SEED schedules cause4d some schools to be eliminated from the study.

Table 1
SEED and Control Schools

Experimental (SEED)	Control
McCulloch	Birney*
Davison	A.L.Holmes
King	T. Marshal
Stark	Howe*
Dossin	McKenney*
Bennett	Burns
Parkman	-
Sherrill	Lodge
Holcomb	Vandenburg
Brady	Joyce
Berry*	Carstens*
Krolik	Nichols
Hutchinson	Hosmer
Fitzgerald	-
Harding	Priest**
Winship	Crary*
Harms	McMillan**
McFarlane	Gardner**
Gompers	-

* Data not available.
** School not included as control because of previous SEED instruction.

Students from these schools were then matched as described above.

Major Evaluation Questions

The major evaluation questions investigated through this study were as follows:

- **Was the program implemented as designed?**

- **What is the impact of one semester of SEED instruction on mathematics achievement?**

- **What was the reaction of SEED students to the program?**

- **Did students display an improved attitude toward mathematics after exposure to SEED instruction?**

- **What is the reaction to the program of SEED principals, classroom teachers, and parents of SEED students?**

Study Results

Program Implementation

Sample. The evaluator viewed SEED classroom instruction at three different sites across the country.

Results. The research base on teaching and learning provides insight into factors related to teachers and students that influence school learning. Included among influential factors are (a) curricular emphasis on both content and process knowledge; (b) active student engagement in learning; (c) accommodation of individual student differences; (d) emphasis on higher-order thinking strategies, (e) teachers as facilitators and mediators of learning; (f) a quality physical and learning environment; (g) efficient and effective time management; and (h) the observation and assessment of student outcomes.

Students are now viewed as active interpreters or mediators of teacher behaviors instead of passive recipients of those behaviors. Teachers are expected to provide relevant and meaningful learning experiences, create a learner-centered community, respond appropriately to diverse learners, and to create an environment in which taking risks, sharing new ideas, and innovative problem solving are supported and encouraged. The strategies alluded to above are endorsed by the National Research Council (science standards), the National Council of Mathematics (mathematics standards), the National Science Foundation, and Project SEED.

The classroom observations of SEED instruction yielded consistent results that are in harmony with the SEED program description outlined in the first section of this report and with the national standards alluded to above.

Student Algebraic Achievement

<u>Sample.</u> 523 students, who had been exposed to SEED instruction at the third grade level during the first semester of 1997, were administered an evaluator-developed test of abstract algebra (group theory). A comparison group of 133 students were also administered this test. This test is contained in Appendix A to this report.

<u>Results.</u> The Detroit SEED students achieved a mean of **9.10** with a standard deviation of **4.13** on the test of abstract algebra. The comparison group achieved a mean of **3.94** with a standard deviation of **2.06**. This produced a *t statistic* of **13.97** which is statistically significant at **$p \leq .001$**. The t-test was a non-directional test for independent samples that assumes equal variances, the most conservative parametric test available..

The results of this analyses produced a highly statistically significant difference between the SEED and comparison group that was very similar to the results found in the other districts in the study. The difference is of a magnitude to also be considered practically significant, Clearly SEED students are learning algebraic concepts while comparison students are scoring below chance.

Student Mathematics Achievement

<u>Sample</u>. 302 Detroit School District third grade students who had been exposed to at least fourteen weeks of SEED instruction and their 302 matched comparisons were tested with the *Math Procedures*, *Math Concepts /* Problem Solving, *Math Total*, and *Reading Comprehension* subtests of the *Metropolitan Achievement Test*. These students were tested in the Spring of 1997 and again in the Spring of 1998. Because of the unavailability of student test scores from some of the original planned comparison schools, the match was not as close as was desirable. The Detroit Research Office provided three-digit *standard scores* for third grade students from the treatment and comparison schools. The pretest *Reading Comprehension* mean *standard score* was 449.17 for the comparison group and 439.48 for the SEED group (see Appendix F-1) while the pretest *Math Total* mean *standard score* was 453.04 for the comparison group and 446.32 for the SEED group (see Appendix F-2). The disparity in the SEED and comparison group's pretest scores required an analysis of covariance to determine program effect. A t-test for independent samples was also calculated so that simple, straightforward graphs of program effect could be produced.

