DOCUMENT RESUME

ED 027 136 32 RC 003 301

It Works: Project R-3, San Jose, California.
American Inst. for Research in Behavioral Sciences, Palo Alto, Calif.
Spons Agency-Office of Education (DHEW), Washington, D.C. Div. of Compensatory Education.
Report No-OE-37040; SPCE-4
Pub Date [68]
Note-22p.
Available from-Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (OE-37040, $0.25)
EDRS Price MF-$0.25 HC Not Available from EDRS.
Descriptors-*Compensatory Education Programs, Economically Disadvantaged, Grade 8, Grade 9, Learning Difficulties, *Methodology, *Mexican Americans, Personnel, Program Evaluation, *Readiness, Reading Skills, *Reinforcement, Secondary School Students, Skill Development
Identifiers-Lockheed Missiles and Space Company, *San Jose Unified School District

A project was designed by the San Jose Unified School District and the education division of the Lockheed Missiles and Space Company to treat learning problems experienced by eighth and ninth grade students with underdeveloped reading and mathematics skills. The students were largely Mexican American and were from predominately disadvantaged economic backgrounds. The program, designated R-3, was concerned with student readiness, subject relevance, and learning reinforcement. It consisted of: a special curriculum which interrelated math, reading, and technological skills; a series of field trips; and an inservice training program for the project staff. Sources to contact for additional information conclude the document. (SW)

PROJECT R-3
San Jose, California

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Level II

IT WORKS

PROJECT R-3
SAN JOSE, CALIFORNIA

One of a Series of

Successful Compensatory Education Programs

U.S. Department of Health, Education, and Welfare
Robert H. Finch, Secretary

Office of Education
Peter P. Muirhead, Acting Commissioner

FOREWORD

This project report is part of an independent study of selected exemplary programs for the education of disadvantaged children completed by the American Institutes for Research in the Behavioral Sciences, Palo Alto, Calif., under contract with the U.S. Office of Education.

The researchers report this project significantly improved the educational attainment of the disadvantaged children involved. Other communities, in reviewing the educational needs of the disadvantaged youngsters they serve, may wish to use this project as a model - adapting it to their specific requirements and resources.

Division of Compensatory Education
Bureau of Elementary and Secondary Education

PROJECT R-3

IN SAN JOSE, CALIFORNIA

Introduction

The R-3 program was designed to treat the learning problems experienced by eighth- and ninth-grade students from predominantly disadvantaged economic backgrounds with underdeveloped reading and mathematics skills. The three R's signified student Readiness, subject Relevance, and learning Reinforcement. The treatment was jointly designed by the San Jose Unified School District and the education division of the Lockheed Missiles and Space Company. It consisted of a special curriculum which interrelated math, reading, and technological skills; a series of field trips; and an inservice training program for the project staff.

The students were largely of Mexican-American background, English-speaking, and underachieving at least one, but not more than 2 years, in either reading or math as measured by the California Achievement Tests.

Project R-3 began in February 1967 with 37 eighth-grade students. Each subsequent year a new eighth-grade group was added in the fall, and the previous eighth-graders moved into the ninth-grade phase of the program. Therefore, each group participated in the program for 2 consecutive years.

An evaluation report of the 1967-68 eighth-grade pupils' progress showed that they made significant gains over those of comparable controls on standardized tests measuring competence in the areas of reading and mathematics.

Personnel

The following personnel were responsible for the eighth-grade R-3 program; a comparable staff directed the ninth-grade program.

A. Project Coordinator. (Full-time; certified in elementary and secondary education and administration; 12 years' experience as a teacher-counselor in target school; coordinator for Manpower Development Training Act.)

The coordinator made the initial contact with the parents and maintained contact throughout the program; participated in the curriculum planning and evaluation meetings, and the R-3 periods of instruction; performed other duties similar to those of a school principal; coordinated the efforts of Lockheed, School District, and Rand staff; directed intensive involvements.

B. Mathematics Teacher. (Full-time; certified in mathematics, guidance, and counseling; 6 years of experience as a production technician with an electronics firm; 5 years of teaching experience in a target school.)

He instructed two periods of R-3 math and co-directed the R-3 activity period each morning; participated in curriculum planning and evaluation meetings. He also participated in the intensive involvement field trips (described subsequently) as an instructor.

C. Reading Teacher. (Full-time; certified in general elementary and secondary education; 6 years' experience as a teacher and reading specialist in the target school.)

She taught two periods of R-3 reading and co-directed the R-3 activity each morning; participated in curriculum planning and evaluation, and in intensive involvement field trips.

