DOCUMENT RESUME

ED 209 878 EC 140 395

AUTHOR Silver, Rawley A.: And Others
TITLE Assessing and Developing Cognitive Skills in Handicapped Children Through Art. Final Report, 1979-1980.
INSTITUTION New Rochelle Coll., N.Y.
SPONS AGENCY National Inst. of Education (ED), Washington, D.C.
PUB DATE Dec 80
GRANT NIE-G-79-0081
NOTE 55p.: Print is poor in parts.

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Art Therapy: *Cognitive Development: *Concept Formation: Creativity: *Disabilities: Elementary Education: Program Effectiveness: Self Esteem: Test Validity
IDENTIFIERS *Silver Test of Cognitive Creative Skills

ABSTRACT

The study evaluated the effect of art therapy on the development of basic academic concepts with 84 handicapped children (ages 7 to 11 years). The children were given the Silver Test of Cognitive and Creative Skills which uses drawing tasks to assess the child's understanding of the concept of a class or group of objects, the concept of space, and concepts of sequential order and conservation. Ss were also given tests of mental ability and reading and arithmetic achievement. Children received an art therapy program for approximately 40 minutes a week for 12 weeks. The program stressed the development of concepts of class, space, and order as well as creativity and self esteem. Results indicated that experimental Ss showed higher, though not significantly higher, gains in cognitive skills and achievement than did control Ss. Results suggested the validity of the Silver Test as a nonverbal measure of cognitive skills and the probable value of the art therapy program. Charts provide detailed analyses of findings. (DB)

ASSESSING AND DEVELOPING COGNITIVE SKILLS IN HANDICAPPED CHILDREN THROUGH ART

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Final Report

No G 79 0081

A Project Funded by
The National Institute of Education

1979-1980

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December, 1980

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Rationale

When children have handicaps that interfere with learning, we are often so preoccupied with their limitations that we lose sight of their strengths. Some skills can be developed in spite of impairments, other skills develop because of impairments and can equal and even excel those of normal children. As Rene Dubois has observed, one of the most important laws of biology is that the many potentials of a cell usually become manifest only when it is compelled to use them. The many potentials of a handicapped child may also become manifest when disabilities compel their use.

One such potential, often overlooked, is the ability to represent throughts and feelings through visual forms. There is evidence that imagery is a basic instrument in thinking for some normal adults (Witkin). For the child who has difficulty learning language, imagery may serve to by pass verbal weaknesses and capitalize on visual strengths. Another such potential is the ability to generalize from experiences, and to transfer learning from one situation to another.

Children who cannot learn language in the usual way are often deficient in intellectual functioning. Their education traditionally centers around language development. It is generally assumed that the cause of their deficiency is language retardation, but this may be misleading. Language is obviously related to thinking, but whether it is essential is open to question. There is considerable evidence that language and thought develop independently, and even though language expands and facilitates thought, that high level thinking can and does proceed without it (Piaget, Torrance, Arnheim, Furth).

There is a need to assess the intelligence of these children on tests that are independent of language skills. Children who have difficulty understanding directions or putting thoughts into words may nevertheless have cognitive skills that escape detection on traditional measures. Cognitive skills are usually assessed through language. Language is often equated with intelligence and it is often assumed that the inarticulate child lacks intelligence.

In the thinking of normal children, the function of language is primarily to pin down perceptions, organize experiences, and exercise some control over the people in their worlds. In addition, language opens up the whole field of vicarious experience. When children cannot obtain a desired result, they can substitute words for the unsuccessful activity and by symbolizing, obtain it in imagination (Strauss and Kephart).

Art symbols can take over some of the functions of language symbols in the thinking of children deficient in language. Like language symbols, art symbols are a way of labeling perceptions and experiences. They can represent particular subjects or classes of subjects. The painting of a man, for example, can represent the painter's father, or authority figures in general, or Man in the abstract, or all three, just as the word "man" can represent each or all of these ideas, depending on the verbal context.

The child with inadequate language is handicapped in representing his thoughts effectively, but even though his capacity for language may be impaired, his capacity for symbolizing may be intact, and he may be able to represent his thoughts nonverbally by drawing them. Although abstract concepts can be represented only by symbols, they can be represented in visual as well as verbal contexts.

It is our hypothesis that art can be the language of cognition paralleling spoken language. Concepts that can be expressed through words can also be expressed through art. Similarly, cognitive skills that can be developed and assessed through language-oriented activities can also be developed and assessed through art activities.

The aim of this project was to evaluate a new test and to verify an approach to teaching in which art activities take the place of language in receiving and expressing abstract concepts. In three previous studies, handicapped children showed significant gains in expressing concepts as measured by a pre-post test designed for the studies.

This project has built upon the earlier studies, attempting to verify their results by using a more controlled research design, a wider variety of settings, and a more diverse population. In addition, it has examined the relationship between our test instrument and traditional measures of intelligence and achievement.

The Concepts under Consideration

The art procedures that were used in the project were designed to assess and to develop in children three concepts said to be basic in mathematics and reading, as well as important in everyday life. These are first, the concept of a class of group of objects; second, concepts of space; and third, concepts of sequential order.

Piaget cites three concepts found by the Bourbaki group of mathematicians in an attempt to isolate the fundamental structures of mathematics. They found three independent structures, i.e., not reducible to one another, from which all mathematical structures can be generated. One structure is based on ideas of space and applies to neighborhoods, borders, points of view, and frames of reference. A second structure is based on the idea of a group and applies to numbers and classifications. The third is based on ideas of sequential order and applies to relationships.

Although these ideas are usually developed through language, they can also be perceived and interpreted visually, and although they may seem highly abstract, Piaget has found them in primitive form in the thinking of unimpaired children as young as six or seven.