<u>Results</u>. Even given the fact that the comparison group started higher on both measures of *Reading Comprehension* and *Total Mathematics*, SEED students outscored comparison students on all three unadjusted measures of mathematics achievement. They achieved a mean *standard score* of **470.98**

with a standard deviation of **225.20** on *Math Total* as compared to a mean *standard score* of **424.57** with a standard deviation of **212.70** for the comparison group, a difference that produced a t-statistic of **2.60** and was statistically significant, **$p \leq .01$**. On *Math Concepts/Problem Solving*, the SEED group outscored the comparison group in mean *standard score* performance **491.93** (standard deviation of **217.96**) to **439.78** (standard deviation of **205.92**), a difference that produced a t-statistic of **3.02** that was also statistically significant, **$p \leq .01$**. On *Math Procedures*, the SEED group achieved a posttest mean of **462.37** (standard deviation of **235.62**) compared to a comparison group mean of **432.45** (standard deviation of **214.77**). This difference produced a t-statistic of **1.38** and, probably because of the large within group variances, was not statistically significant. As in the case of the algebra analysis, the t-tests used were non-directional tests for independent samples that assume equal variances, the most conservative parametric tests available. In all three comparisons the SEED group started behind the comparison group and ended up ahead, in two cases significantly ahead. Again, it must be emphasized that the t-tests were for unadjusted means making the results quite remarkable. The results of this analysis are consistent with previous evaluations of SEED and with data from other districts in this study. These data are tabled in Appendix F.

Since the matches for the t-tests were not good and provided a major advantage for the comparison group, an analysis of covariance was also computed on each of the outcome variables. The models included student-level variables ethnicity, lunch status, gender, SEED status, 1997 Reading score, and the appropriate 1997 mathematics score (97 *Math Total* for 98 *Math Total*, 97 *Math Concepts/Problem Solving* for 98 *Math Concepts/Problem Solving*, and 97 *Math Procedures* for 98 *Math Procedures*). The analyses of covariance produced F-statistics for all three subtests that were all Highly significant in favor of SEED, **$p \leq .01$**.

Because the pretest matching produced such disparate results, the analysis of covariance is the preferred mode of analysis in that it attempts to control for unequal pretest scores of experimental and comparison groups, and therefore will be discussed in detail.

Table 2 presents the effects test from the analysis of covariance performed on the 1998 *Math Total* posttest. Study of Table 2 suggests major effects of pretest *Reading Comprehension* and *Math Total* scores on 1998 posttest *Math Total* scores as well as a significant effect of **SEED participation** on those same scores **($p \leq .0001$)**. Socioeconomic status, as measured by participation in the free or reduced lunch program, also contributed to higher posttest mathematics scores ($p \leq .03$). Gender and ethnicity were not significantly related to *Math Total* posttest scores.

Table 2

Effects Test-Total Mathematics Posttest-1998

Source	df	ss	F ratio	Probability
Gender	1	9158.4	0.3023	0.5827
Ethnicity	4	240925.5	1.9878	0.0949
Lunch (SES)	1	152183.5	5.0225	0.0254
SEED	1	462737.0	15.2761	0.0001
97 Reading Comp.	1	1532178.8	50.5661	<0.0001
97 Math Total	1	2420371.4	79.8788	<0.0001

df=degrees of freedom

ss=sum of squares

Table 3 presents the effects test from the analysis of covariance performed on the 1998 *Math Concepts/Problem Solving* posttest. Study of Table 3 suggests major effects of pretest *Reading Comprehension* and *Math Concepts/Problem Solving* scores on 1998 posttest *Math Concepts/Problem Solving* scores as well as a significant effect of SEED participation on those same scores ($p \leq .0001$). Socioeconomic status, as measured by participation in the free or reduced lunch program, also contributed to higher posttest mathematics scores ($p \leq .0463$), although not to nearly the same extent as SEED participation. Gender and ethnicity were not significantly related to *Math Concepts/Problem Solving* posttest scores.

Table 3

Effects Test-Math Concepts/Problem Solving Posttest-1998

Source	df	ss	F ratio	Probability
Gender	1	951.3	0.0303	0.8618
Ethnicity	4	89212.2	0.7114	0.5843

Lunch (SES)	1	124956.2	3.9857	0.0463
SEED	1	505554.2	16.1257	<0.0001
97 Reading Comp.	1	1779753.7	56.7689	<0.0001
97 Math Concepts	1	1233705.1	39.3516	<0.0001

df=degrees of freedom

ss=sum of squares

Table 4 presents the effects test from the analysis of covariance performed on the 1998 *Math Procedures* posttest. Study of Table 4 suggests major effects of pretest *Reading Comprehension* and *Math Procedures* scores on 1998 posttest *Math Procedures* scores as well as a significant effect of SEED participation on those same scores ($p \leq .01$). Socioeconomic status, as measured by participation in the free or reduced lunch program, again contributed to higher posttest mathematics scores ($p \leq .04$). Gender was not significantly related to *Math Procedures* posttest scores but ethnicity was ($\leq .003$).

Table 4

Effects Test- Mathematics Procedures Posttest-1998

Source	**df**	**ss**	**F ratio**	**Probability**
Gender	1	52719.3	1.5117	0.2194
Ethnicity	4	567825.7	4.0705	0.0029
Lunch (SES)	1	154756.5	4.4375	0.0356
SEED	1	299253.3	8.5608	0.0035
97 Reading Comp.	1	2758569.4	79.0992	<0.0001
97 Math Procedure	1	1905051.7	54.6254	<0.0001

df=degrees of freedom

ss=sum of squares

Taking all of the standardized test data into account, it seems obvious that participation in SEED instruction contributes to substantially increased mathematics test scores.

