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ABSTRACT

This study evaluates the effects of placement of additional equipment in preschool classrooms on the cognitive, perceptual, and social development of urban Negro four-year-old children. Two Get Set classrooms in each of six areas of Philadelphia were paired for teachers, subjects, physical facilities and equipment. One classroom in each pair was enriched through the addition of materials designed to augment one or more of the following: verbal ability, performance ability, visual perception, auditory perception, and social interaction. Enrichment items included a tape recorder and tapes, a Polaroid camera with film and flashbulbs, puzzle sets, prisms, and Negro dolls and puppets. Pretest and posttest measures assessed cognitive, perceptual, and social development of the children. The findings show that the enrichment significantly altered the classroom environment in the experimental classes. Signs of the alteration were present in the cognitive, perceptual, and social development of the experimental children. However, the control children showed greater gain scores in performance ability. Since both desirable and undesirable effects can result from environmental enrichment, the more extravagant claims for the efficacy of certain play materials should be muted and a properly equipped classroom should not be regarded as a panacea for the problems of disadvantaged children. (WY)

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Environmentally Enriched Classrooms and the Development of Disadvantaged Preschool Children[1]

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This study evaluates the effects that placement of additional equipment in preschool classrooms has on cognitive, perceptual, and social development of disadvantaged children.

The quantity and quality of the play materials available to preschool children has long been considered important in their development (Isaacs, 1968 [first publication, 1929]; Montessori, 1965 [first publication, 1914]). Textbooks in early childhood (e.g., Leeper, Dales, Skipper, and Witherspoon, 1968; Read, 1966) usually stress the equipment and supplies available in preschool classrooms.

Opinions about the value and effectiveness of play materials differ considerably. On the one extreme is a Creative Playthings' ad (1969) which features one young boy saying to another:

> "My parents say Creative Playthings designs its toys to expand the sensory, motor, and perceptual skills; to extend a child's horizons and to inculcate a feeling for size, shape and distance. Not to mention pattern learning and relationship thinking."

Emphasizing the same point in a more moderate tone is the statement by Read (1966):

"By providing materials which have been carefully selected and by offering adequate arrangements for their use, the nursery school helps ensure a rich environment for the children which stimulates intellectual development as well as social and emotional growth [p. 60]."

Tudor-Hart (1939) makes a similar point:

"We should never force or even urge our offer of assistance, but should concentrate our effort in providing him (a young child) with an environment and play material which will enable him to acquire self-reliance, initiative, and the best physical and mental development independently [p. 16]."

On the other hand, Bereiter and Engelmann (1966) argue that:

"The tendency to overstock a preschool with 'interesting' toys is based on a misunderstanding of the child's deficit and a desire to 'make up' for the lack of holiday experiences the children have had. The practice of providing an object-rich environment is ineffective in compensating for the child's toy deficit and in stimulating learning. Concrete objects are merely vehicles of concepts. Sometimes toys are good concept vehicles; sometimes they are not. However, presenting the child with many toys and thereby blindly bombarding him with a wide range of sensory experience is not an effective way to present any concept. What the child must learn is not formless; he does not assimilate a little of this concept and a little of that one. He learns very

specific rules. The value of any toy should be judged accordingly [p. 72]."

Law and Wu (1964) voice similar sentiments:

"Putting out materials just once or just one way won't do it. Putting things on open shelves day after day won't do it either. Equipment by itself is not creative, but children are [p. 21]."

In fact, very little empirical research has dealt with the relationship between play materials and the cognitive, perceptual and social development of young children.

Van Alstyne (1929) related the kinds of play materials that three-year-old children used (as stated by mothers) with the children's mental ages (Kuhlmann-Binet IQ Test) and with their mothers' intelligence as measured by a test of vocabulary. The correlation between the use of "constructive" play materials (the educational value of the toys as defined by judges) and the children's mental ages was .50, and that between the use of "constructive" play materials and the mother's vocabulary score was .54. No partial correlation was computed, but it appears that the more intelligent mothers provide more "constructive" educational materials for their children. Because of the design of the study no causes can be attributed to these effects.

Johnson (1935) in a study of the effects of playground equipment on the social behavior of preschool children found that social contact and undesirable behavior (teasing, crying, quarreling, hitting) decreased with the addition of a substantial quantity of equipment to two playgrounds. Both social contact and undesirable behavior increased when equipment was removed from a third playground. Muste and Sharpe (1947) found

that the frequencies of social contact and aggression are correlated positively. Green's (1933) results suggested that quarreling behavior is a necessary concomitant of friendship at the preschool level. Several studies (Farwell, 1930; Hulson, 1930; Van Alstyne, 1932) showed that certain play materials have high social interaction value while others have low social interaction value.

Since it is important that appropriate equipment be not only available but also used, the factor of teachers' encouragement of the use of equipment was studied in the present research. Several authors (Caldwell and Richmond, 1968; Gray and Klaus, 1965; Thompson, 1944) have suggested that the way in which play materials are used may determine their effectiveness. Linn (1967) found teacher behavior variables to be related to cognitive gains in Head Start children.

There is evidence that boys spend a greater percentage of their time playing with materials and equipment than do girls (Johnson, 1935). Several studies (Benjamin, 1932; Farwell, 1930; Herring and Koch, 1930; Van Alstyne, 1932; Vance and McCall, 1934) showed that various toys have differential attractiveness for boys and girls. For example, Benjamin's data verified the "obvious" proposition that boys prefer cars and girls prefer dolls when given a standardized set of toys with which to play. Thus all analyses in this study were done separately by sex.

Method

Subjects

Two Get Set classrooms in each of six areas of Philadelphia were paired for physical facilities and equipment.[3] Each classroom was

located in a different Get Set center , but paired classrooms were never more than three blocks apart. In so far as it was possible, only children living between paired centers were selected. These children were then blocked by sex and randomized by the experimenters into one of the paired classrooms. After the initial registration was completed, one classroom from each pair was randomly selected and "enriched." Thus there were six enriched and six control classes.

This procedure resulted in the following pretest subject distribution: 36 experimental boys, 44 control boys, 42 experimental girls, and 39 control girls. All children were Negro and all attended the four-year-old program of Get Set. The unequal numbers between experimental and control groups were caused both by the unstable nature of Get Set enrollment and by the use of paired centers as the randomization unit.

Additional children who registered throughout the year were likewise blocked by sex and randomly assigned to experimental and control classes. These children were not included in the sample.

Throughout the year a number of subjects either withdrew from the program or could not be tested because of excessive absences. The following subjects were administered all of the cognitive and perceptual measures and were used as well in the sociometric analyses: 28 experimental boys, 31 control boys, 34 experimental girls, and 30 control girls. The experimental boys had a median age of 4-1 with a range of 3-7 to 4-7 at the beginning of the school year; the control boys had a median age of 4-2 with a range of 3-9 to 4-6; the experimental girls had a median age

of 4-3 with a range of 3-8 to 4-8; the control girls had a median age of 4-3 with a range of 3-7 to 4-7.

Teachers

Teachers in paired centers were matched for race and age. All were female and all had taught previously in the Get Set program. Eight of the teachers were Negro and four were white. The median difference between the ages of paired teachers was five years. The range was from one to seven years. Three teachers (two experimental [in classes E3 and E4] and one control [in class C4]) left during the year. Their replacements were matched as before. In the two experimental classes, the replacement teacher served for most of the year. In the control class there was difficulty finding an appropriate substitute. For a substantial part of the year class C4 had a succession of substitutes. One teacher of this class who served for three months will be treated as the teacher of this class.

Each teacher worked with a teacher's aide. All of these teacher's aides were Negro females. They were not matched in any other way.

Classrooms

The experimental and control classrooms were located in church buildings. Five pairs of classrooms were in the heart of the Negro community. Two classrooms were on the fringe of that community, but these were attended almost exclusively by Negro youngsters.

For the most part the physical facilities, particularly soundproofing, were inferior to those which are customary in public school buildings.

Techniques

Enrichment procedures. The subjects were randomized into paired classrooms in September, 1968. One classroom of each pair was randomly assigned to the experimental condition. Then a substantial amount of equipment and supplies was added to those six classrooms (listed in Appendix A).