The teaching and testing procedures were based on these three structures as well as on observations by Piaget and Inhelder, and by Bruner and his associates, who have traced the development of cognition through successive stages by presenting children with various tasks. Their tasks were dependent on language since these investigators were concerned with normal rather than handicapped children, but their tasks are easily adapted to art activities and their observations about stages of development have enabled us to compare handicapped with normal children.

The same three structures found basic in mathematics may also be basic in reading. They appear, in slightly different form, in recent studies by investigators concerned with learning disabilities who seem to be on the same trail, having come from another direction.

One of these investigators, Bannatyne, found that children with dyslexia usually obtain higher scores on certain WISC subtests which, as a group, involve manipulating objects in space without sequencing. He suggested that the three subtests - Picture Completion, Block Design, and Object Assembly - formed a special category which he called Spatial Ability. Bannatyne also found that dyslexic children do reasonably well in three WISC Subtests of Similarities, Comprehension, and Vocabulary - his Conceptual category that involves ability to

manipulate spatial images conceptually. In one study involving 87 learning disabled children, ages 8 to 11, he found that 70% had spatial scores greater than their conceptual scores, and since the WISC Test is standardized, only 50% of normal children would have spatial scores greater than their verbal conceptual scores (1971).

Bannatyne also found that these children almost always have lower scores on WISC subtests involving ability to sequence (Arithmetic, Coding, and Digit Span - his Sequencing category). He reasoned that it would be useful to regroup the subtests into Spatial, Conceptual, and Sequential categories rather than the traditional Verbal and Performance categories, and subsequent studies by other investigators have supported his hypothesis and confirmed his findings.

Rugel reviewed 25 studies of WISC Subtest scores of disabled readers, reclassifying the subtests into Spatial, Conceptual, and Sequencing categories. He found that disabled readers scored highest in Spatial ability, intermediate in Conceptual ability, and lowest in Sequencing ability, thus supporting Bannatyne's hypothesis (1974).

Smith and his associates administered the WISC-R test to 208 school-verified learning disabled children. Recategorizing the subtests in the manner suggested by Bannatyne, they too found validation for Bannatyne's arrangement. The mean Spatial score obtained was significantly greater than the mean Conceptual score, which, in turn, exceeded the Sequential scores (1977, pp. 437-443). Their findings suggest that learning disabled children are characterized by the same pattern of abilities that Bannatyne found for children with dyslexia and that Rugel found for disabled readers in general.

In discussing the significance of finding that these children possess in common high visuo-spatial skills, moderate conceptual skills, and low sequential skills, these investigators note that a cognitive approach to diagnosis and remediation has received little attention compared to perceptual and psycholinguistic approaches. They suggest that the time may now be ripe for serious consideration of the cognitive approach.

The time may also be ripe for serious consideration of the role of art in the cognitive approach. As Bannatyne observed, learning disabled children have intellectual abilities of a visuo-spatial nature that are not being recognized, allowed for or trained, since the emphasis is usually on linguistic rather than visuo-spatial education. (p. 401).

Art procedures used in the project deal with conceptual, sequential and spatial skills. Drawing from imagination involves ability to select, combine, and represent ideas in a context. Drawing from observation involves ability to perceive and represent spatial relationships. Predictive drawing, painting, and modeling clay all involve ability to represent spatial concepts and to order sequentially. The teaching procedures are designed to stimulate abstract thinking and reasoning and to develop readiness for mathematics and language. The testing procedures are designed to evaluate ability to form concepts

The Assessment Instrument

This instrument, the Silver test of Cognitive and Creative Skills, consists of three tasks designed to assess a child's understanding of the three basic concepts, and to provide a pre-post test for evaluating the progress of individuals or the effectiveness of programs.

Drawing from Imagination (assessing ability to associate and represent the concept of a class)

The concept of a class (or group of objects) involves ability to make selections, associate them with past experiences, and combine them into a context, such as selecting words and combining them into sentences.

Selecting and combining are the two fundamental operations underlying verbal behavior, according to the linguist, Roman Jakobson, and the two fundamental kinds of language disorder are linked with verbal selection and combination. He calls receptive disorders disturbance in ability to make selections; and expressive disorders, disturbance in ability to combine parts into wholes.

Selecting and combining are no less fundamental in the nonverbal behavior of art activities. The painter, for example, selects and combines colors and shapes, and if his work is figurative, he selects and combines images as well.

Furthermore, selecting and combining are fundamental in creative thinking. The creative person is often characterized as one who makes unusual leaps in associating experiences and combining them into innovative forms. In other words, the creative person has an unusual capability for selecting and combining, regardless of whether expression is through language, visual art, or other media.

Finally, selecting and combining are fundamental in emotional adjustment. Impairment of concept formation is one of the main ways in which neurological damage impinges on thinking. The effects of maladjustment can be discovered earlier in concept formation than in other thought processes, according to Rappoport. In verbal expression, impairment may escape detection, he notes, because verbal conventions often survive as "empty shells" even when the ability to form concepts has become disorganized.

To determine ability in this task, children are asked to select two subjects, one from each page of stimulus drawings, and combine them into narrative drawings of their own.

Their responses are scored on the basis of content or meaning (ability to select), on the basis of form (ability to combine), and on the basis of creativity (ability to represent). There are also two optional test items that are useful in certain programs: aptitude for art and language. Scoring is on a scale of 1 to 5 points.

Drawing from Observation (assessing ability to form concepts of space)

Concepts of space are another of the three basic structures of mathematics cited by Piaget, and one of the three basic categories cited by Bannatyne. In addition, skill in discerning spatial relationships is important in geometry and science, as well as the visual arts.