Student Opinions

Sample. 462 Detroit students who had been exposed to SEED instruction were administered a seven item scale that was designed to determine their attitude toward SEED instruction as well as whether or not they perceived SEED instruction to have had impact on their general mathematics ability and on their general feeling of confidence in school. Only valid responses were tabulated. The Student Survey is included in Appendix B.

Results. Results are also tabled in Appendix B. A summary of those results suggests that, after exposure to Project SEED instruction, 98.1% of respondents enjoyed their SEED classes, 97.4% felt that they learned Algebra through their SEED classes, 90.9% felt that they liked mathematics more because of their experience with SEED, 92.9% believed that their mathematics abilities were stronger because of their exposure to SEED, 94% felt more confident about mathematics, and 90.7% felt more confident in school. Thus students expressed very positive attitudes about their experiences with SEED and believed that their positive SEED experience effected their overall attitude toward mathematics and school in general.

Teacher Characteristics and Opinions

Sample. 25 Detroit teachers who had SEED instructors in their classrooms responded to an 18 item opinionaire about their experiences teaching mathematics and about Project SEED. Only valid responses were tabulated. The Teacher Survey is included as Appendix C.

Results. Results are also tabled in Appendix C. Significant facts include that only 20% of respondents had even a college minor in mathematics while 84% had at least six years of teaching experience. 64% were experiencing their first year of SEED instruction.

In terms of observations about SEED, 72% of respondents believed that their experience with SEED significantly strengthened their understanding of mathematics while 92% believed that the SEED instructional methods were notably effective. 92% also felt that student enthusiasm and class participation was good to excellent and observed normally shy or withdrawn students actively participating in the SEED classroom.

In response to a series of questions about the direct impact of SEED instruction on students, 84% of responding teachers believed that SEED considerably stimulated student interest in mathematics, 80% believed that student critical thinking and problem solving skills were extensively improved by SEED instruction, 87.5% believed that SEED instruction provided considerable motivation to learn, 92% held that student self-confidence was considerably improved, 76% saw significant improvement in peer relations, 76% observed substantial improvement in student communications skills, and 72% saw significant improvement in student performance in regular math classes. It should be noted that at 100% of responding teachers saw at least some improvement in all of these important student traits.

In terms of the impact of SEED on the actual teaching behavior of observing teachers, 96% reported gaining some new or insightful way to teach mathematical concepts and 100% employed one or more SEED instructional techniques in their teaching.

In summary, over 96% of Detroit teachers surveyed believed that Project SEED instruction was notably effective and increased their own understanding of mathematics, They also reported benefiting from new insights in how to teach mathematics and 100% said that they utilized at least one SEED instructional strategy in their own teaching.

SEED's direct impact on student instruction was seen as increasing student enthusiasm and class participation, stimulating student interest in mathematics, motivating students to learn, improving student self-confidence, improving student peer relations, improving student communication skills, and improving student performance in mathematics. Finally, 100% of responding teachers reported that they would like to see the type of instruction employed by Project SEED in more classrooms.

Principal Opinions

Sample. 9 Detroit principals responded to a 15 item opinionaire about their perceptions of Project SEED. The principal response rate was probably low because Detroit principals responded to a similar survey a few years ago. Responses to this survey were very similar to the responses tabulated for the previous survey. Only valid responses were tabulated. The Principal Survey is included as Appendix D.

Results. Appendix D also contains the results of the survey. 100% of reporting principals noted that they had had SEED classes in their building for more than one year. 100% reported observing a SEED class at least once during the year while 62.5% reported multiple observations.

100% of Detroit principals rated the teaching methods employed by SEED as extremely effective while 88.9% felt that student enthusiasm and participation in SEED classes was excellent. In a series of parallel questions, 100% of Detroit principals reported that the SEED lessons considerably stimulated student interest in mathematics, motivated students to learn, helped improve critical thinking and problem solving skills, and helped build student self-confidence, while 88.9% saw significant impact on fostering better peer relationships and the improvement of student communication skills. No principal believed that SEED had no impact on any of these important student outcomes.

In the area of professional relationships, principals consistently rated SEED specialists highly in a number of important areas and 100 % believed that the SEED program positively affected the classroom teacher.

In summary, Detroit principals were generally very positive toward Project SEED and its specialists. They generally felt that SEED instruction was extremely effective, that it exerted a positive effect on the classroom teacher, that it motivated and stimulated students to learn mathematics, improved critical thinking and problem solving skills, and helped build student self-confidence and communications skills. Finally, 100% of Detroit principals would like SEED in their schools next year and 100% would like to see this kind of instruction in more classrooms.

Parent Opinions

Sample. 267 parents of Detroit students enrolled in SEED classes responded to a short opinionaire about Project SEED. Only valid responses were tabulated. The Parent Survey is included as Appendix E.