A number of authors (ENKI Corporation, undated; Murphy, 1968; Olson and Larson, 1965; Ward, 1968) have argued that various materials produce differential developmental gains. They suggest, for example, that some materials are likely to produce gains in verbal ability, while other materials are most suited for encouraging social development. Updegraff and Herbst's study (1933) showing that sociable and cooperative behavior occurred more frequently during play with clay than with blocks empirically supports this idea. Accordingly, each item placed in the enriched classrooms was chosen specifically to augment one or more of the following: verbal ability, performance ability, visual perception, auditory perception, and social interaction.

A sample of the materials placed in the enriched classrooms included: a tape recorder and tapes, a Polaroid camera and film and flashbulbs, book sets, rubber farm animals, sound cylinders, magnets, wooden puzzles, a shape-sorting box, prisms, rhythm band instruments, record sets, Negro dolls, Negro community workers (rubber figures), and Negro puppets.

Almost all of the equipment was chosen from the then current

Creative Playthings catalogs. The listed cost of the materials for each enriched center totaled approximately $1,300.

A number of suggested lists of equipment and supplies for the preschool classroom were studied before choosing the enrichment materials (Association for Childhood Education International, 1968; Evans, 1966; National Child Research Center, undated; Olson and Larson, 1965; Stern, 1967). An attempt was made to avoid duplication of equipment and supplies typically found in Philadelphia Get Set classrooms by taking an inventory in five Get Set classrooms in the experimental area prior to the study.

The equipment and supplies, except for a few back-ordered items, were placed in the experimental classrooms in late October, 1968. In addition, the teachers were kept supplied with flashbulbs, film, and tapes throughout the year. The effect of adding the equipment and supplies to the experimental classrooms was to take a meagerly equipped classroom and turn it into a "dream" classroom. The experimental teachers evaluations of the materials included: "wonderful," "really great," and "fabulous." It should be mentioned that the teachers in the experimental classes were required to keep the materials in their classes.

All equipment in the twelve classrooms was inventoried at the end of June, 1969. Most of the enrichment materials were still in the experimental classrooms at the end of the year. The complete inventory for each of the classrooms is reproduced in Appendix B. The superiority of the experimental classes in terms of play materials is quite evident.

Cognitive and perceptual measures. The Stanford-Binet IQ test (Terman and Merrill, 1960), the five performance subtests of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI; Wechsler, 1967), and four subtests of the Illinois Test of Psycholinguistic Abilities (ITPA; Kirk, McCarthy, and Kirk, 1968) were administered twice to the 123 subjects. Most of the pretests were administered during November, 1968; a majority of the posttests was given during May, 1969. The mean time between pre and posttesting was 24 weeks for the Binet, 23 weeks for the WPPSI, and 25 weeks for the ITPA subtests.

The five performance subtests of the WPPSI given were animal house, picture completion, mazes, geometric design, and block design.

The four subtests of the ITPA used were: (a) "visual reception," in which the examiner exposes a printed stimulus and then asks the subject to find it among three others printed on a separate page; (b) "visual sequential memory," in which the examiner exposes a picture showing a particular ordering of geometric items that the subject then has to reproduce with a set of chips imprinted with the same geometric shapes; (c) "auditory reception," in which the examiner asks the subjects to respond "yes" or "no" to items such as "Do boys play?" and "Do dresses sing?"; (d) "auditory sequential memory," in which the subject is asked to repeat a series of digits that has been read to him at one-half second intervals.

These tests were chosen to evaluate developmental gains in verbal ability (Binet), performance ability (WPPSI performance subtests), visual perception (visual reception and visual sequential memory), and

auditory perception (auditory reception and auditory sequential memory) for the experimental and control classes.

Social interaction measures. The Preschool Observation Schedule and the Playboard Sociometric Technique (Boger, undated) were used to assess social interaction differences between experimental and control classes.

The Preschool Observation Schedule was constructed to measure two of the most salient dimensions of the preschool classroom: types of play and types of aggressive behavior. The children on whom the Preschool Observation Schedule was used were randomly selected from the total group. This subsample consisted of 21 experimental boys, 21 control boys, 20 experimental girls, and 23 control girls.[4] Complete data for the Preschool Observation Schedule was obtained for 20 experimental boys, 17 control boys, 18 experimental girls, and 19 control girls. Children were only observed during free play periods. Each subject was individually observed for three 15-minute periods at one month intervals. The 15-minute observations were divided into thirty 30-second periods. During each of these 30-second periods, the type of play used for the greatest amount of time in that period was scored. Likewise, the types of aggressive behavior occurring during each 30-second period were checked. This data was collected between January and May of 1969.

The types of play dimension included six scoring categories:

1. Solitary play: Child plays with toy(s) by himself (no other peers in close proximity).

2. Parallel play: Child plays with toy(s) by himself but in close proximity to another child (or children) who is playing with toy(s). No interaction occurs between the children. Interest and activity seems to be heightened because of a second child's presence. No verbal communication occurs between the children.

3. Cooperative toy play (equipment-centered): Child uses toy(s) while interacting with other child(ren) who uses same or similar toy(s). Play involving only natural, structural, or geological features of the play area (ledges, columns, mounds of earth, etc.) will not be scored as cooperative toy play.

4. Cooperative peer play (peer-centered): Child interacts with other child(ren) in an activity in which no toys are involved.

5. Isolation: Child does not play. Child remains alone (no other peers in close proximity).

6. Other: Child's behavior is not specifically included in the above categories.

The percentage of thirty 30-second periods in which two raters agreed on the type of play behavior to be scored was 74.8% for fifteen randomly selected boys and 79.7% for fifteen randomly selected girls.

Types of aggressive behavior were scored in the following categories:

1. Personal physical attack: Hitting, biting, scratching, spitting, pushing, shoving.

2. Taunting: Reproaching in scornful or sarcastic language,

jeering, mocking. For example, "You can't do that, you're too dumb."

3. Threatening: Physical (e.g., fist-waving) and verbal (e.g., "I'll beat you up if you don't let me play with that.") threats are included.

4. Destroying property of another's labor: For example, knocking down another child's tower of blocks.

5. Usurping property: Forcefully taking toys, etc., away from another child.

6. No aggressive behavior.

Because of the low frequencies, the aggressive behavior categories were collapsed into two: either one of the aggressive behaviors occurred during a 30-second period or one did not. The percentage of thirty 30-second periods in which two raters agreed in scoring that some form of aggressive behavior did or did not take place was 97.3% for fifteen randomly selected boys and 97.7% for fifteen randomly selected girls.

The Playboard Sociometric instrument was used to study differences between the interaction networks in the experimental and control classes. In particular, it seemed desirable to compare the number of isolates and the number of stars. Each child was photographed in full front pose. The photographs were then mounted on a white fiberboard square (2 feet by 2 feet). The subject was familarized with all of the pictures on the board by pointing at and naming them (with the examiner's help when necessary). E then said: "We're going

to play a game using some pictures. Here are some pictures of things to play with. I want you to look at each one and pick out those you would like to play with the most." E showed the subject five drawings of play situations: two Raggedy-Ann dolls (girls only), two dump trucks (boys only), a sandbox with sand toys in it, two riding horses, a dual swing set, and a teeter totter. E then ascertained which three items the S would have liked to play with most. Using the pictures one at a time, E placed the S's photograph on the picture and asked: "Who would you like to have play with you (with this activity pictured)? Thus each subject had three sociometric choices. He might have given all three to one child, or typically, split them among three children. For this study two scores, the number of isolates and the number of stars in each class, were computed from the 123 children who completed pre- and post-testing on the cognitive measures.[5] A star is a child who was chosen by three or more different children; an isolate is a child who received no choices. The scores were computed separately by sex of chooser and sex of chosen person. The sociometric data was collected in May, 1969.

Teacher behavior instruments. Two different facets of teacher behavior were studied. First, an interaction measure of the teachers' encouragement of the use of equipment was obtained. Second, the teachers were ranked as to their effectiveness in fostering cognitive and perceptual learning in their children. The teachers were not aware that they were being observed; they thought that the observers were recording only the children's behavior.

Each teacher was observed for six 30-minute periods on a random basis, from January to June, 1969.[6] Each teacher was observed during the same six time periods, (e.g., 9:00-9:30), but on different mornings. Every thirty seconds the recorder checked off as present or absent teacher encouragement of the use of equipment.

Teacher encouragement was considered to encompass the following specific behaviors.[7]

1. Exhortation toward the use of equipment and supplies. For example, "Let's all play with crayons now."

2. Physical assistance in the use of equipment and supplies. Most probably individually directed (e.g., helps child with ruler; moves paint brush as the child holds it).