In tracing the development of concepts of space, Piaget and Inhelder observe that young children start out regarding each object in isolation and eventually arrive at a coordinated system embracing objects in three directions - left-right, before-behind, and above-below.

To determine ability, children are asked to draw an arrangement of four objects. Their responses are scored on a 5-point scale for ability to perceive and represent horizontal, vertical, and depth relationships.

Predictive Drawing (assessing ability to sequence and conserve)

The ability to make a series or sequence of objects has been linked with mathematics and ability to read. Up to the age of about seven, children are typically unable to order systematically, according to Piaget.

Like ability to order, ability to conserve is basic in logical thinking. This ability - to recognize constancy in spite of transformations in appearance - normally appears around the age of seven. Piaget and Inhelder state that the first natural system of reference involves horizontals and verticals, the most stable framework of everyday experience, and that it is important to find out if a child can spontaneously use such a system of reference (1967, p. 377). As adults, we are so accustomed to think in terms of horizontals and verticals that they may seem self-evident. The child of four or five, however, asked to draw trees on the outline of a mountain, draws them inside the outline. The child of five or six draws trees perpendicular to the incline, and not until the age of eight or nine does he tend to draw them upright. As for horizontal concepts, the four-year old scribbles round shapes when asked to draw the way water would look in the outline of a bottle. In the next stage, he draws lines parallel to the base of the bottle even when the bottle is tilted. Later, he draws an oblique line in the tilted bottles. His lines become less oblique and more horizontal until, at about the age of nine, he draws a horizontal line immediately (Piaget and Inhelder, 1967, pp. 375-418).

To determine ability, children are asked to draw the way a house would look on a steep slope, and how a tilted bottle would look half-filled with water.

To determine ability to sequence, children are asked to show how a glass would look as it is gradually emptied. These responses are also scored on a 5-point scale.

Our three Previous Studies

The teaching and testing procedures were initially developed in a 1972-73 State Urban Education Project in which one teacher worked with an experimental group of 34 children. They were a randomly selected 50% sample of 12 classes in a school for language and hearing impaired children. The remaining 34 children served as controls. Since all classes in the school were limited to 8 children, there were 4 children in each art class, held once a week for 11 weeks in the fall, and 9 weeks in the spring. To compare handicapped with normal children, the tests were also administered to normal children in a suburban public school (Silver, 1973).

In the drawing from imagination task, improvement in the experimental group was found at the $p.<01$ level in the combined abilities of selecting, combining, and representing. Comparing scores of the handicapped experimental group with the normal group (N=63), the normal children were superior on the pretest but not quite significantly better. On the post-test, however, the handicapped experimental children (N=34) were significantly superior to the normal children.

In the predictive drawing task, comparing mean scores of the handicapped experimental children before and after the art program, significant improvement was found at the $p < .01$ level. The control group did not improve. Comparing handicapped and normal children, the normal children had significantly higher scores on the pretest in both horizontal and vertical orientation. After the art program, however, no significant difference was found in horizontal orientation while in vertical orientation, the handicapped experimental children had improved to a degree to which they were significantly superior to the normal children.

In drawing from observation, the experimental group improved significantly at the $p < .05$ level. The control group did not improve. Although the normal children had higher scores on the pretest and the handicapped experimental children had higher scores on the post-test, there was no significant difference between the groups (Silver, 1973; 1978 p. 203-225).

Although creativity and aesthetics were not among the stated objectives of the State Urban Education Project, it was of much concern. Some art educators feel that using art for any purpose other than aesthetic will undermine art education. Some art therapists feel that structuring art experience will inhibit spontaneity.

To determine whether aesthetic and therapeutic goals can be pursued concurrently, two judges, a university professor of art and a registered art therapist, were asked to evaluate three drawings or paintings produced by each child in the fall program experimental group (N-18): the child's first work, his last work, and a work produced at mid-term. The fifty-four drawings or paintings were identified only by number and shown in random order to conceal the sequence in which they had been produced.

The judges, working independently, rated each work on a scale of 1 to 5 points for sensitivity and skill, as well as for ability to represent objects or events at the low level of description (imitative, learned, impersonal, scored 1 point), the moderate level of restructuring (going beyond description to elaborate or edit an experience - 3 points), or at the high level of transformation (beyond restructuring, highly personal, imaginative, inventive - 5 points).

Of the 18 children, the first drawing of 9 children received the lowest score, 1 point, while their last drawings received the highest score, 5 points, for being highly personal and imaginative, or highly skillful. In skill and expressiveness combined, both judges found improvements that were significant at the $p < .01$ level (Silver, 1978, p. 225).

Our second study was concerned with the question whether the teaching and testing procedures would be useful with children who had an opposite constellation of disabilities -- visual-motor weaknesses rather than language and hearing impairments, and whether the procedures could be used effectively by teachers other than the one who developed them. Eleven graduate students, who had registered for a course in using the art procedures, worked under supervision with 11 children. The children were not systematically selected but were enrolled as their applications were received.

After ten one-hour art classes, the children improved significantly in the three areas of cognition: at the $p.<01$ level in ability to associate and represent concepts through drawing from imagination, at the $p.<05$ level in ability to perceive and represent concepts of space through drawing from observation, and at the $p.<01$ level in ability to sequence through ordering a matrix (Silver and Lavin, 1977).

In our third study in the Spring semester, 1978, another group of 11 graduate students worked under supervision with 11 children in a suburban public school. Selected by school administrators for having special educational needs, these children also showed significant gains in the three areas of cognition: at the $p.<01$ level in drawing from imagination, and at the $p.<05$ level in both predictive drawing and drawing from observation. Thus the results reported in the previous study were again verified.