D. Electronic Technician. (Full-time; trained in electronics and use of audio visual equipment; experience as U.S. Navy technician and electronic technician for Pacific Telephone and Telegraph, I.B.M. and Lockheed.)

He operated and repaired the electronic equipment used daily in the R-3 classrooms and frequently for evening presentations.

E. Secretary. (Full-time; experience as team-teaching secretary in a target area school.)

In addition to the full-time staff, the project had access to the part-time services of civic and industrial personnel who were involved in planning and evaluation sessions and intermittent instructional activities. Parents were frequently invited to participate in field trips.

The evaluation was conducted by an independent agency, Rand Corporation, of Santa Monica, California.

Methodology: General

The rationale for developing the R-3 program was based on the premise that traditional curricula and classroom activities have not been successful in helping students, such as those included in this study, bridge the gap between inherent capabilities and expected performance; therefore, the students quit trying and the typical

behavioral symptoms of dropouts and delinquencies become apparent (San Jose Unified School District, Lockheed, Rand, 1968). The approach to this problem in the R-3 program was to identify the basic causes of underachievement in fundamental skill areas and then to use school, home, community, and technological resources to change the students' behaviors.

The title, R-3, suggests both the program objectives and methodology: students are ready to learn only when they are motivated; motivation is achieved when the performance of an act (learning to read) is positively linked with or made relevant to a reward and when the whole process is socially acceptable (has parental and peer group approval); major behavioral changes are made lasting by reinforcing the positive, desired acts which promote cognitive and affective development (San Jose Unified School District, Lockheed, Rand, 1968).

These are the major objectives of the program (San Jose Unified School District and Lockheed, 1967):

1. To develop student/family understanding of the technology-based society of the State of California.

2. To design a curriculum incorporating occupational skills analyses to make relevant the acquisition of reading and mathematics skills.

3. To motivate students with the desire to learn by instituting innovative techniques such as gaming/simulation, field trips, team learning, leadership instruction.

4. To upgrade performance in reading and mathematics.

5. To raise student occupational and educational aspiration level.

6. To improve overall classroom and school social behavior.

7. To enable students to relate positively individual cultural strengths to school activities.

8. To enable school staff to acquire understanding of the special characteristics of R-3 pupils.

9. To provide means for the students' parents and families to participate in the program.

The R-3 students attended a target junior high school; they spent each morning in three classes taught by project staff and the remainder of the day in the regular school curriculum (physical education, science, industrial arts or home-making, foreign language). The morning classes were devoted to reading and mathematics instruction, and the R-3 activity period. The students were grouped in classes of approximately 15 for mathematics and reading instruction and in groups of 30 for the activity period. Each math and reading class was taught by one staff member; the activity period was directed by two or more.

The mathematics and reading curricula were organized by the school district. They then submitted these curricula to the Lockheed personnel, who proceeded to incorporate the skills taught in these areas into the curriculum which they then designed for the R-3 activity period. The R-3 curriculum utilized a modular approach to relate closely program activities to program goals. This means that the annual program was composed of elements (units of study) which occupied given time segments and which imparted certain of the overall program objectives. The project staff felt that this approach offered the assurance that all objectives were covered, an increased facility for evaluation, ease of transfer of successful program elements, greater potential for general applicability through mixing of modules, and the ability to utilize scarce manpower in the production of program segments. The contents of each segment in the math and reading curricula were developed around a set of specific behavioral objectives for that segment. The content for each segment of the activity period curriculum was designed about a core subject of a given cluster of occupations (e.g., assembly occupations).

Each R-3 curriculum segment generally operated for the duration of 2 weeks (module). There were approximately 14 segments in the annual program. Two of these, known as intensive involvement periods, were each a week in length and were actually highly structured field trips to locations distant from the school community. The techniques employed to motivate and to involve the students actively in the learning situations comprising each segment included the following:

1. Gaming/Simulation
2. Intensive Involvement
3. Learning by Discovery
4. Team Learning
5. Concept-Motor Skills Linkage

6. Multi-Sensory Input
7. Learning to Learn
8. Role-Playing
9. Field Trips
10. Participation of Industrial and Civic Personnel

The project staff did not design the curriculum materials used in the reading and math segments of the program, but used current publications from among those which were suitable for this group of students in view of initial diagnoses based on California Achievement Test and SRA test scores. The staff did, however, sequence the learning events so that the students mastered certain skills necessary to the understanding of the corresponding occupational segment being taught during that activity period.

The materials used during the R-3 activity period were designed and printed by Lockheed expressly for use in this program.