3. Instruction about equipment and supplies (purely descriptive). Teacher must endeavor to involve the child with described equipment. For example, "This is a ruler. It is used to measure things." or "This is a map of Pennsylvania. Here is where we live."

4. Instruction about methods of use. Teacher must endeavor to involve the child with equipment. For example, "You fill up the can with water, then you dip the paint brush in." or "You fold your paper in half like this."

5. Questions leading to the use of equipment and supplies. For example, "Can anybody make an airplane with this paper?"

The total number of periods out of 360 during which the use of equipment and supplies was encouraged is the teachers score on this measure.

For reliability purposes, 12 different teachers were each observed on the same occasion by two different raters for sixty 30-second periods. The percentage of periods in which the two raters agreed on the scoring of encouragement as being either present or absent was 94.4%.

The second teacher behavior measure was a ranking of the teachers in terms of their effectiveness in fostering cognitive and perceptual learning in their children. Where more than one teacher was in charge during the year, the teacher who was there longest was the one used in this ranking. The ranking was done once, after the close of the data gathering by the same two observers who did the teacher encouragement and Preschool Observation Schedule scoring. The Spearman rank-order correlation between the rankings of the two observers was .85 ($p < .01$, for a one-tailed test); since there was communication between observers throughout the year, this intercorrelation must be taken lightly. The mean of the two observers' rankings was used as a teacher's rank in the analyses.

Results

Cognitive and perceptual measures

The Stanford-Binet IQ test, the WPPSI Performance IQ, and the visual reception, visual sequential memory, auditory reception, and auditory sequential memory subtests of the ITPA are the measures analyzed here. The intercorrelations of these variables are shown in Table 1.[8] Lacey and Lacey's (1962) approach for obtaining regression gain scores was used. The Laceys' equation for obtaining a subject's gain score (G) is:

$$G = 50 + 10 \left[\frac{Y - X\,(r_{xy})}{(1 - r^2_{xy})^{1/2}} \right]$$

where X is the pretest and Y is the posttest score in z units for a subject on a particular measure, and r is the product-moment correlation. The means and standard deviations of the scaled scores, the mean scaled score gain, and the means and standard deviations of the Laceys' gain scores for the six variables are presented in Table 2. The product-moment intercorrelations of the gain scores are shown in Table 3.

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Insert Tables 1, 2, and 3 about here

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The six variables in the Laceys' gain score form were then run in a 2 treatments (enriched and normal classrooms) by 2 sexes multivariate analysis of variance (Jones, 1966).[9] Finn's (1968) fortran IV

computer program was used for these calculations. The likelihood ratio criterion (lambda) was used to test the hypotheses. As shown in Table 4, the multivariate Fs for sex and treatment by sex were insignificant. However, the multivariate F for treatment effect alone was highly significant ($p < .0001$).

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Insert Table 4 about here

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The univariate analysis of variance results are also presented in Table 4. Significant univariate treatment effects were found for the WPPSI performance IQ ($p < .02$), the visual reception subtest ($p < .01$), and the visual sequential memory subtest ($p < .02$).

Studying the means of Laceys' gain scores presented in Table 2, it is evident that children in the control classes gained significantly more than children in the experimental classes on both the WPPSI performance IQ and the visual reception subtest. On the other hand, experimental children gained significantly more on the visual sequential memory subtest.

Findings by paired centers. Table 5 shows the means and standard deviations of Laceys' gain scores for the six variables by paired classrooms. It is evident that in terms of WPPSI performance IQ, all six of the control classes showed greater gains than did the experimental class with which they were paired (e.g., C1 > E1). For two of the pairs the difference in gains was small.

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Insert Table 5 about here

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For the visual reception test, each of the six control classes also gained more than their paired experimental class. None of the differences between pairs was small.

For the visual sequential memory test, four experimental classes gained more than their paired control classes, while two experimental classes gained less than their paired control classes.

The other three variables (Binet IQ, auditory reception, and auditory sequential memory) showed no overall significant differences between experimental and control children. Thus, their differences between paired centers will not be discussed.

Cognitive and perceptual measures and teacher encouragement of the use of equipment. The median number of 30-second periods (out of 360) during which the experimental teachers encouraged the use of equipment was 51.50 with a range of 23 to 67. For control teachers, the median was 51.00 with a range of 17 to 62. The difference is not significant.

Table 6 gives the Spearman rank-order correlations between the frequency of a teacher's encouragement of the use of equipment and Laceys' gain scores for the six cognitive and perceptual variables in the teacher's class. None of the gain scores by classes was significantly related to a teacher's encouragement of the use of equipment in her

class. Nor were there any significant relationships when these correlations were computed separately for experimental and control teachers. Thus there was no interaction effect between the teachers' "encouragement" and whether her class was enriched or not.

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Insert Table 6 about here

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Cognitive and perceptual measures and teacher effectiveness. Each teacher was ranked according to her effectiveness in fostering cognitive and perceptual learning in children. The observers did not make these ratings using specific behavioral criteria. Rather they were instructed to use their clinical judgment, Mean rankings of the two observers yielded an overall effectiveness rank for the teachers. The mean rank for the six experimental teachers was 6.83 and for the six control teachers was 6.17. Thus the control teachers were judged as slightly more effective; the difference was not significant. Teacher effectiveness rankings had a Spearman rank-order correlation of .52 with teacher encouragement of the use of materials ($p < .05$, for a one-tailed test).

The Spearman rank-order correlations between the teacher effectiveness rankings and the mean Laceys' gain scores in the classes for the six cognitive and perceptual variables are shown in Table 7. None of the correlations was significant. Likewise, when these correlations were computed separately for experimental and control teachers,

none was significant.

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Insert Table 7 about here

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Social interaction measures

The Preschool Observation Schedule measured both the frequencies of the types of play in the classrooms and the frequency of aggressive behavior in the classrooms. The Spearman rank-order intercorrelations of the five play variables and aggressive behavior are shown in Table 8 separately for boys and girls. For boys, the frequency of cooperative toy play was negatively related to the frequencies of both solitary play ($p < .01$) and parallel play ($p < .01$). The frequency of girls' cooperative toy play was positively related to the frequency of cooperative peer play ($p < .05$) and inversely related to the frequency of solitary play ($p < .05$). In addition, for girls the frequencies of cooperative peer play and aggressive behavior were related positively ($p < .01$).

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Insert Table 8 about here

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The medians and semi-interquartile ranges of the five play variables and aggressiveness for experimental and control subjects are shown separately for each sex in Table 9. The Mann-Whitney U test was used to test the differences between the medians of the experimental and control children for each variable. All tests were nonsignificant

except for the boys' cooperative toy play category which showed a significantly ($p < .05$) greater frequency in the experimental group. It should be noted that for boys the solitary play and isolation categories showed higher, although nonsignificant, frequencies in the control group. In addition, the cooperative peer play category occurred with greater frequency in the experimental group; this difference was not significant. However, taking the categories together, it appears that the play behavior of the experimental boys was more cooperative than that of the control boys.

As is also evident in Table 9, no significant differences occurred between experimental and control girls in any of the play categories or in aggressive behavior.

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Insert Table 9 about here

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The number of isolates and the number of stars in experimental and control classes as found by the use of the Playboard Sociometric Technique are shown in Table 10. Chi squares testing for differences between experimental and control groups were computed separately for each sex. Of twelve such tests, only one, the number of boys who were isolates in girls' choices, was significant ($p < .05$). The experimental boys had fewer isolates than did the control boys when chosen by girls.

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Insert Table 10 about here

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Discussion

Taken as a whole the findings show that the enrichment significantly altered the classroom environment in the experimental classes. Signs of the alteration were present in the cognitive, perceptual, and social development of the children.

Play materials and the related equipment placed in the experimental classes were specifically chosen for their hypothesized ability to produce gains in verbal ability, performance ability, visual perception, auditory perception, and social development. Specific measures were included to evaluate the effects of the enrichment on each of these.

No differences between experimental and control children were evident in verbal ability or auditory perception. However, the control children showed significantly greater gains in performance ability than did the experimental children. It should be noted that the pretest mean of the WPPSI performance IQ of the experimental boys was substantially higher than that of the other three groups (94.61 vs. 89.03, 89.21, and 88.90). However, the regression gain scores used in the analyses of variance are "independent" of pretest scores.