In working with children identified by their classroom teachers as having learning weaknesses, we occasionally found contradictory strengths. For example, one 7 year old, said to have difficulty retaining information, drew a scene from a library book he had seen weeks before. In clay, he spontaneously modeled an igloo, kayak, polar bear, walrus, penguins, and dog sled pulled by huskies. Although he was among the youngest children in the art class, his scores on the Silver Test was among the highest.

Similarly, adult stroke patients unable to talk showed unsuspected cognitive strengths as measured by the drawing test (Silver, 1975).

When we compared normal with handicapped children in the 1973 study, we were surprised to find that two of the six children with the highest scores in Drawing from Observation were handicapped. One child, a boy of 12 with an IQ estimated at 50 had receptive and expressive language impairments. We were also surprised to find that the six highest scorers ranged in age between the oldest and youngest tested (7 1/2 to 13 years).

We also found a wide range in age and academic ability among the children with the lowest scores. Of 95 children tested, 9 had low scores and 5 of the 9 were presumably normal. In Predictive Drawing, 18 of 136 handicapped and normal children had high scores and 8 of the 18 were handicapped.

The test has also been presented to audiences of teachers and other professionals and without fail, some draw houses perpendicular to the mountain slope or confuse spatial relationships in other tasks.

How can these findings be explained? The obvious answer, lack of experience in drawing seems inadequate because the tasks call for more than art skills. It may be, instead, that some children and adults have subtle cognitive dysfunctions easily overlooked because our schools emphasize verbal skills - it doesn't matter much if students cannot draw.

By the same token, subtle cognitive skills may be escaping detection. It may well be important to identify and evaluate strengths in visuo-spatial thinking if the strengths can help children with language disorders learn concepts normally associated with language.

There is a recognized need for greater precision in identifying abilities and disabilities in handicapped children. A survey has found much confusion: New York claimed to be serving 35,093 learning disabled children although a clear definition had not been provided, and when local school officials were asked how they had recognized the children and made the count, the answers were found to be varied and confusing (N. Y. A. C. L. D. News, 15:2, Mar-Apr. 1977).

Related Studies by Other Investigators

Hayes investigated the question whether a correlation exists between children's drawings and reading achievement. She administered the Silver Test to 75 children: first, second, and third graders from lower to middle income backgrounds, and correlated these scores to scores on the S. R. A. Reading Form F/Primary II for second and third graders and the Informal Reading Inventory for first graders (1978).

Significant correlations were found between Drawing from Imagination and reading test scores in all three grades, as indicated in Table 1. In the Drawing from Observation and Predictive Drawing tasks, correlations were inconsistent. In Drawing from Observation, correlations were significant for the third grade only; in Predictive Drawing, significant for the first grade only. The relationship between drawing and reading ability was stronger for the girls than for the boys in the second and third grades.

Spearman Rank Order Correlation Coefficients for Drawing from Imagination and Reading Scores

Grade	N	R	Results
1	25	.945	Statistically Significant
2	25	.657	Statistically Significant
3	25	.668	Statistically Significant

Table 2

Rank Order Correlations between the Silver Subtest Scores and Canadian Cognitive Abilities Test Scores

Subtest	N	R	Results
Drawing from Imagination (concepts of class)	25	.50	Significant at the .01 level
Drawing from Observation (concepts of space)	25	.05	Not significant
Predictive Drawing (concepts of order)	25	.33	Not significant

Table 3

Test-Retest Reliability Coefficients on the Silver Test

Subtest	N	R	Results
Drawing from Imagination	12	.5637	sig. .05
Drawing from Observation	12	.8401	sig. .05
Ability to Represent Spatial Concepts	12	.8036	sig. .05

Earlier this year, correlations were computed between the Silver Test and the Canadian Cognitive Abilities Test, administered by Norma Ott, a Resource Teacher, to 25 second grade Canadian children.

Significant correlations were found between the CCAT and Drawing from Imagination, as indicated in Table 2. No significant correlations were found between scores on the CCAT and scores on the Drawing from Observation and Predictive Drawing subtests.

Moser used the Silver Test as a pre-post measure in an experimental teaching program for 38 learning disabled subjects. Investigating test-retest reliability, she computed reliability coefficients and found significant correlations at the $<.05$ level in each of the subtests, as indicated in Table 3 (1979).

In addition, she correlated these scores with their scores on the WAIS, Bender, and Draw-A-Man tests with surprising results. Significant correlations at the $<.001$ level were found between each of these tests and total scores of the Silver test, as well as with some of the subtest scores, as indicated in Table 4. These scores were calculated at New York University by Rita Tanenbaum, PhD, who also prepared and forwarded Table 4.

Objectives of the Project

1. To Assess and Improve Significantly the Ability to Express Concepts of Space, Order, and Class in an Experimental Group of Handicapped Children.

2. To Identify Children who have Cognitive Skills Overlooked by Traditional Measures of Cognition and Achievement by Examining the Relationship of the Silver Test to These Measures.

3a. To Determine Whether Improvement in Concept Formation Through Art will Transfer to Achievement in Reading or Mathematics.

3b. To Determine Whether Children in a Specific Setting Make Significantly Greater Gains than Children in Different Settings.

Table 4

Correlation Matrix for Moser's PEC Students

N=38

		1	2	3	4	5	6	7	8
Silver (Imagination)	(1)	1.00							
Silver (Observation)	(2)	.45**	1.00						
Silver (Prediction)	(3)	.62***	.22	1.00					
Silver (Total)	(4)	.88***	.71***	.75***	1.00				
Draw-A-Man	(5)	.75***	.31*	.62***	.72***	1.00			
Bender	(6)	-.59***	-.17	-.42**	-.50***	-.37**	1.00		
Wais (Verbal)	(7)	-.04	.18	-.01	.02	-.12	-.01	1.00	
Wais (Performance)	(8)	.59***	.37**	.50***	.60***	.60***	-.45**	.01	1.00

* Significant at the .05 level.