Results. Appendix E also contains the results of the Parent Survey. An amazing 40.4% of parents reported observing a Project SEED class. 90.6% said that their children were very excited about studying Algebra through Project SEED, 92.2% reported that their children greatly enjoyed SEED classes, 76.7 % observed that their children's confidence had significantly improved since exposure to SEED, and 75.5% believed that their children's math ability had notably improved after exposure to SEED. Finally, 94.8% felt that other children should be exposed to SEED.

Summary

Principals, classroom teachers, and parents of SEED students all believed that the SEED program provided significant value-added benefit to SEED students. In addition, principals and teachers believed that the classroom teacher benefited from witnessing SEED instruction, both from the standpoint of improved teaching methodology and strengthened understanding of mathematics.

SEED instruction was generally seen to be extremely effective accompanied by high rates of student participation and enthusiasm. Among the perceived outcomes of SEED instruction were increased student interest in mathematics, improved critical thinking and problem solving skills, increased student motivation to learn, increased student self-confidence, and better understanding of mathematics. Student performance on both the norm-referenced achievement test and on the Algebra tests administered through this evaluation support these observations as well as point to increased student achievement levels in mathematics.

Students themselves reported enjoying their Project SEED Algebra classes, believed that they had learned Algebra through their SEED classes (an observation that is backed up by empirical data), liked mathematics more because of SEED, felt that their mathematical abilities were strengthened as a result of SEED, and reported notably increased feelings of confidence about mathematics and school in general.

This study was a cooperative study conducted across and within five school districts. These districts included Camden City School District in New Jersey, the Dallas Public Schools in Texas, the Detroit Public Schools in Michigan, the Indianapolis Public Schools in Indiana, and the West Contra Costa School District in Richmond, California. Results across these five districts were strikingly similar in terms of both cognitive impact of the program on student mastery of algebraic concepts and the strong support for the program from classroom teachers, principals, students, and parents. Perhaps the greatest measure of support for the program is that, across the five districts, 97.2% of classroom teachers and 100% of principals, polled by anonymous survey, said that they would like to see this type of instruction in more classrooms. In addition, 95.7% of principals reported that they would like SEED in their schools next year while 89.9% of the parents of SEED students believed that other children should be exposed to SEED. The amount of parental interest in the program is attested to by the fact that an unusually high 38.2% of parents across the five districts visited and observed a SEED class.

Successful programs in education are rare. Successful educational programs that have grassroots support are practically unique. From all of the data that have been analyzed across a number of different districts throughout a period of more than thirty years, SEED appears to be one of those unique programs. The findings of this study have supported the findings of previous studies. Project SEED has a positive impact on student achievement and attitudes toward school and mathematics as well as a positive impact on the instructional and mathematical abilities of observing teachers.

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Appendix A
PROJECT SEED
POSTTEST QUESTIONS 1997 - 98
Level A: Abstract Algebra (Group Theory)

Directions: On your blue answer sheet, darken the circle that best answers the question. Attempt all problems but do not spend too much time on any one answer. Please notice that the questions start with number 51.

Hints: In this test,

I_+ stands for 0, the additive identity.
I_x stands for 1, the multiplicative identity.

51. If $a + I_+ = a$, then $I_+ =$

A) a
B) 0
C) 1
D) 9

52. $7 + I_+ + 3 + I_+ = \square$

A) 12
B) 10
C) 28
D) $10I_+$

53. $+ 19 + I_+ = 29$

A) 48
B) I_+
C) 9
D) 10

54. $^-a + b + a + {}^-b + 6 = \square$

A) 6
B) ^-b
C) a
D) $^-6$

55. $\square + 7 + 3 = 3$

A) 13
B) 7
C) $^-7$
D) 10

56. $^-6 + 5 + 6 + {}^-5 + 8 + {}^-9 + {}^-8 + 9 = \triangle$

A) $^-28$
B) 28
C) 56

D) I_+

57. $8 + \square = {}^{-}7$

A) 1
B) $^{-}1$
C) 15
D) $^{-}15$

58. $^{-}17 + 20 = \triangleleft$

A) 3
B) 37
C) $^{-}37$
D) $^{-}3$

59. $\square + {}^{-}2 + {}^{-}4 = 0$

A) $^{-}6$
B) I_+
C) 6
D) $\frac{1}{6}$

60. If $^{-}5 + {}^{-}2 + p = 0$, then $p =$

A) $^{-}7$
B) 7
C) $^{-}3$
D) 3

61. If $a \times I_x = a$, then $I_x =$

A) a
B) 0
C) 1
D) 9

62. $I_x \times 6 \times \square = 6$

A) 0
B) $^{-}6$
C) 7
D) I_x

63. $(8 + I_+) \times I_x = \triangle$

A) 0
B) 8
C) 9
D) 10

64. $5 \times \frac{1}{5} = \bigcirc$

A) 1

B) $5\frac{1}{5}$

C) 5

D) $\frac{1}{25}$

65. $a \times \frac{1}{\alpha} = \lhd$, (for $a \neq 0$)