The differences in gains between experimental and control children are mixed for visual perception. Gains in visual reception were significantly greater in the control children, but gains in visual sequential memory were greater for the experimental group. Neither sex differences nor treatment by sex interactions were significant for any of the cognitive or perceptual variables.

For the most part, the overall cognitive and perceptual differences

between experimental and control groups were present for the individual classes.

Several measures were analyzed to discover whether the findings about performance ability and visual perception could be attributed to teacher behavior. Neither an interaction measure of the frequency of the teacher's encouragement of the use of materials, nor an overall rating of the teacher's effectiveness were significantly related to mean class gains of any of the cognitive or perceptual variables. This lack of a relationship with teacher behavior tends to indicate that the cognitive and perceptual differences between experimental and control groups can be ascribed to the added equipment.

However, additional teacher behavior variables not used in this study might have yielded relationships with the class gain scores. For example, Linn (1967) using a broad range of teacher behavior variables found a relationship between them and cognitive gains in Head Start children.

One hypothesis which might account for the cognitive and perceptual findings in favor of the control children suggests that the experimental teachers took advantage of the materials by, for example, having less interaction with their children. The lack of any significant relationships between the teacher behavior variables and the cognitive and perceptual gains would seem to discount this possibility. Also, the mean effectiveness ratings of the experimental and control teachers were almost identical. The frequencies of the experimental and control

teachers in the encouragement of the use of materials likewise showed no substantial differences.

Several psychologists and educators (Caldwell and Richmond, 1968; Gray and Klaus, 1965; Thompson, 1944) have suggested that the way play materials are used may determine their effectiveness. Thus, since none of the teachers who participated in this study were certified to teach at the preschool level by the State of Pennsylvania, it can be argued that if the experimental teachers had a better knowledge of how to use the enrichment materials, the experimental children would have shown substantial gains. This argument rests on the assumption that knowledge of how to use play materials does exist; but a search of the psychological literature turned up no empirical data on this question. Moreover, from the standpoint of the usefulness and applicability of the findings of this study to other Head Start programs, it seemed best not to introduce complex instructions in the use of the materials, instructions which could not easily be applied in the non-research setting.

The greater gains of the control groups in performance ability and visual reception might also be explained by the control teachers' attempts to "show" the experimenters. They might have been motivated to work harder because they knew they were participating in an experiment. The findings from the two measures of teacher behavior argue against this possibility. There were no differences between the experimental and control teachers on these measures, nor were any of the correlations between the measures and the children's developmental

gains significant.

It seems that the most probable reason for the findings concerning cognitive and perceptual development remains the play materials themselves. There can be too much of a good thing. The present results thus seem to support the theorizing of Bereiter and Engelmann (1966). In their words:

> "An object-rich environment stimulates the culturally deprived child to attend to the glitter of superabundant stimuli. He darts from one object to another, treating each only in terms of sensory gratification -- in terms of movement, sound, or feel. The concepts contained in this clutter are often lost . . . [p. 72]."

The most clear-cut finding concerning social development indicated that the boys in the experimental classes engaged in more cooperative play with toys than did the control boys. Moreover, it appears that the play behavior of the experimental boys in general was more cooperative than that of the control boys. There were no differences between experimental and control girls in types of play behavior.

The frequency of aggressive behavior showed no differences between experimentals and controls for either sex.

Sociometrically speaking, the experimental and control classes were fairly similar. The number of stars and the number of isolates were not significantly different except that the experimental boys had fewer isolates than did the control boys when chosen by girls.

The finding that experimental boys engaged in more cooperative play than did control boys lacks any precedent. Johnson's (1935) study of the effects of playground equipment would seem to suggest the opposite -- that the control boys (and girls) would engage in more cooperative play. This variation between studies can be traced to a number of differences between them including indoor vs. outdoor play, and long-term vs. short-term effects of equipment.

Several previous studies (Green, 1933; Johnson, 1935; Muste and Sharpe, 1947) have found the frequencies of social contact and aggression positively correlated. The categories of cooperative toy play and cooperative peer play from the Preschool Observation Schedule measured social contact in the present study. For boys, the frequencies of both categories were positively related to the boys' aggression, but neither significantly so. For girls, the frequency of cooperative peer play was very significantly related to the frequency of aggression; the frequency of the girls' cooperative toy play was also positively, but not significantly related to girls' aggression. Thus, the present findings give support to the previous ones, but the present results would also suggest that, at least for girls, cooperative play with toys is less aggression-provoking than peer play without toys.

It might be beneficial to restate some limiting features of this research. First, the children involved are urban, lower-class Negroes. The applicability of the findings, for example, to suburban, middle-class white children is questionable. Second, none of the

teachers involved in the study were officially certified to teach at the preschool level, although all held college degrees. Perhaps fully-certified teachers would have been more effective in their use of the play materials. Third, no special training was given to the experimental teachers, except for instructions in how to operate the tape recorder and Polaroid camera. Training of the experimental teachers in how to effectively use the play materials might have produced different results. Fourth, most pretests of the cognitive and perceptual variables were administered after the play materials were placed in the experimental classrooms. But, if as is generally thought, the play materials have long-term rather than immediate effects, this timing should make very little difference, since the typical child had access to the materials for about two weeks before being pretested. Fifth, the particular play materials chosen for enrichment purposes might not be the most appropriate materials for the Head Start children. Sixth, other variables not measured in this research might have yielded additional differences between the experimental and control children.

The results suggest that both desirable and undesirable effects can be expected from environmental enrichment. At the very least, the more extravagant claims for the efficacy of certain play materials ought to be muted. A "properly" equipped preschool classroom is apparently not a panacea for the problems of disadvantaged children.

Perhaps it is true, as several authors (Caldwell and Richmond,

1968; Gray and Klaus, 1965; Thompson, 1944) have suggested, that the way in which play materials are used determines their effectiveness. But each of these authors, as well as Bereiter and Engelmann (1966), has different ideas as to how they should be used. Certainly, in light of the present findings, it would seem inadvisable to turn over play materials to Head Start teachers without substantial instruction as to how the materials might be effectively used. Therefore, future research should be directed toward discovering which approach (or approaches) are most effective with disadvantaged children. In addition, research varying the quantity of equipment available is needed; perhaps a smaller quantity of "enriched" materials might prove to be effective.

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Footnotes

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[2] The authors would like especially to thank Norman Chansky for his continuing advice. The authors also wish to acknowledge valuable help in data collection by Cathleen Kubiniec, James Roberge, Judith Goodwin, Nancy Weidenfeld, Margaret Havard, Patricia Phillips, Charles Slater, John Tighe, Natalie Sanders, and Paula Weitzman. Susan Lyons' coding, scoring and sundry other contributions were most appreciated. Daniel Solomon and Patricia Blum are thanked for comment on an earlier draft of this paper. Jeffrey O. Jones and Rosemary Mazzatenta of the Philadelphia Get Set program willingly cooperated in order to make this study possible.

[3] Get Set is the local name for the year-round National Head Start program.

[4] Each of the four groups originally consisted of 20 children. However, several subjects stopped attending during the first round of observations. These subjects were randomly replaced. Subjects who left after the first round were not replaced.

[5] The scores were computed only for these children because they were known to have attended class regularly from the beginning of the school year and would thus have an equal chance of being known to the members of the class. This procedure excluded children who were added to the classes during the year and children who were absent so much that they could not be tested on all of the cognitive and perceptual

measures. However, the sociometric choices of everyone in the classes were used in computing the two scores for each of the 123 subjects.

[6] In one control center (C4), five observations were done on several different teachers, each of whom taught for a time. A sixth observation was not done because of teacher absence; the mean of the other observation periods was substituted.

[7] Additional scoring criteria can be found in Appendix C.

[8] The square root transformation was applied to two of the variables, auditory reception - posttest and auditory sequential memory-posttest, to eliminate skewness.

[9] The Binet IQ gain scores were transformed by the square root transformation in order to eliminate skewness.