** Significant at the .01 level.

*** Significant at the .001 level.

Method

Subjects

Participants were children ages 7 to 11 who had been designated as handicapped or as having special educational needs by school administrators on the basis of significant retardation of at least one year in reading or mathematics. They were drawn from six schools: two for handicapped children (learning disabled, deaf) and four for normal children which also contain children with special needs in their population.

Administrators in each school were asked to nominate 35 children who were either legally designated as handicapped or at least one year below grade level in reading or mathematics. From this pool of subjects, children were selected for participation in the study on the basis of their scores on the Silver Test.

As originally planned, only those children who received scores of at least three points on the Drawing from Imagination subtest would participate. As it happened, however, it was necessary to include many children with lower scores in order to find as many as 20 children in each school. The 120 children selected were randomly assigned to experimental and control groups, 10 children in each group in each school.

During the course of the project, a number of subjects were lost. Some children had moved or were unavailable for posttesting, and all subjects in the school for deaf children had to be eliminated when it was discovered that 6 of the 10 children in the control group were participating in a training program based on the same Piagetian concepts that were the focus of our study (this will be reported among the results). The final number of subject totaled 84 children in five schools.

Procedures

Testing. The significance of differences in the pre and posttest performance of experimental and control groups was examined using two way analyses of variance for repeated measures. The criterion measures were the Otis Lennon Mental Ability Test, The Metropolitan Reading Test, the Metropolitan Arithmetic Test, and the Silver Test.

The Otis Lennon Mental Ability Test is designed to evaluate general intelligence. Items deal with verbal conceptualization, quantitative reasoning, general information, classification, and ability to follow directions. Norms were devised from 200,000 pupils in 100 school systems.

The Metropolitan Test is one of the most widely used achievement tests in New York State. It contains seven subtests: Word Knowledge, Word Analysis, Reading, Spelling, Mathematics Computation, Mathematic Concepts, and Mathematics Problem Solving. Separate subtest scores in reading and math were used in evaluating children's performances.

The tests were administered before and after the art therapy program. The severity of the handicaps of some of the children precluded the administration of the Otis Lennon and Metropolitan Tests (group tests which could not be given to small groups as readily as the Silver Test). In those cases, the children's scores on comparable instruments in their school records were used instead.

In addition, the Silver Test was administered to other populations by art therapists and teachers elsewhere who had volunteered to give the test to the children they worked with. This opportunity to examine the transportability and validity of the test arose when teachers attending a workshop in Quebec volunteered to give it to their learning disabled pupils and to send us the test booklets together with the childrens' scores on intelligence or achievement tests. Other volunteers at other conferences provided additional opportunities to correlate scores on the Silver Test with scores on standardized measures such as the WISC Performance IQ, Canadian Cognitive Abilities Test, SRA Math Test. and Iowa Test of Basic Skills.

To determine reliability in scoring the Silver Test, seven judges participated in a series of training sessions and subsequently scored drawings by children identified only by number. Separate reliability coefficients were computed for each subtest.

A series of product moment correlations were used to determine the relationship of the Silver Test to these traditional tests and to the Otis Lennon and Metropolitan Tests.

The Art Therapy Program. In each school, an art therapist worked with two groups of 5 children for approximately 40 minutes a week for 12 weeks. The children in the control group received no special treatment.

During the first six weeks, all art therapists used the same procedures, following guidelines that specified objectives, procedures, and materials. These guidelines are presented in Appendix B. as the basic 6-week program.

During the second six weeks, they adapted the procedures to meet the needs of individual children, and were encouraged to devise procedures of their own.

The art program was designed to develop ability to form concepts of space, order, and class. Developing creative abilities and building self-confidence were also of much concern. Emphasis was on exploratory learning rather than instruction.

Instead of a wide variety of art techniques and materials, they were limited primarily to drawing, painting, and modeling clay. The children used only four colors of poster paint: red, blue, yellow, and white, mixing them with palette knives on paper palettes. They also used brushes, felt-tipped pens in various colors, and earth clays.

The art therapists attended monthly supervisory meetings to discuss procedures and examine artwork produced by the children. They also scored the test booklets. In order to establish agreement and to determine the extent of that agreement they attended training sessions and reached significant agreement in all test items at the third session (table 5).

Pilot Studies. Three studies, exploring the testing and therapeutic procedures in other settings, have been initiated and are still in process:

1. A Canadian Resource Teacher is working with a learning disabled child using the same procedures used by art therapists in the project. She is being supervised via correspondence and telephone. This child had a low IQ score on the Canadian Cognitive Abilities Test and a high score on the Silver Drawing from Imagination subtest which showed significant correlations at the $<.01$ level as indicated on page 12.

2. An art teacher serving over 200 children in a public school, has been participating in a pilot inservice training program

3. the procedures are being used in an experimental program for adult stroke patients in a rehabilitation center

Results

Statistical Analyses Performed by Claire Lavin, PhD

Inter-rater Reliability

In order to determine the reliability of scores on the Silver Test, inter-rater reliability coefficients were computed. Seven judges participated in a series of training sessions. Subsequently, seven judges scored the drawings of six children. The drawings were identified by number rather than by name.

Separate reliability coefficients were computed for each subtest. The results are presented in Table 5.

Table 5

Interrater Reliability Coefficients for Silver Drawing Test

Drawing from Imagination	.98
Aptitude	.97
Language	.88
Drawing from Observation	.91
Predictive Drawing	.93

These results indicate a high degree of inter-rater reliability. The judges assigned similar ratings to the drawings in all categories.

Subjects

At the beginning of the study, 118 subjects were selected and randomly assigned to the experimental and control groups in six schools.