A) $\frac{1}{\alpha}$

B) $2a$

C) 1

D) $\frac{1}{2}a$

66. $\frac{1}{2} \times \square \times \frac{1}{\beta} \times b = 1$, (for $b \neq 0$)

A) $2b$

B) 0

C) 1

D) 2

67. $\frac{1}{2} \times \frac{1}{3} \times \bigtriangledown = 1$

A) $\frac{1}{6}$

B) 6

C) 5

D) $\frac{2}{5}$

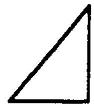
68. $\square \times 9 = 3$

A) $\frac{1}{3}$

B) $\frac{1}{9}$

C) 3

D) 6

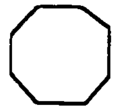
69. $(^{-}2 \times 3) + (^{-}2 \times 5) =$  $\times (3 + 5)$

A) $^{-}2$

B) 4

C) $^{-}6$

D) $^{-}10$

70. $(\frac{1}{2} \times 4) + (\frac{1}{2} \times 6) = \frac{1}{2} \times$ 

A) 2

B) 10

C) 3

D) 5

Appendix B
Project SEED Student Survey

Detroit Public Schools

1. My class has Project SEED algebra lessons in the ...

a.	morning	196	45.4
b.	afternoon	266	61.6

2. I enjoy my Project SEED algebra class.

a.	Yes, a whole lot	423	92.6
b.	Yes, somewhat	25	5.5
c.	Not true	9	1.9

3. I have learned about Algebra through my Project SEED class.

a.	Yes, a whole lot	404	89.2
b.	Yes, somewhat	37	8.2
c.	Not true	12	2.6

4. I like mathematics more due to my experience with Project SEED algebra.

a.	Yes, a whole lot	345	76.3
b.	Yes, somewhat	66	14.6
c.	Not true	41	9.1

5. My mathematics abilities are stronger due to my experience with Project SEED algebra.

a.	Yes, a whole lot	340	75.7
b.	Yes, somewhat	77	17.2
c.	Not true	32	7.1

6. I feel more confident about doing mathematics due to my experience with Project SEED algebra.

a.	Yes, a whole lot	346	77.1
b.	Yes, somewhat	76	16.9
c.	Not true	27	6.0

7. I feel more confident in school due to my experience with Project SEED algebra.

a.	Yes, a whole lot	333	75.3
b.	Yes, somewhat	68	15.4
c.	Not true	41	9.3

Appendix C
Project SEED Teacher Survey

Detroit Public Schools

1. How many years have you had Project SEED classes?

a___	1 year	16	64.0
b___	2 years	2	8.0
c___	3 or more years	7	28.0

2. How many years have you been teaching?

a___	1 year	0	0
b___	2-5 years	4	16.0
c___	6-10 years	3	12.0
d___	11 or more years	18	72.0

3. How much college mathematics do you have?

a___	Major in mathematics	1	4.0
b___	Minor in mathematics	4	16.0
c___	Some courses in mathematics	20	80.0
d___	No courses in mathematics	0	0

4. Has Project SEED instruction strengthened your understanding of mathematics?

a___	Yes, a great deal	9	36.0
b___	Yes, quite a lot	9	36.0
c___	Somewhat	7	28.0
d___	Not at all	0	0

5. How effective are the teaching methods employed by the Project SEED instructor?

a___	Extremely effective	19	76.0
b___	Very Effective	4	16.0
c___	Somewhat effective	2	8.0
d___	Not effective	0	0

6. How would you rate student enthusiasm and participation during the Project SEED instruction?

a___	Excellent	17	68.0
b___	Good	6	24.0
c___	Average	2	8.0
d___	Poor	0	0

7. Do you have any shy or withdrawn students who participated actively in the Project SEED lessons?

a___	Yes	23	92.0
b___	No	2	8.0

8. How well do the Project SEED lessons stimulate student interest in mathematics?

a___	A great deal	14	56.0
b___	Quite a lot	7	28.0
c___	Somewhat	4	16.0
d___	Not at all	0	0

9. Have the Project SEED lessons helped your students improve their critical thinking and problem solving skills?

a___	Yes, a great deal	10	40.0
b___	Yes, quite a lot	10	40.0
c___	Somewhat	5	20.0
d___	Not at all	0	0

10. Does Project SEED motivate students to learn?

a___	Yes, a great deal	11	45.8
b___	Yes, quite a lot	10	41.7
c___	Somewhat	3	12.5
d___	Not at all	0	0

11. How well do the Project SEED lessons build students' self-confidence?

a___	A great deal	13	52.0
b___	Quite a lot	10	40.0
c___	Somewhat	2	8.0
d___	Not at all	0	0.0

12. Does Project SEED help students to relate to their peers more positively?

a___	Yes, a great deal	6	24.0
b___	Yes, quite a lot	13	52.0
c___	Somewhat	6	24.0
d___	Not at all	0	0