Table 1

Product-Moment Intercorrelations between Cognitive and Perceptual Variables - Pretest and Posttest (N = 123)

	1	2	3	4	5	6	7	8	9	10	11	12
1. Binet IQ-pre	---											
2. WPPSI Performance IQ-pre	.69	---										
3. Visual reception-pre	.46	.39	---									
4. Visual sequential memory -pre	.42	.54	.27	---								
5. Auditory reception-pre	.50	.37	.40	.30	---							
6. Auditory sequential memory -pre	.42	.39	.21	.09	.29	---						
7. Binet IQ-post	.78	.70	.48	.33	.51	.43	---					
8. WPPSI Performance IQ-post	.67	.82	.41	.54	.35	.39	.68	---				
9. Visual reception-post	.49	.52	.25	.38	.36	.33	.49	.61	---			
10. Visual sequential memory -post	.50	.44	.30	.35	.43	.37	.53	.51	.30	---		

Table 1, Continued

	1	2	3	4	5	6	7	8	9	10	11	12
11. Auditory reception-post	.29	.34	.34	.15	.14	.27	.26	.45	.24	.27	---	
12. Auditory sequential memory-post	.42	.38	.22	.15	.23	.64	.37	.43	.43	.34	.28	---

$p < .05$ when $r = .18$

$p < .01$ when $r = .23$

Table 2

Gain Scores

	Scaled Scores Post		Scaled Scores Pre		Mean Scaled Score Gain	Gain Scores by Laceys' Method in T-score form	
	Mean	SD	Mean	SD		Mean	SD
Experimental Boys (N = 28)							
Binet IQ	102.96	9.02	95.39	12.76	7.57	51.39	7.52
WPPSI performance IQ	97.11	15.29	94.61	13.64	2.50	46.56	11.33
Visual reception	36.46	5.14	36.43	5.07	.03	47.84	9.04
Visual sequential memory	36.86	6.95	34.39	6.14	2.47	51.47	10.04
Auditory reception	34.36	4.63	32.86	4.48	1.50	50.66	9.58
Auditory sequential memory	44.25	10.02	43.36	9.08	.89	51.61	11.34

Table 2, Continued

	Scaled Scores Post		Scaled Scores Pre		Mean Scaled Score	Gain Scores by Laceys' Method in T-score form	
	Mean	SD	Mean	SD	Gain	Mean	SD
Control Boys (N = 31)							
Binet IQ	101.26	11.86	95.39	13.34	5.87	49.05	9.80
WPPSI Performance IQ	96.65	14.80	89.03	11.67	7.62	52.21	9.92
Visual reception	39.16	5.36	38.68	6.37	.48	51.70	9.90
Visual sequential memory	34.19	7.61	33.77	7.49	.42	47.84	11.09
Auditory reception	34.10	5.97	32.84	5.13	1.26	49.69	10.75
Auditory sequential memory	40.65	7.65	40.52	8.59	.13	49.13	9.03

Table 2, Continued

	Scaled Scores Post		Scaled Scores Pre		Mean Scaled Score	Gain Scores by Laceys' Method in T-score form	
	Mean	SD	Mean	SD	Gain	Mean	SD
Experimental Girls (N = 34)							
Binet IQ	101.47	13.31	93.88	13.58	7.59	51.02	12.21
WPPSY Performance IQ	94.15	14.63	89.21	13.07	4.94	48.86	8.17
Visual reception	35.79	4.89	35.76	5.22	.03	46.95	10.32
Visual sequential memory	37.15	7.91	33.09	6.86	4.06	52.71	10.08
Auditory reception	34.24	5.22	32.91	4.90	1.33	49.92	9.76
Auditory sequential memory	41.18	7.20	41.79	7.27	- .61	49.01	10.63

Table 2, Continued

	Scaled Scores Post		Scaled Scores Pre		Mean Scaled Score	Gain Scores by Laceys' Method in T-score form	
	Mean	SD	Mean	SD	Gain	Mean	SD
Control Girls (N = 30)							
Binet IQ	100.17	11.61	94.10	12.12	6.07	48.79	9.60
WPPSI Performance IQ	96.53	10.13	88.90	12.33	7.63	52.22	10.01
Visual reception	39.37	5.37	36.23	5.08	3.14	53.72	9.44
Visual sequential memory	33.97	5.58	33.30	6.23	.67	47.79	7.95
Auditory reception	33.33	4.80	31.60	4.64	1.73	49.54	10.33
Auditory sequential memory	41.60	7.17	41.03	7.51	.57	50.51	9.13

Table 3

Product-Moment Intercorrelations between Laceys' Gain Scores (N = 123)

		1	2	3	4	5	6
1.	Binet IQ	---					
2.	WPPSI Performance IQ	.07	---				
3.	Visual reception	-.01	.25**	---			
4.	Visual sequential memory	.19*	.29**	.15	---		
5.	Auditory reception	.15	.26**	.20*	.06	---	
6.	Auditory sequential memory	-.06	.17	.10	.26**	.12	---

* $p < .05$

** $p < .01$

Table 4

Multivariate and Univariate Analysis of Variance of Laceys' Gain Scores

Source of Variation	Multivariate df	Multivariate F	variable	Univariate df	Univariate F
Treatment	6/114	5.25***	Binet IQ	1/119	1.56
			WPPSI Performance IQ	1/119	6.13*
			Visual Reception	1/119	9.30**
			Visual Sequential Memory	1/119	5.93*
			Auditory Reception	1/119	.12
			Auditory Sequential Memory	1/119	.04
Sex	6/114	.17	Binet IQ	1/119	.09
			WPPSI Performance IQ	1/119	.42
			Visual Reception	1/119	.10
			Visual Sequential Memory	1/119	.11
			Auditory Reception	1/119	.06
			Auditory Sequential Memory	1/119	.12
Treatment X Sex	6/114	.52	Binet IQ	1/119	.02
			WPPSI Performance IQ	1/119	.41
			Visual Reception	1/119	.69
			Visual Sequential Memory	1/119	.13
			Auditory Reception	1/119	.03
			Auditory Sequential Memory	1/119	1.20

* $p < .02$

** $p < .01$

*** $p < .0001$

Table 5

Laceys' Gain Scores in T-Score Form by Paired Classes

Experimental Classes	Mean	SD	Control Classes	Mean	SD	Mean Experimental -Mean Control
Binet IQ						
E1 (N=10)	53.11	8.78	C1 (N=9)	43.66	7.22	9.45
E2 (N=14)	55.04	11.78	C2 (N=13)	52.05	9.30	2.99
E3 (N=8)	49.79	11.22	C3 (N=10)	51.64	6.87	-1.85
E4 (N=10)	50.00	10.89	C4 (N=10)	48.40	9.06	1.60
E5 (N=12)	48.35	10.83	C5 (N=11)	52.13	12.02	-3.78
E6 (N=8)	49.18	6.63	C6 (N=8)	42.57	9.32	6.61
WPPSI Performance IQ						
E1	47.64	13.14	C1	51.54	13.10	-3.90
E2	44.34	8.60	C2	52.53	7.25	-8.19
E3	54.72	10.46	C3	54.75	10.83	- .03
E4	48.35	7.34	C4	54.07	10.92	-5.72
E5	46.30	8.56	C5	50.45	8.38	-4.15
E6	48.84	9.17	C6	49.40	10.82	- .56
Visual Reception						
E1	45.28	8.61	C1	47.86	11.08	-2.58
E2	48.19	12.96	C2	50.87	10.14	-2.68
E3	53.73	9.28	C3	61.08	10.26	-7.35
E4	45.21	7.90	C4	51.43	6.19	-6.22
E5	49.12	9.20	C5	52.37	7.41	-3.25
E6	42.08	3.83	C6	52.65	8.88	-10.57

Table 5, Continued

Visual Sequential Memory

Experimental Classes	Mean	SD	Control Classes	Mean	SD	Mean Experimental -Mean Control
E1	56.26	8.01	C1	42.38	13.04	13.88
E2	55.50	8.56	C2	47.24	8.04	8.26
E3	57.67	10.21	C3	52.85	11.84	4.82
E4	46.26	11.45	C4	43.72	5.82	2.54
E5	47.71	8.96	C5	50.38	9.10	- 2.67
E6	49.67	9.07	C6	50.15	5.13	- .48
Auditory Reception						
E1	47.82	6.93	C1	45.56	11.11	2.26
E2	46.53	9.52	C2	51.66	7.42	- 5.13
E3	48.09	7.76	C3	48.17	7.01	- .08
E4	57.87	9.82	C4	48.02	13.64	9.85
E5	49.87	11.35	C5	51.25	11.61	- 1.38
E6	53.04	7.34	C6	52.42	12.75	.62
Auditory Sequential Memory						
E1	45.78	8.74	C1	48.91	13.62	- 3.13
E2	55.32	11.00	C2	51.07	6.50	4.25
E3	54.16	6.35	C3	48.94	8.39	5.22
E4	45.61	8.27	C4	48.47	6.47	- 2.86
E5	47.92	13.89	C5	49.92	12.22	- 2.00
E6	51.85	12.19	C6	51.42	6.81	.43

Table 6

Rank-Order Correlations Between Cognitive and Perceptual Variables and Teacher Encouragement of the Use of Equipment

Binet IQ	.49
WPPSI Performance IQ	-.08
Visual reception	-.15
Visual sequential memory	.31
Auditory reception	.07
Auditory sequential memory	.40

All correlations are non-significant for N = 12.