During the course of the experiment a number of subjects were lost. All of the subjects at St. Joseph's were eliminated since it was discovered that they were participating in a Piagetian training program during the duration of our study. Some subjects either moved or were not available for all of the testing sessions, and, therefore, had incomplete data. Additional subjects were randomly removed to equate the number in each group for the statistical analysis. A breakdown of the subjects lost is presented in Table 6.

Table 6

Subjects Lost from Experimental/Control Groups

	Experimental	Control
Absent from pre/posttest	5	4
Randomly removed to equate in each group	4	2
St. Joseph's School	9	10
TOTAL	18	16

The data analyses which follow, therefore, were based upon the scores of 84 subjects in five schools.

Initial Differences Between Groups

The significance of initial differences between subjects in the experimental and control groups was examined through the use of a series of t tests for uncorrelated means on the following variables: I.Q., reading, math, and Silver Test scores: total score, drawing from imagination, drawing from observation and predictive drawing scores. The results are presented in Tables 7 through 13.

Table 7

t Tests of Mean Differences in Pre-test I.Q. Scores of Experimental and Control Subjects

School	Exp N	Exp Mean	Exp SD	Control N	Control Mean	Control SD	t	
Windward	9	96.20	11.79	9	95.90	7.86	.06	ns
St. Frances	9	93.00	8.01	9	89.11	10.44	.88	ns
Primrose	8	106.75	6.75	8	104.25	4.26	.88	ns
P.S. 175	8	88.62	10.05	8	89.12	10.70	.09	ns
Trinity	8	87.12	11.49	8	85.25	18.85	.24	
Total Group	42	93.84	11.70	42	91.84	13.68	.63	ns

Table 8

t Tests of Mean Differences in Pretest Reading Scores

School	Exp			Control			
	N	Mean	SD	N	Mean	SD	t	Sig
Windward*	9	3.01	1.62	9	2.40	.52	1.05	ns
St.Frances	9	698.22	43.34	9	673.22	46.25	1.18	ns
Primrose	8	591.12	80.17	8	584.62	55.41	.18	ns
P.S. 175	8	625.00	65.82	8	643.12	91.21	.47	ns
Trinity	8	638.12	91.04	8	599.50	69.80	.95	ns
Total	33	639.50	78.69	33	628.58	73.28	.59	ns

Table 9

t Test of Mean Differences in Pre-test Math Scores

School	Exp			Control			
	N	Mean	SD	N	Mean	SD	t	Sig
Windward*	9			9				
St. Frances	9	654.11	103.34	9	647.66	83.75	.05	ns
Primrose	8	510.00	56.45	8	514.75	67.47	.15	ns
P.S. 175	8	574.55	138.06	8	611.12	92.80	.63	ns
Trinity	8	564.75	126.83	8	47.12	118.51	.28	ns
Total	33	575.73	116.99	33	582.21	102.79	.24	ns

* Grade equivalent scores. Not included in total group analysis.

Table 10

t Test of Mean Differences in Pre-test Total Silver Scores

School	Exp			Control			Sig
	N	Mean	SD	N	Mean	SD	t	
Windward	9	26.00	6.34	9	25.90	5.13	.03	ns
St. Frances	9	23.33	5.83	9	23.44	6.76	.009	ns
Primrose	8	20.37	4.80	8	23.12	4.94	1.12	ns
P.S. 175	8	19.25	4.13	8	21.25	6.18	.76	ns
Trinity.	8	23.00	5.50	8	22.00	6.71	.32	ns
Total	42	22.58	5.72	42	23.27	5.92	.55	ns

Table 11

t Test of Mean Differences in Pretest Drawing from Imagination Scores

School	Exp			Control			Sig
	N	Mean	SD	N	Mean	SD	t	
Windward	9	3.24	.78	9	2.83	.68	1.24	ns
St. Frances	9	3.04	.35	9	2.78	.44	1.34	ns
Primrose	8	2.81	.57	8	2.92	.79	-.32	ns
P.S. 175	8	2.78	.64	8	2.72	.74	.17	ns
Trinity	8	2.72	.54	8	2.30	.60	1.48	ns
Total	42	2.93	.60	42	2.72	.66	1.58	ns

Table 12

t Test of Mean Differences in Drawing from Observation Pretest Scores

School	Exp			Control				
	N	Mean	SD	N	Mean	SD	t	Sig
Windward	9	2.55	1.47	9	2.61	1.09	-.10	ns
St. Frances	9	1.78	1.36	9	2.04	1.64	-.35	ns
Primrose	8	1.47	1.15	8	2.21	1.40	-1.14	ns
P. S. 175	8	1.46	.97	8	1.72	1.32	-.25	ns
Trinity	8	2.[illegible]	1.29	8	2.60	1.28	.11	ns
Total	42	2.01	1.32	42	2.24	1.33	-.80	ns

Table 13

t Test of Mean Differences in Predictive Drawing Pre-test Scores

School	Exp			Control				
	N	Mean	SD	N	Mean	SD	t	Sig
Windward	9	2.87	1.29	9	3.10	.69	-.49	ns
St. Frances	9	2.83	1.02	9	2.81	.66	.05	ns
Primrose	8	2.42	1.02	8	2.46	.89	-.07	ns
P.S. 175	8	2.02	.88	8	2.55	.54	-1.42	ns
Trinity	8	2.16	.88	8	2.32	1.26	-.29	ns
Total	42	2.49	1.05	42	2.67	.84	-.88	ns

None of the obtained t values presented in table 7 through 13 were significant at the .05 level. The experimental and control group subjects, therefore, were performing on the same levels with respect to the variables under consideration prior to treatment.