13. Have you seen improvement in the communication skills of students: good listening, speaking clearly, using vocabulary, etc.?

a___	Yes, a great deal	9	36.0
b___	Yes, quite a lot	10	40.0
c___	Somewhat	6	24.0
d___	Not at all	0	0

14. Did the Project SEED lessons improve your student's performance in their regular math program?

a___	Yes, a great deal	8	32.0
b___	Yes, quite a lot	10	40.0
c___	Somewhat	5	20.0
d___	Not at all	0	0
e___	I do not teach math to this class	2	8.0

15. Did the Project SEED lessons provide you with any new or insightful ways of teaching mathematical concepts?

a___	Yes	24	96.0
b___	No	1	4.0

16. Which of the following techniques have you employed in your own teaching? (Check as many items as are appropriate)

a___	Agreement and Disagreement Signals	22	88.0
b___	Deliberate Errors	14	56.0
c___	Chorus Reading	17	68.0
d___	Having Students Indicate Answers On Their Fingers	15	60.0
e___	Having A Student Call On Another Student	19	76.0
f___	Exploring The Thinking Behind "Wrong Answers"	17	68.0
g___	None	0	0

18. Would you like to see this type of instructions in more classrooms?

a___	Yes	25	100.00
b___	No	0	0

Appendix D
Project SEED Principal Survey

Detroit Public Schools

1. How many years have you had Project SEED classes?

a___	1 year	0	0
b___	2 years	2	22.2
c___	3 or more years	7	77.8

2. Did you observe Project SEED this year?

a___	Yes, once	3	37.5
b___	Yes, more than once	5	62.5
c___	No	0	0

3. How effective are the teaching methods employed by the Project SEED instructors?

a___	Extremely effective	9	100.0
b___	Somewhat effective	0	0
c___	Not very effective	0	0
d___	Not effective at all	0	0

4. How would you rate student enthusiasm and participation during the Project SEED instruction?

a___	Excellent	8	88.9
b___	Good	1	11.1
c___	Fair	0	0
d___	Poor	0	0

5. How well do the Project SEED lessons stimulate student interest in mathematics?

a___	A great deal	7	77.8
b___	Quite a lot	2	22.2
c___	Somewhat	0	0
d___	Not at all	0	0

6. Have the Project SEED lessons helped students improve their critical thinking and problem solving skills?

a___	A great deal	5	55.6
b___	Quite a lot	4	44.4
c___	Somewhat	0	0
d___	Not much	0	0

7. Does Project SEED help motivate students to learn?

a___	A great deal	5	55.6
b___	Quite a lot	4	44.4
c___	Somewhat	0	0
d___	Not much	0	0

8. How well do the Project SEED lessons build student self-confidence?

a___	A great deal	6	66.7
b___	Quite a lot	3	33.3
c___	Somewhat	0	0
d___	Not much	0	0

9. Does Project SEED help students to relate to their peers more positively?

a___	A great deal	6	66.7
b___	Quite a lot	2	22.2
c___	Somewhat	1	11.1
d___	Not much	0	0

10. Has Project SEED helped students improve in their communication skills: good listening, speaking clearly, using vocabulary, etc.?

a___	A great deal	5	55.6
b___	Quite a lot	3	33.3
c___	Somewhat	1	11.1
d___	Not much	0	0

11. Do you feel that the Project SEED program affects the classroom teacher positively?

a___	Yes	9	100.0
b___	No	0	0

12. On a five point scale (1 to 5), how would you rate the Project SEED Specialist. Five being the top of the scale.

a___	Professional	5.00
b___	Positive	5.00
c___	Enthusiastic	4.78
d___	High Expectations	4.67
e___	Prepared	5.00
f___	Motivating	4.88
g___	Professional	5.00
h___	Friendly	5.00

13. Would you like to see Project SEED in your school next year?

a___	Yes	9	100.00
b___	No	0	0

14. Would you like to see this kind of instruction in more classrooms in other schools?

a___	Yes	9	100.00
b___	No	0	0

Project SEED Parent Survey

Detroit Public Schools

1 I have observed a Project SEED class.

a___	Yes	108	40.4
b___	No	159	59.6

2. My child is excited about studying Algebra through Project SEED.

a___	Yes, a great deal	181	67.5
b___	Yes, quite a lot	62	23.1
c___	Yes, somewhat	19	7.1
d___	No, not at all	0	0
e___	I don't know	6	2.2

3. My child enjoys the Project SEED classes.

a___	Yes, a great deal	198	73.2
b___	Yes, quite a lot	51	19.0
c___	Yes, somewhat	15	5.6
d___	No, not at all	2	0.7
e___	I don't know	2	0.7

4. My child's confidence has improved since exposure to Project SEED.

a___	Yes, a great deal	140	52.4
b___	Yes, quite a lot	65	24.3
c___	Yes, somewhat	54	20.2
d___	No, not at all	2	0.7
e___	I don't know	6	2.2