Table 7

Rank-Order Correlations between Cognitive and Perceptual Variables and Teacher Effectiveness Rankings

Binet IQ	.50
WPPSI Performance IQ	.06
Visual reception	-.04
Visual sequential memory	.16
Auditory reception	-.22
Auditory sequential memory	.44

All correlations are non-significant for N = 12.

Table 8

Rank-Order Intercorrelations of Preschool Observation Schedule Variables

Boys (N = 37)

	1	2	3	4	5	6
1. Solitary play	---					
2. Parallel play	.04	---				
3. Cooperative toy play	-.45**	-.62**	---			
4. Cooperative peer play	-.18	-.06	.04	---		
5. Isolation	-.16	-.06	-.05	.04	---	
6. Aggressive behavior	-.12	-.01	.17	.22	.24	---

Girls (N=37)

	1	2	3	4	5	6
1. Solitary play	---					
2. Parallel play	-.07	---				
3. Cooperative toy play	-.37*	-.29	---			
4. Cooperative peer play	-.23	-.26	.40*	---		
5. Isolation	-.02	.11	-.16	-.29	---	
6. Aggressive behavior	-.12	.01	.23	.56**	-.10	---

* $p < .05$ (two-tailed test)

** $p < .01$ (two-tailed test)

Table 9

Preschool Observation Schedule

Boys

	Experimental (N=20) Median	Q	Control (N=17) Median	Q	Mann-Whitney U
Solitary Play	7.50	7.00	11.00	3.75	142.50
Parallel Play	15.50	9.50	20.00	10.38	128.50
Cooperative Toy Play	31.00	8.00	20.00	8.50	105.00*
Cooperative Peer Play	4.50	3.50	2.00	2.38	140.00
Isolation	0.00	0.50	1.00	1.00	122.50
Aggressive Behavior	2.50	2.50	2.00	2.63	150.50

Girls

	Experimental (N=18) Median	Q	Control (N=19) Median	Q	Mann-Whitney U
Solitary Play	8.00	6.50	7.00	3.75	163.50
Parallel Play	17.00	8.25	15.00	5.50	154.50
Cooperative Toy Play	23.50	7.75	19.00	8.63	145.00
Cooperative Peer Play	2.00	3.50	3.00	8.00	150.00
Isolation	1.00	1.25	2.00	3.13	145.00
Aggressive Behavior	2.00	1.75	2.00	1.38	138.50

* $p < .05$ (two-tailed test)

Table 10

Playboard Sociometric Summary Table

	Boys Choices		Girls Choices		Total Choices	
	# of isolates	# of stars	# of isolates	# of stars	# of isolates	# of stars
Boys Experimental (N=28)	3	10	9	3	3	17
Boys Control (N=31)	6	13	19	2	6	17
Girls Experimental (N=34)	16	5	4	11	1	16
Girls Control (N=30)	13	3	3	13	3	15

Chi square tests of significance between experimental and control groups were computed separately for each sex. Of twelve such tests only one (number of boys who were isolates in girls choices) was significant. Chi square = 5.02, df = 1, $p < .05$.

Appendix A

Supplementary Equipment for Each Enriched Classroom

Quantity	Creative Playthings Item Number[1]	Item Description
Verbal Ability		
1	V102	(Book set 1), Animal stories
1	V103	(Book set 2), Animal stories
1	V104	(Book set 9), Fantasy and fun
1	V110	(Book set 12), Cities, homes and transportation
1	V113	(Book set 2), Exploring the outdoors and nature
1	Q747	Rubber farm animals, set of 15
1	Q748	Rubber wild animals, set of 6
Performance Ability		
2	T601	Zipper frame
4	T602	Shoe lacing frame
4	T603	Buttoning frame
4	T604	Bow-tying frame
1	T608	Sound cylinders
1	T620	Insert cylinders, equal in diameter, graded in height

[1] The prime supplier from whom most of this equipment was purchased is Creative Playthings, Princetor, New Jersey.

1	T622	Insert cylinders, graded in height and diameter
2	A814	Color paddles
3	T230	Manipulative lock board
4	T302	100 Stringing beads, 1" diameter
4	A817	Magnetic basic form set
1	T737	Junior lock box
3	S395	Vari-shaped magnets
2	S380	Electrical invention box
2	N530	Magnetized rubber fraction pies, set of 9
2	N220	Fruit plate

Visual Perception

2	J010	Magic reflector
1		Polaroid camera (film and flashbulbs)
2	J319	Round flexible mirror
1	V106	(Set 2) picture books
1	V108	(Set 4) picture books
1	V111	Concepts: number, time, shape, space (book set)
4	N100	Graded circles, squares and triangles
4	Q949	Shape-sorting box
2	T066	Set of 12 see-inside puzzles
1	T068	Set of 12 Intermediate playskool puzzle

1	T679	Cityscape, beginners' rubber puzzle
2	S379	Magnifying glass, 2 1/2" diameter
4	J325	Liquid prisms, set of 3
2	S406	Large prism, 3"

Auditory Perception

1		Sony tape recorder (and tapes)
2	S407	Tuning fork, 7 1/2" long
1	M315	Rhythm band, set of 15
4	M313	Brass cymbals, 7"
7	M250	Tambourine, 6 1/2"
4	M282	Aluminum maracas
2	M260	Hand tom-tom drum
2	M262	Hand snare drum
2	M267	Snare drum
1	M833	Folk Songs for Singing and Dancing (Set of records)
1	M830	Music by Great Composers for Children Toy Symphony Music of Aaron Copland Peter & the Wolf, and Nutcracker Suite by Tschaikovsky - Leonard Bernstein & the New York Philharmonic

		Eine Kleine Nachtmusik, Mozart
		Leonard Bernstein Conducts for Young People
1	M832	Rhymes and Games
		Call and Response - Ella Jenkins
		Adventures in Rhythm, Games - Ella Jenkins
		Music Time with Charity Bailey
		Counting Games and Rhyme for Little Ones - Ella Jenkins
		Rhythm and Game Songs - Ella Jenkins
		Children's Songs and Games from the Southern Mountains
1	M840	Marches and Band Music
		Marches of John Phillip Sousa
		Marches (includes marches of Schubert, Berlioz, Prokofiev)
		Circus Spectacular
1	M842	Sounds of City and Country
		Muffin in the City
		Muffin in the Country
		The Frog Boat Story from Here and Now Story Book
		One, Two, Three and a Zing-Zing-Zing

		Sounds of Animals
		Song Birds of America, in color, sound and story
1	M058	Headstart with Music

Social Development

7	D197	Negro vinyl doll with layette, 20"
3	D276	Negro girl cloth doll, 24"
3	D275	Negro boy cloth doll, 26"
3	B284	Wedgie Negro community workers, set of 6
1	B290	Stationary white family, set of 5
3	B490	Stationary rubber Negro family, set of 5
7	B405	Stationary rubber Negro community workers, set of 5
3	B492	Bendable rubber Negro family, set of 5
1	B292	Bendable rubber white family, set of 5
2	B450	Bendable rubber Negro grandmother and grandfather
2	B452	Bendable rubber Negro doctor and nurse
2	B404	Bendable rubber Negro community workers, set of 6

1	B304	Bendable rubber white community workers, set of 6
3	B319	Bendable rubber integrated community workers, set of 6
2	G550	Negro family rubber hand puppets
2	G568	Negro policeman rubber hand puppets