A separate packet comprised of a series of lesson plans for one 2-week segment was prepared for the teachers. Each packet included the following:

1. A list of the general mathematics objectives of the program.

2. A list of the general reading objectives of the program.

3. A list of the specific behavioral objectives to be realized by the completion of the occupational module.

4. Lesson plans for the 2-week period.

5. Descriptions of games to be included in specific lessons.

6. Descriptions of relevant field trips to be taken in conjunction with the unit.

Printed matter and other materials used by the students were also developed or supplied by Lockheed.

Lockheed also prepared a technique which the project staff used to determine the success of each lesson. These forms permitted an evaluation of the extent to which each objective was met.

The R-3 classrooms were specially equipped for the operation of this project with carpeting, octagonal tables, closed circuit T. V., overhead, 16 mm and slide projectors, tape recorders, calculators, and fluorescent lighting.

Parents were encouraged to participate in the program. During the initial planning stages the families of the R-3 students attended a motivational night which included the following schedule of activities:

1. a dinner
2. a game with their children
3. a speaker - former student from the school district who is currently successful in business, industry, or a profession
4. a multi-media film presentation, "Se Puede - It Can Be Done"

Parents also served as chaperones on field trips and participated in meetings.

The project staff met during the afternoons to evaluate lessons and discuss plans for future packets. Video tapes of the lessons provided excellent feedback. The Lockheed personnel were frequently present at these sessions.

Methodology: Specific

A. Program Model

Table 1 is a partial reproduction of the total eighth-grade R-3 program for 1967-68 illustrating the parallel curriculum segments in reading, mathematics, and occupational technology.

B. Sample Packet: Assembly Occupations

The first three pages of the teacher's packet listed and described extensively the mathematics and reading objectives for the R-3 program. They were (Lockheed, XIV):

1. Improve oral vocabulary.

2. Improve reading rates and comprehension of materials.

Table 1

PARTIAL REPRODUCTION OF THE EIGHTH-GRADE R-3 PROGRAM CURRICULA (1967-68)

	Calendar Weeks						
	7	8	9	10	11	12	13
	Introduction to Technological Society		Intensive Involvement	Office Occupations	Electronic Data Processing		
R-3 Period	Library treasure hunt game "Historian" simulation "Job Hunters" simulation Lockheed employment interview Job-Education-Pay Game		Math Specialists Training Conference phone call Land Grant game Tour of historical sites	"Office workers" simulation Individual steel file boxes Field trip to school district office	Talk by Lockheed expert Boy vs. girl computing contest Programmed lecture (decimal to binary number conversions) Flow charting "I Am a Computer" game Two-state sentence builder Two-state coin mechanism Field trip to I.B.M. "Computer Dating" game "Alpha-numeric Search" game		
Reading Curriculum	Research Dewey Decimal System Industrial revolution films Vocabulary development Literature		Intensive involvement activities	Research and discovery Written reports	Literature "Revolt of the Machines"	Literature film "Tom Was Just a Little Boy"	Creative writing and listening
Mathematics Curriculum	Measurement	Land grant preparation	Land grant preparation Intensive involvement activities	Graphs and charts	Exponents Roman numerals Number bases Place value	Decimals SRA kits 284-310	Place value Addition Subtraction Multiplication Division

[Source: Adapted from matrix prepared by San Jose Unified School District, Lockheed, Rand, (1968)]

3. Use written materials to obtain information.

4. Convert decimal numbers to numbers of other bases.

5. Read simple scales and measuring devices.

6. Solve math problems at grade level.

7. Solve problems of distance, angles, and rates.

8. Read simple graphs, maps, and tables.

The next page of the packet listed the specific objectives to be covered by the lessons in the 2-week occupational segment. They were as follows (Lockheed, XIV, 1967 [?]):

1. Follow oral instructions and demonstrate simple soldering techniques.

2. Follow written instructions included in electronic kits and complete the kit assembly.

3. Successfully assemble a flow chart of assembly operations by combining the component parts of the flow chart in a joint activity with other students.

4. Solve mathematical problems in long division and multiplication to compute parts cost for flashlight assembly.

5. Solve mathematical problems to complete cost reduction evaluation to improve assembly line operation.

6. Correctly maneuver game markers based on written instructions regarding assembly industry operations.

The succeeding pages describe each daily lesson in exhaustive detail listing materials to be used, vocabulary to be learned, and procedures to be followed in each activity. Samples of student work sheets are also included along with suggestions to the teacher for their proper implementation.