5. My child's math ability has improved since exposure to SEED.

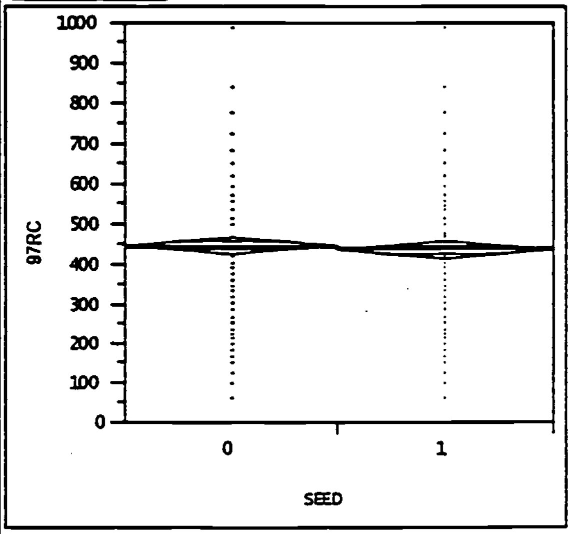
a___	Yes, a great deal	132	49.4
b___	Yes, quite a lot	67	25.1
c___	Yes, somewhat	52	19.5
d___	No, not at all	7	2.6
e___	I don't know	9	3.4

6. Other children should be exposed to SEED.

a___	Yes	254	94.8
b___	No	3	1.1
c___	I don't know	11	4.1

Figure F-1
Reading Comprehension Pretest
Spring, 1997

97RC By SEED



Oneway Anova

Summary of Fit

RSquare	0.00062
RSquare Adj	-0.00104
Root Mean Square Error	194.8454
Mean of Response	444.3262
Observations (or Sum Wgts)	604

t-Test

	Difference	t-Test	DF	Prob>|t|
Estimate	9.6921	0.611	602	0.5413
Std Error	15.8563			
Lower 95%	-21.4488			
Upper 95%	40.8329			

Assuming equal variances

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	14184	14184.3	0.3736
Error	602	22854774	37964.7	Prob>F
C Total	603	22868959	37925.3	0.5413

Means for Oneway Anova

Level	Number	Mean	Std Error
0	302	449.172	11.212
1	302	439.480	11.212

Std Error uses a pooled estimate of error variance

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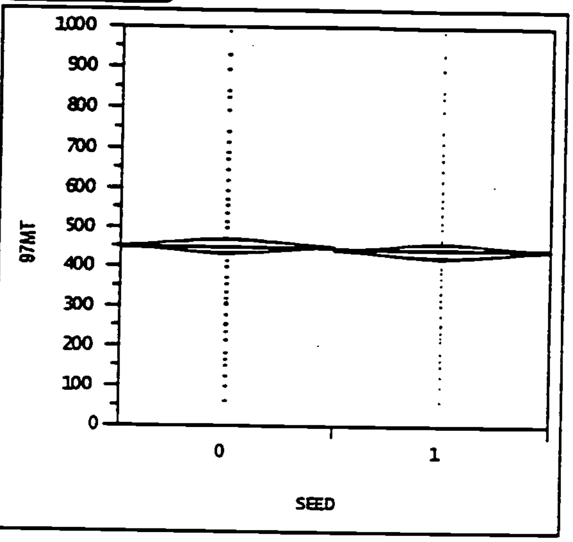
Figure F-2
Mathematics Total Pretest
Spring, 1997

97MT By SEED



Oneway Anova

Summary of Fit

RSquare	0.000221
RSquare Adj	-0.00144
Root Mean Square Error	226.4508
Mean of Response	449.6805
Observations (or Sum Wgts)	604

t-Test

	Difference	t-Test	DF	Prob>|t|
Estimate	6.7252	0.365	602	0.7153
Std Error	18.4283			
Lower 95%	-29.4670			
Upper 95%	42.9173			

Assuming equal variances

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	6829	6829.4	0.1332
Error	602	30870530	51280.0	Prob>F
C Total	603	30877359	51206.2	0.7153

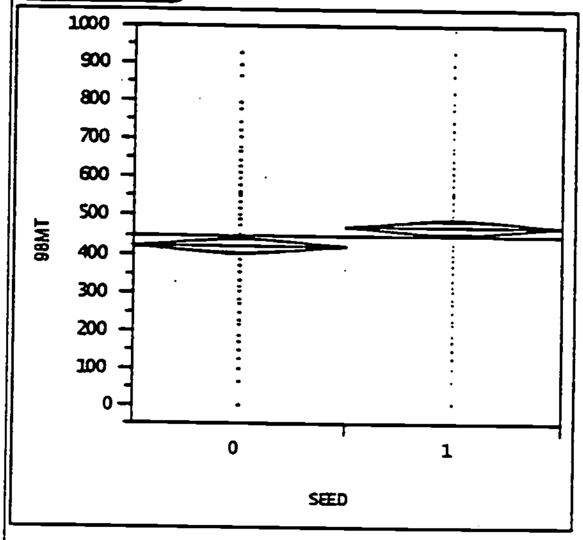
Means for Oneway Anova

Level	Number	Mean	Std Error
0	302	453.043	13.031
1	302	446.318	13.031

Std Error uses a pooled estimate of error variance

Figure F-3
Mathematics Total Posttest
Spring, 1998

98MT By SEED



Oneway Anova

Summary of Fit

RSquare	0.011134
RSquare Adj	0.009491
Root Mean Square Error	219.0418
Mean of Response	447.7765
Observations (or Sum Wgts)	604