Objective #1:

The first objective of the project was to improve significantly the ability of experimental subjects to express concepts of space, order, and class, as measured by the Silver Test of Cognitive Skills.

The significance of differences between the pre and post-test scores of experimental and control subjects was examined through the use of an analysis of variance for repeated measures.

It was our hypotheses that the F ratio for main effects would indicate a significant difference between the pre and post test scores, and that the F ratio for interaction would indicate a significantly higher posttest score for the experimental group as conpared with control subjects. All calculations were performed on the Monroe 1860 Programmed Calculator.

The results of the analyses of variance are presented in Table 14.

The F ratios for differences between pre and post test means and for interaction was significant at the .01 level. Sheffe' analyses were performed to determine the source of the significant differences. The F ratio for differences between the pre and post test means of the experimental group were significant at the .01 level. No other differences were significant.

The experimental group, therefore, did significantly improve in total drawing scores between pre and post tests. Although the control group also improved, the difference was not significant.

A similar procedure was performed with respect to gains in general intelligence as measured by the Otis Lennon School Ability Test. The experimental group failed to demonstrate significantly higher posttest scores than control subjects. The results are presented in Table 15.

Table 14

Analyses of Variance and Scheffe' Comparisons for Total Drawing Test Scores

Source	SS	df	MS	F	ε
Total	7,696.47	167			
Between Subjects	-28,429.02	83			
A (Exp-Cont)	-44,897.32	1.00	44,897.32		
Subject within groups (S/A)	16,468.29	82	200.83	-223.55	1(
Within Subjects	36,125.50	84			
B (Pre/Post)	1,292.59	1.00	1,292.59	-10.44	.(
AB	44,982.48	1.00	44,982.48	-363.42	.(
B x Subjects within groups $^{SB}/_{A}$	-10,149.58	82	-123.77		

Scheffe' Comparisons	Difference	F	Sig
Experimental pre-Post	6.88	8.03	.01
Control Pre-Post	4.22	3.02	ns
Experimental Pre-Control Pre	.83	.11	ns
Experimental Post-Control Post	2.83	1.35	ns

Table 15

Analysis of Variance for IQ Test Scores

Source	SS	df	MS	F	s
Total	19,727.96	131			
Between Subjects	-97,303.03	65			
A (Exp-Cont)	-210,054.18	100	-210,054.18		
Subject within groups (S/A)	112,751.15	64	1,761.73	-119.23	
Within Subjects	117, 031.00	66			
B (Pre/Post)	297.00	1.00	237.00	-.20	ns
AB	210,120.24	1.00	210,120.24	-144	
B x subject within groups SB/A	-93,386.24	64	1,459.16		

Objective #2:

The second objective of the project was to determine the relationship of the Silver Test of Cognitive Skills to traditional tests of intelligence and achievement. A series of product moment correlations were used for these analyses.

Relationship of the Silver Test to Otis Lennon School Ability Test

To determine the degree to which the Otis Lennon and Silver Tests measure the same cognitive skills, both instruments were administered to second and third grade children in two of the schools included in our investigation - P.S. 175 and St Frances of Rome. They were administered in a third school, the John Paulding School in Tarrytown, N.Y. by a volunteer, Pat Schachner, art teacher in the school. Results are presented in Table 16.

Table 16

Product Moment Correlations between Silver Test Scores and Otis Lennon School Ability Scores

	N	.r	sig
Drawing fromImagination	99	.39	.01
Drawing from Observation	99	.05	ns
Predictive Drawing	99	.30	.01

there were significant relationships between two of the subtests - Drawing from Imagination and Predictive Drawing - and the Otis Lennon scores. There was no significant relationship between Drawing from Observation and the Otis Lennon School Ability Test.

The relationship between these tests is only moderate. The Otis Lennon is heavily weighted with verbal items which do not appear at all in the Silver Test. On the other hand, the Silver Test taps the ability to select, combine, and represent through drawing, a skill which is not included in the Otis Lennon Test. Both instruments assess intellectual ability, but use different assessment techniques, and emphasize language and visuo-spatial cognitive skills to a different extent.

Relationship of the Silver Test to WISC Performance IQ Scores

A further investigation of the relationship between the Silver Drawing from Imagination subtest and traditional measures of cognitive skills was conducted using students from three schools - St Joseph's School for the Deaf, the Buckingham School*, and the Mystic School*. Because of the nature of the children's handicaps, the WISC Performance Test was used to measure intellectual ability rather than the Otis Lennon School Ability Test.

Product moment correlations between the WISC Performance IQ scores and the Silver Test were computed. The data are presented in Table 17.

Table 17

Product Moment Correlations Between WISC Performance IQ Scores and the Silver Test

	N	r	Sig.
Total Score	65	.29	.05
Drawing from Imagination	67	.37	.01
Drawing from Observation	64	.16	ns
Predictive Drawing	65	.33	.01

Total Silver scores, and the subtest scores of Drawing from Imagination and Predictive Drawing were significantly related to WISC scores.

The relationship of WISC Performance IQ scores to the Silver Drawing from Imagination subtest closely approximated the relationship of the Silver Test to the Otis Lennon Test. The Silver Test which involves the ability to select, combine, and represent, can therefore be said to measure aspects of cognition which are also measured to some extent by both the Otis Lennon and WISC Tests.

These results lend support to our hypothesis that the Silver Test does measure cognitive skills through the use of drawing rather than language. It can, therefore, be valuable in identifying cognitive skills in children with known language deficiencies such as the deaf, language impaired, learning disabled, and disadvantaged. These results also explain why we have found unexpected cognitive strengths in some of these children when using the Silver Test - strengths which do not appear on other tests.

*Lisa Irving Halprin was volunteer at Buckingham School; Jam Bell at Mystic School.