Other Equipment

1		Steel cabinet 78" high by 36" wide with lockable double doors

Appendix B

Inventory of Equipment by Classroom in June, 1969

TOYS	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
Big Swingers-Polaroid												
Black & White Camera	0	0	0	0	0	0	1	1	1	1	1	0
Sony TC 100-Tape												
Recorder	0	0	0	0	0	0	1	1	1	1	1	0
Magnetized Rubber												
Fraction Pies	0	0	0	0	0	0	0	18	9	13	18	9
Fruit Plate	1	1	0	2	1	0	2	3	3	3	2	2
Magic Reflector	0	0	0	0	0	0	2	2	2	2	2	2
Round Flexible Mirrors	0	0	0	0	0	0	2	2	0	2	2	2
Books	42	70	37	28	66	47	107	137	77	100	93	106
Magazines	17	0	3	10	11	5	0	14	0	0	1	8
Learning numbers,												
games	2	1	2	3	4	1	2	2	2	3	3	4
Graded circles, squares,												
triangles	1	1	0	2	2	0	5	4	4	6	5	2
Insert Cylinders, equal												
in diameter, graded												
in height	0	0	0	0	0	0	1	1	1	1	1	1
Insert Cylinders, graded												
in height & diameter	0	0	0	0	0	0	1	1	1	1	1	1

	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
Color Paddles, small, 2" X 1"	0	0	0	0	0	0	1	6	6	6	6	0
Color Paddles, large, 6" X 4"	3	0	2	4	3	1	0	3	0	2	3	2
Manipulative lock board	1	1	0	1	0	0	3	2	3	4	2	2
Stringing beads, 1" dia.	50	200	0	250	300	100	300	400	700	500	400	400
Magnetic basic form set	0	0	0	0	0	0	0	3	4	*	4	0
Junior lock box	0	1	1	1	1	0	1	1	1	1	1	2
Vari-shaped magnets	0	0	0	0	3	0	15	15	10	10	15	15
Electrical Invention Box	0	0	0	0	0	0	1	2	1	2	2	1
Shape-sorting box	0	1	1	1	1	0	4	3	4	4	4	4
See-inside puzzles	0	0	0	0	0	0	10	24	23	24	13	22
Cityscape, beginners rubber puzzle	0	0	0	1	4	0	0	1	0	0	3	4
Magnifying glass, 2 1/2" diameter	3	0	0	0	0	0	0	1	3	3	1	1
Liquid prism	0	0	0	0	0	0	9	5	11	3	1	12
Large prism, 3"	0	0	0	0	0	0	2	1	3	2	2	0
Tuning fork, 7 1/2" long	0	0	0	0	0	0	2	1	1	0	0	0
Rhythm band set for 15	0	0	0	1	0	0	1	1	1	1	1	1
7" brass symbols	0	0	0	0	0	0	1	6	1	3	3	4

* Forms only

	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
6 1/2" tambourine	0	0	0	0	0	0	3	2	5	7	8	3
Aluminum Maracas	0	0	0	0	0	0	6	10	9	8	8	8
Wooden Maracas	0	0	1	2	0	0	0	2	0	2	0	0
Hand tom-tom drum	0	0	0	0	0	0	2	2	4	1	4	3
Hand snare drum	0	0	0	4	0	2	2	4	1	6	1	0
Snare drum	0	0	0	0	0	0	2	2	2	2	1	0
Headstart with Music	0	0	0	0	0	0	1	1	1	1	1	1
Negro vinyl doll without layette	2	1	0	1	4	2	0	1	2	0	0	0
Negro vinyl doll with layette, 20"	0	0	0	0	0	0	6	3	9	7	4	5
Negro girl cloth doll, 24"	0	0	0	0	0	0	5	1	3	1	4	0
Negro boy cloth doll, 26"	0	0	0	0	0	0	3	3	3	1	1	2
Stationary white family members	8	0	0	0	0	0	0	5	10	5	5	0
Stationary rubber Negro family members	0	0	0	0	0	0	8	15	15	5	20	15
Stationary rubber Negro community workers	10	0	0	0	0	0	15	35	24	8	35	30
Bendable rubber Negro family members	0	0	0	0	0	0	9	10	21	0	5	15

	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
Bendable rubber white family members	0	0	3	0	5	0	0	5	11	0	5	5
Bendable rubber Negro grandmothers & grandfathers	0	0	0	0	0	0	4	2	4	4	4	2
Bendable rubber Negro doctors & nurses	0	0	0	0	0	0	6	2	3	0	4	2
Bendable rubber Negro community workers	0	0	0	24	0	0	0	18	36	0	12	18
Bendable rubber white community workers	0	0	0	0	2	0	0	0	4	0	6	12
Bendable rubber integrated community workers	0	0	0	0	0	0	0	12	18	0	18	24
Negro family rubber hand puppets	6	7	0	0	0	0	9	7	10	4	10	10
Negro policeman rubber hand puppets	1	1	0	0	0	0	2	1	2	2	2	2
White puppets	0	3	2	0	0	0	0	4	0	3	0	0
Zipper frame	0	0	0	0	0	0	2	2	2	2	2	2
Shoe lacing frame	0	0	0	0	0	0	4	4	4	3	4	4
Buttoning frame	0	0	0	0	0	0	4	4	4	4	4	3

	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
Bow-tying frame	0	0	0	0	0	0	4	4	3	4	4	5
Sound cylinders	0	0	0	0	0	0	0	1	1	0	2	0
Rubber wild animals	10	9	1	12	19	8	12	8	7	6	6	16
Rubber farm animals	8	6	0	10	6	2	6	4	11	11	11	18
Records	0	34	0	0	0	0	13	17	20	19	21	7
Disconnected telephone	1	2	0	1	0	0	0	2	3	0	0	1
Toy clock	0	0	0	0	1	0	0	0	0	0	0	0
Jumping rope	0	2	0	0	0	0	0	3	0	0	0	0
Aquarium	0	2	1	2	1	1	2	1	1	2	0	0
Live fish in aquarium	0	0	0	2	0	0	0	0	0	0	0	0
Mop	0	0	0	2	2	0	0	1	0	0	0	1
Broom	0	1	0	2	0	0	2	1	2	2	1	1
Aluminum tray	1	1	1	3	5	4	1	1	1	1	1	1
Egg beater	0	0	0	1	2	0	0	1	0	0	1	0
Pots (small)	9	6	4	2	0	5	3	10	8	6	6	9
Sink	1	1	1	1	1	1	1	1	1	1	1	1
Refrigerator	1	1	1	1	1	1	2	1	1	1	1	1
Stove	1	1	1	1	1	1	2	1	1	1	1	1
Washboard	1	0	3	1	1	1	1	0	0	1	1	0
Ironing board	1	1	1	1	1	2	1	1	1	1	1	1
Iron (wood)	2	1	1	1	1	2	0	1	2	0	1	1
Cabinet	2	4	3	4	4	3	4	3	4	4	3	4

	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
Chest of drawers	1	2	1	1	2	1	1	1	2	1	1	1
Doll crib	1	1	0	1	1	1	1	1	1	1	2	1
Rocking chair	1	2	0	2	1	0	1	1	1	2	1	2
Easel	1	2	1	1	1	2	1	1	1	1	1	1
Tables	7	8	7	4	6	6	5	5	7	6	7	6
Chairs (small)	27	24	22	25	27	17	21	27	28	22	26	19
Book rack	1	1	1	1	1	1	1	1	1	2	1	0
Book shelves (60" wide X 36" high)	0	0	0	0	0	0	0	0	0	0	0	1
Mirror (18")	1	1	0	1	1	1	3	1	1	1	1	1
Cots	15	0	8	19	19	0	6	15	18	18	20	0
Cabinet (wood)	4	2	0	2	3	3	4	2	1	4	4	3
Desk (adult)	0	1	1	1	1	1	1	0	1	1	1	0
Chair (adult)	1	2	0	1	2	2	2	7	2	2	1	0
Table (small, round)	1	0	0	1	1	1	1	1	1	1	1	0
Dividing screen	1	1	1	3	3	2	3	1	0	1	0	1
Cloak cabinet	2	3	1	3	3	3	2	2	0	3	3	1
Cabinet (Steel, 6' 6", double door)	3	2	2	2	3	2	2	3	3	2	2	2
Cabinet (Steel, 6' 6", single door)	0	1	0	0	1	1	1	0	1	1	1	1
Claw hammer	1	2	1	1	2	0	1	0	0	0	2	1