t-Test

	Difference	t-Test	DF	Prob>|t|
Estimate	-46.4073	-2.603	602	0.0095
Std Error	17.8254			
Lower 95%	-81.4153			
Upper 95%	-11.3993			

Assuming equal variances

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	325199	325199	6.7779
Error	602	28883542	47979	Prob>F
C Total	603	29208741	48439	0.0095

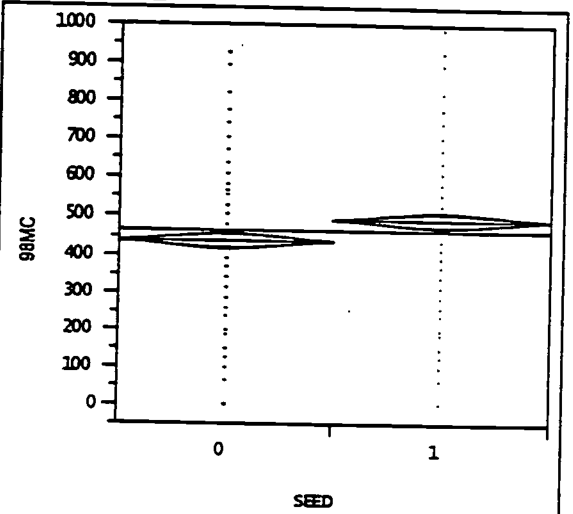
Means for Oneway Anova

Level	Number	Mean	Std Error
0	302	424.573	12.604
1	302	470.980	12.604

Std Error uses a pooled estimate of error variance

Figure F-4
Mathematics Concepts/Problem Solving Posttest
Spring, 1998

98MC By SEED



Oneway Anova

Summary of Fit

RSquare	0.014951
RSquare Adj	0.013315
Root Mean Square Error	212.0255
Mean of Response	465.856
Observations (or Sum Wgts)	604

t-Test

	Difference	t-Test	DF	Prob>|t|
Estimate	-52.1556	-3.023	602	0.0026
Std Error	17.2544			
Lower 95%	-86.0423			
Upper 95%	-18.2690			

Assuming equal variances

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	410752	410752	9.1370
Error	602	27062789	44955	Prob>F
C Total	603	27473540	45561	0.0026

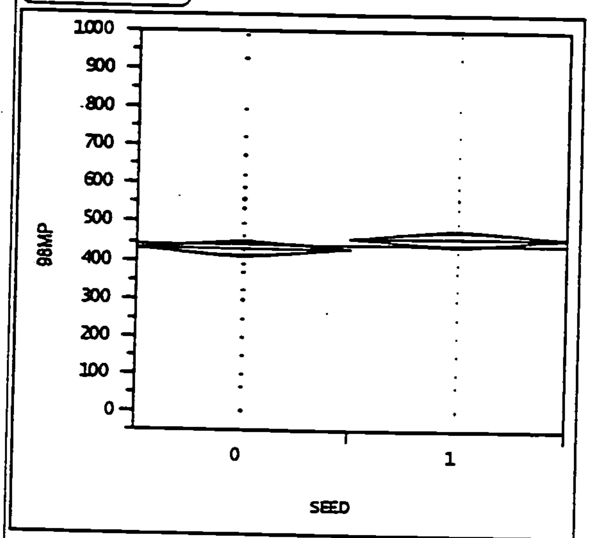
Means for Oneway Anova

Level	Number	Mean	Std Error
0	302	439.778	12.201
1	302	491.934	12.201

Std Error uses a pooled estimate of error variance

Figure F-5
Mathematics Procedures Posttest
Spring, 1998

98MP By SEED



Oneway Anova

Summary of Fit

RSquare	0.004476
RSquare Adj	0.002822
Root Mean Square Error	225.433
Mean of Response	447.5447
Observations (or Sum Wgts)	604

t-Test

	Difference	t-Test	DF	Prob>|t|
Estimate	-30.1821	-1.645	602	0.1004
Std Error	18.3455			
Lower 95%	-66.2116			
Upper 95%	5.8474			

Assuming equal variances

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	137555	137555	2.7067
Error	602	30593651	50820	Prob>F
C Total	603	30731206	50964	0.1004

Means for Oneway Anova

Level	Number	Mean	Std Error
0	302	432.454	12.972
1	302	462.636	12.972

Std Error uses a pooled estimate of error variance

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