The other 13 packets used during the 1967-68 program with the eighth-graders were:

1. Office Occupations
2. Sales and Services
3. Agriculture and Food Processing
4. Transportation
5. Budget and Finance
6. Communications
7. Oceanology
8. Medical Occupations
9. Public Service
10. Electronic Data Processing
11. Santa Clara Valley
12. Introduction to Technological Society
13. Intensive Involvement, Land Grant

C. Gaming/Simulation

Gaming/Simulation is a highly structured representation of a real world situation which can be carried out in the environment of the classroom. Each packet in the occupational curriculum usually included at least one game in the lessons. The key elements of the experience to be simulated were analyzed by the Lockheed team and school staff and restructured into a classroom activity which retained those elements. The basis for using gaming/simulation is that it can generate anticipation and can specify reward. The Land Grant Game will serve as an example.

Land Grant Game
(San Jose Unified School District,
and Lockheed, 1966[?])

Objectives:

1. Relate positively the cultural inheritance of Spanish and Mexican California to this century.

2. Develop specific mathematics and reading skills.

3. Illustrate through student involvement with cognitive and psychomotor tasks the relevance of mathematics to civil engineering occupations.

4. Learn formal decision-making skills inductively.

5. Practice decision-making and social-participation skills by means of team activities.

The goal of student teams was to obtain a "grant" of land in the Big Sur State Park area where the game, or simulation, was staged. This took place during an "Intensive Involvement" week of the R-3 program. The game called for teams to survey the land, to describe the shape and location of single portions/plots and to file an official Grant Application for analysis and approval by the Governor and his Land Commission.

D. Intensive Involvement

Students were taken from the school setting for up to 5 days and nights. Parents, teachers, students, consultants, and industrial personnel took part in a carefully designed educational program which occupied much of each day. The chief objective of the intensive involvement was to break down the structured role in which the solitary teacher stands in front of a seated group of passive students. Table 2 illustrates some of the activities pursued during one 4-day intensive involvement period. The intensive involvements gave all the participants a new sense of time unbroken by class schedules. Often activities lasted from early morning until late at night. Lockheed prepared a packet of lessons and activities for each of these periods, just as they did for each 2-week occupational module of classroom work. There were usually two intensive involvement periods for each grade per year.

E. Parental Involvement

Parents were asked to join in the games, trips, intensive involvements, and meetings, and did so. At all functions, whether academic or social, everyone was treated in the same manner. There were no head tables, no introductions of special guests such as authority figures. On intensive involvements the students, parents, and teachers shared the same accommodations for eating, housing, and socializing.

Table 2

SOME OF THE ACTIVITIES OF AN INTENSIVE INVOLVEMENT PERIOD IN THE R-3 PROGRAM, MAY 1968

	Tuesday	Wednesday	Thursday	Friday
Morning	Load and depart. Study land formations en route.	Pt. Lobos Tide Pools. San Jose Beach. (Study and explore and handle marine organisms.) Return to Asilomar Shower - Prepare for lunch.	Moss Landing - diggings outer coast, break water, bay/ estuary (study, discover and understand the environmental forces that operate at these habitats).	Load boat at Monterey. Boat tour of Monterey Bay. Study of currents, drift bottles, plankton netting. Study coast line features. Fishing.
Afternoon	Chanal Islands. Travel to Moss Landing Lighthouse. Sealions. Tour of State College Marine Lab. Arrive at Asilomar. Introduction to area and involvement.	Monterey Aquarium, wharf, divers, museum (identify and handle local sea-life organisms).	Return to Asilomar. Mounting specimens dug during morning; mole crab, sea urchin, star fish, shrimp.	
Evening	Ship's Navigator Game. Write post-cards home.	Marine Biology Game. Write post-cards home.	Complete mounting of specimens. Sailboat Race Game.	

[Source: Adapted from last page, San Jose Unified School District, Lockheed and Rand (1968)]

Evaluation

The impact of the R-3 program on students, teachers, parents, and community was evaluated by the project staff and Lockheed personnel during planning and evaluation sessions each weekday afternoon. In addition, the Rand Corporation evaluated each aspect of the program in a lengthy report at the conclusion of each program year. These evaluations were based on both objective and subjective data gathered during the year on various types of standardized tests and rating forms.

A. Measures of Achievement

Rand Corporation suggested that the testing be done under standardized conditions, preferably under the supervision of a counselor from the School District's administration office. This was done. The California Achievement Test was chosen as the instrument for measuring changes in arithmetic and reading competence. A pre- and posttest design was employed to compute the results. For the sake of simplicity the data which are presented here represent the 1967-68 eighth-grade R-3 students who had been in the program for 1 entire year. The results from the previous year followed the same trends.