	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
Scissors	12	9	5	3	13	1	0	16	0	6	8	5
Peg set	2	2	0	0	0	0	0	0	0	3	1	0
Cans of crayons												
6 crayons/can	10	12	11	10	23	11	21	29	48	6	11	106
Jars of paint	98	18	22	62	30	10	60	54	28	51	35	43
Paint brushes	4	3	5	19	24	7	32	42	9	2	9	10
Boxes of chalk												
12 sticks/box	8	4	3	4	11	1	5	3	3	3	3	2
Electric frying pan-toy	0	0	0	0	0	0	0	0	0	0	0	1
Rubber ball	1	4	0	0	4	2	0	0	0	0	0	2
Jars of sparkles	0	6	0	0	0	0	0	0	0	0	0	0
Xylophone	1	0	0	1	0	0	0	1	0	1	0	0
Jungle gym	0	1	0	0	0	0	0	0	1	0	0	0
Lotto game	7	10	1	3	13	4	1	6	3	2	10	8
Wood puzzles	25	23	7	19	16	11	21	22	2	15	36	44
Set of dominoes	1	1	1	1	1	1	0	0	1	1	1	1
Flower pots	18	4	21	48	5	1	2	2	1	0	1	1
Small colored blocks	34	0	0	0	331	0	54	155	10	105	0	110
Large unpainted blocks	85	175	80	150	300	200	64	120	100	150	120	0
Wood auto (8")	2	2	1	2	2	0	0	1	0	0	0	0
Airplane, wood (18")	1	0	0	1	1	1	0	2	0	0	0	0
Truck, wood (16")	7	5	3	3	4	4	1	4	6	0	0	0
Firechief car, wood (16")	0	0	0	0	2	0	0	2	1	0	2	0

	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
United States flag	3	4	2	1	1	0	0	1	2	1	0	2
Posters	11	6	0	6	2	0	5	5	0	0	0	0
Thermometer	1	0	1	1	2	2	1	0	2	0	1	1
White dolls	3	2	5	4	5	3	0	7	2	2	0	3
Rubber shapes puzzle	0	1	1	2	3	1	0	3	2	1	0	0
Sewing boards	4	1	0	5	0	5	0	5	4	4	0	0
Sand box	0	0	0	1	0	1	1	1	1	1	0	1
Material (box)	1	2	0	1	1	1	2	1	1	0	0	0
Straws, 100/box	2	3	1	2	2	2	1	3	1	1	1	0
Science teaching pictures	0	0	6	1	6	12	6	6	0	6	0	0
Felt instructors letters	1	4	0	2	0	2	1	2	2	1	1	4
Wooden working table	0	0	1	1	1	1	1	0	1	1	1	1
Vise	0	0	1	1	1	1	1	0	1	1	1	1
Hats	0	0	0	3	0	1	0	0	0	2	0	4
Dresses	0	0	0	4	4	3	0	0	0	3	6	3
Toy dishes	12	13	10	20	20	8	4	30	9	21	8	28
Pocket books	1	0	2	0	0	3	1	0	0	0	3	3
Instructo Felt animals, cut-outs, pictures (box)	2	7	0	0	2	0	0	2	0	1	3	1
Pounding bench	2	0	0	2	1	0	1	2	1	0	0	1
Record player*	0	1	0	0	0	0	0	1	0	0	0	0
Balloons	0	0	0	0	0	0	1	0	0	0	0	0
Dust pan	0	1	0	1	1	0	1	0	0	0	0	1

* Record players were always available in the centers, even though not necessarily present in each classroom.

	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
Bucket	3	0	1	2	1	1	3	2	0	1	3	1
Shovel	0	0	0	2	1	5	1	1	0	0	0	2
Stethoscopes	0	0	0	0	3	0	0	2	0	0	0	0
Wooden animals 1/4" X 1" X 2"	10	0	2	7	8	0	16	4	9	0	10	10
Wooden animals 1" X 3" X 4"	12	0	0	0	7	0	0	0	7	0	10	6
Colored wires packaged	1	1	0	0	20	0	0	1	0	0	0	0
Rope (roll)	1	0	0	1	1	0	1	1	0	1	0	0
Pipe cleaners	0	0	0	0	1	0	1	2	0	0	1	0
Paste	6	4	3	3	8	1	4	6	8	2	2	1
Steering wheel	0	1	0	2	1	1	0	1	1	0	1	0
Felt board	1	1	1	3	1	1	1	1	1	1	1	1
Clay	0	4	1	2	1	1	0	1	0	3	0	0
Clay jar	0	1	1	0	0	1	1	1	0	0	0	0
Mats	0	20	0	0	0	0	13	0	0	0	0	0
Magnetic Spelling Board	0	1	0	0	0	0	1	3	0	1	1	1
Fruit basket	0	1	0	3	0	1	0	0	1	0	1	3
Electric toy mixer	0	0	0	0	0	0	0	0	0	0	0	1
Silverware	0	14	15	4	0	0	0	5	6	0	0	6
Toy hot plate	0	0	1	0	0	0	0	0	0	0	0	0
Toy toaster	1	1	0	1	1	0	1	1	2	1	1	1

	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
Wooden people	0	0	0	0	0	0	0	10	6	0	0	4
High chair	1	1	1	1	0	0	2	1	1	2	1	1
Animal hand puppets	0	1	2	4	0	0	0	4	0	0	0	0
Piano	0	1	0	0	1	0	1	1	0	1	0	0
Potato masher	0	0	0	0	1	0	0	1	0	0	1	0
Plastic flowers	0	1	0	5	3	0	1	2	1	0	0	0
Puppet stage	0	0	0	0	0	0	0	0	0	0	1	0
Saw	0	2	1	2	0	0	1	0	1	0	0	0
Doll carriage	0	2	0	0	0	0	1	0	1	0	2	0
Strainer	1	2	1	0	1	1	0	0	1	1	0	1
Milk bottles	2	6	0	4	6	3	6	4	0	0	6	0
Clothes line	0	1	1	0	0	0	0	2	0	0	0	0
Rolling pin	0	0	0	1	1	0	0	1	0	0	0	0
Doll house	0	1	0	1	0	1	1	0	0	1	0	0
Cray fish	0	1	0	0	0	0	0	0	0	0	0	0
Hamster	0	1	0	0	0	0	0	0	0	0	0	0
Turtle	0	1	0	0	0	0	0	0	0	0	0	0
Interlocking tugboat	0	0	0	1	1	0	0	1	0	0	0	0
Interlocking train	0	0	0	1	1	0	0	1	0	0	0	0
Strip film projector	0	1	0	0	0	0	0	0	0	0	0	0
Scale	0	0	1	0	0	0	0	1	0	0	0	0
View master	0	0	0	0	0	0	0	0	0	0	2	0
Bowling set	0	0	0	0	0	0	1	0	1	0	0	0

	C1	C2	C3	C4	C5	C6	E1	E2	E3	E4	E5	E6
Bicycle	0	0	0	0	0	0	1	0	1	0	0	0
Wheel barrow	0	0	0	0	0	0	0	0	1	0	0	0
Auto Harp	1	0	0	1	0	0	0	0	0	0	0	0
Television	1	0	0	0	0	0	0	0	0	0	0	0
Bird cage with plastic bird	0	0	0	1	0	0	0	0	0	0	0	0
Toy barn	0	0	0	0	0	0	1	0	0	0	0	0
Magnifier 7" X 8"	2	0	0	0	0	1	0	1	0	1	1	0
Metal clips	5	0	0	0	14	0	0	0	0	5	0	0
Dish drainer	1	1	0	0	0	0	0	0	0	0	1	0
Plastic fruit and vegetables	2	12	2	20	0	9	0	0	11	0	7	12
Seven dwarfs pictures	0	0	0	0	0	0	7	0	0	0	0	0
Pillows	0	0	0	12	0	0	20	0	0	0	0	0
Swimming Pool	0	0	0	0	0	0	1	0	0	0	0	0
Frisbee	0	0	0	1	0	0	0	0	0	0	0	0

Appendix C

Additional Scoring Criteria for the Teacher Encouragement of the Use of Equipment Measure

1. Days on which unusual events are occurring are excluded (e.g., field trips, Christmas parties).
2. No distinction is made as to whether the teacher's behavior is directed toward the group or an individual child.
3. Whenever a teacher's answer is primarily a limited response to a child's question, the "encouragement" category should not be scored. However, if the teacher's answer goes substantially beyond the child's question (in a manner that encourages the use of equipment or supplies) then encouragement should be scored.
4. Play maintenance behavior by the teacher is not scored as encouragement. That is, when a teacher is participating with children in a game (etc.), encouragement is not scored unless direct, overt encouragement occurs as defined in "categories of encouragement."
5. Encouragement is recorded in the 30-second interval in which it starts and in all intervals through which the teacher's encouragement continues.