The method for choosing the R-3 sample and their control group should be explained. The California Achievement Test (CAT) was administered in the fall of 1967 to all eighth-grade students in two junior high schools. All students testing at least 1 year below grade level, but not more than 2 years below, in either reading or math were identified.

From this group 33 students at one school were randomly selected as the R-3 experimentals. Selection took place during the first week of school. Posttesting took place in June 1968.

In the control school all those students identified as meeting the selection criteria were then posttested in June of 1968. From among those who received both the pre- and posttest a random sample of 40 students was chosen as the control. The controls were uncontaminated by any treatment given to the program group and both the students and their teachers were blind to the fact that they were serving as controls for the R-3 project.

Tables 3 and 4 record the grade equivalents of the mean CAT pre- and posttest scores in reading and arithmetic for both experimentals and controls.

Table 3

AVERAGE READING GRADE EQUIVALENTS FOR EIGHTH-GRADE PUPILS IN THE R-3 PROGRAM, FALL 1967 AND SPRING 1968

	Boys		Girls	
	Experimental	Control	Experimental	Control
Pre	6.7	6.6	6.9	6.4
Post	8.4	7.9	8.9	7.5
Gain	1.7	1.3	2.0	1.1

N = 33 for the experimental group
N = 40 for the control group

[Source: Table 1, page 15, The Rand Corp. (1968)]

Table 4

AVERAGE ARITHMETIC GRADE EQUIVALENTS FOR EIGHTH-GRADE PUPILS IN THE R-3 PROGRAM, FALL 1967 AND SPRING 1968

	Boys		Girls	
	Experimental	Control	Experimental	Control
Pre	6.7	6.5	6.9	6.7
Post	7.9	7.0	8.3	7.5
Gain	1.2	0.5	1.4	0.8

N = 33 for the experimental group
N = 40 for the control group

[Source: Table 2, page 16, The Rand Corp. (1968)]

There was no statistically significant difference between experimental and control pretest scores. However, both boys and girls in the R-3 program improved significantly more (at or beyond the .05 level) in both reading and arithmetic than did the control group.

B. Other Evaluation Indices

Various other measures were used to evaluate the program such as: Teacher rating of students, attendance, discipline referrals, and parent ratings. Results from all such measures were highly favorable to the experimental program, as for example:

1. Local Title I programs adapted some of the instruction techniques.

2. Absence rate for the program group was uniformly lower - boys and girls, fall and spring - than for a comparison group.

3. Parent attendance at meetings averaged 85 percent (with little variation).

C. Modifications and Suggestions

During the 2 years that the program was in operation the staff made the following modifications:

1. More careful sequencing of the math curriculum to assure student capability in performing skills required in occupational segments of the activity period curriculum.

2. Statement of daily lesson objectives in behavioral terms.

3. Structuring intensive involvements so that they were replicable.

Suggestions which the project staff would make to persons interested in attempting a similar program are:

1. Use all components of the R-3 program as a unit; do not expect the same success if you attempt to employ only portions of it.

2. Do not allow the gaming/simulations to degenerate into something less than a real life simulation.

3. Instructions to teachers for implementing lessons should not read in a manner which restricts the teacher's role to information-giver.

4. Field trips should be integrated into the total curriculum in terms of preparatory and follow-up activities.

5. Vocabulary level of the units should be geared to the students' understanding; perhaps, fewer industrial terms could be used.

6. Specific daily objectives should be explicit in defining what a given student should be capable of doing, under certain conditions, and to what degree by the completion of the unit. The objective should be testable.

7. Students should be invited to judge the worth of each packet for themselves.

8. A school system should allow at least 3 months of preparation for such a comparable program.

Budget

It should be noted at this point that the R-3 Project was designed as a research and development program. For this reason the initial costs for such things as equipping classrooms, producing video tapes, designing and printing occupational packets, and employing the personnel involved in the planning and evaluation of the program exceed the costs of eventual replication. The project staff have estimated their eventual replication cost to be approximately $300 per pupil over and above the normal per pupil cost to the school. This estimate would apply if a school system were able to purchase the inservice films, instructional packets, and educational games on the open market. If a school district wished to have additional or alternative packets developed, the cost would be higher for the initial development period. If the school system itself preferred to design the packets with minimal technical assistance, the costs would be less. If, as a further alternative, a school district preferred to work jointly with a local industry, the capital costs again would be high in relation to the eventual costs of duplication. A more exact estimate of potential costs will be available from the school district at a future date.

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GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON, D.C. 20402

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UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE / OFFICE OF EDUCATION / OE–37040

☆ U. S. GOVERNMENT PRINTING OFFICE : 1969 344-842 (2053)