Relationship of the Silver Test to the Metropolitan Achievement Test

We also explored the possibility that training can lead to an improvement in reading or math. It is our hypothesis that some of the cognitive skills required for reading and math are also involved in the drawing tasks included on the Silver Test. If this hypothesis is true, there should be a positive relationship between scores on the Silver Test and those on tests of reading and math. However, since the language component on the achievement tests is much heavier than on the Silver Test, the relationship should not be extremely high. This is, in effect, what we have found.

Product moment correlations were computed between scores on the Silver Test and the Metropolitan Achievement Test in Reading for 79 children in two schools involved in the present study. The results are presented in the table below.

Table 18

Product Moment Correlations between MAT and Silver Test

	N	r	Sig.
Total Score	76	.23	.05
Imagination	76	.31	.01
Observation	76	.03	ns
Prediction	76	.32	.01

There was a significant relationship between the MAT Reading scores and the total Silver test score as well as two of the three subtests - Drawing from Imagination and Predictive Drawing.

The results parallel those reported in the previous section. There are moderate significant correlations between scores on the Drawing from Imagination and Predictive Drawing subtests and math and reading achievement tests. The total Silver test score is also significantly related to reading achievement scores, but not to math scores.

Relationship of the Silver Test to SRA Math Achievement Scores

Product moment correlations were also computed for scores on the Silver Test and the SRA Math Achivement Test. The results are presented in Table 19.

Table 19

Product Moment Correlations between the Silver Test and the SRA Math Test

	N	r	Sig.
Total		.17	ns
Drawing from Imagination	65	.37	.01
Drawing from Observation	65	-.15	ns
Predictive Drawing	65	.36	.01

There was no significant relationship between the total score on the Silver Test and the SRA Math scores, or between Drawing from Observation and the Math scores. There were significant relationships, however, between Drawing from Imagination and Predictive Drawing with the Math scores.

Relationship of the Silver Test to Iowa Tests of Basic Skills

Product moment correlations were also computed for scores on the Silver Test and the Iowa Test of Basic Skills composite and math scores. The results are present in the Table below.

Table 20

Product Moment Correlations between the Silver Test and the Iowa Test of Basic Skills

	N	Iowa Math	Sig.	Composite	Sig.
Total Score	20	.73	.01	.76	.01
Imagination	20	.46	.05	.44	.05
Observation	20	.47	.05	.55	.01
Prediction	20	.16 ns	ns	.11 ns	ns

There were significant correlations between the total Silver Test, and two of the three subtests with scores on the Iowa Test of Basic Skills.

Objective #3

A. The third objective of the project was to determine whether improvement in concept formation would transfer to achievement in reading and math. Two analyses of variance for repeated measures were used for the purpose, with the MAT, reading and math scores serving as the criterion measure. The results are presented in Tables 21 and 22.

The F ratio for the differences between pre and posttest scores failed to reach the .05 level of significance. The experimental subjects failed to score significantly higher in the math and reading posttests as compared to control subjects.

Table 21

Analyses of variance for MAT Reading Scores

Source	SS	df	MS	F	s
Total	744,603.06	131			
Between Subjects	-5,772,916.93	65			
A (Exp-Cont)	-10,607,762.54	1.00	10,607,762.54		
Subject within groups (S/A)	4,834,845.60	64	75,544.46	-140.41	
Within Subjects	6,517,519.99	66			
B (Pre/Post)	5,655.27	1.00	5,655.27	-.08	ns
AB	10,611,822.09	1.00	10,611,822.09	-165.64	
B x Subject within groups $^{SB}/_{A}$	-4,099,957.36	64	64,061.83		

Table 22

Analyses of Variance for MAT Arithmetic Scores

Source	SS	df	MS	F	s
Total	1,534,756.33	131			
Between Subjects	-5,119,551.66	65			
A (Exp-Cont)	-9,934,548.60	1.00	-9,934,548.60		
Subject within groups (S/A)	4,814,996.93	64	75,234.32	-132.04	
Within Subjects	6,654,307.99	66			
B (Pre/Post)	20,725.12	1	20,725.12	-.40	ns
AB	9,941,915.03	1	9,941,915.03	-192.32	
B x subject within groups SB/A	-3,308,332.15	64	-51,692.68		

Objective #3

B. The final objective of the study was to determine whether children in a specific setting made significantly greater gains than children in different settings.

A school by school analysis was conducted for each variable. The results using series of t tests are presented in Tables 23 through 29.

Table 23

t Tests of Mean Differences in Post-test I.Q. Scores of Experimental and Control Subjects

School	Exp			Control			Sig
	N	Mean	SD	N	Mean	SD	t	
St. Frances	9	100.11	6.43	9	94.55	10.54	1.34	ns
Primrose	8	94.25	11.08	8	94.12	12.50	.02	ns
P.S. 175	8	91.37	11.17	8	101.75	15.16	1.55	ns
Trinity	8	97.00	7.83	8	93.25	17.60	.55	ns
Total	33	95.81	9.43	33	95.87	13.84	.02	ns

In three of the schools, there was virtually no difference in scores, while in a fourth, the experimental group seemed to perform better and in the fifth, the control group seemed to perform better. These differences, however, were not statistically significant.

A school by school analysis was also conducted to determine whether subjects in any one school performed significantly better in reading than subjects in any other school. The results are presented in Table 24.

Table 24

t Tests of Mean Differences in Post-test Reading Scores

School	Exp			Control			Sig
	N	Mean	SD	N	Mean	SD	t	
Windward*	9	4.19	2.56	9	3.92	1.24	.29	ns
St. Frances	9	702.11	72.72	9	669.33	63.06	1.02	ns
Primrose	8	591.10	66.66	9	620.12	34.34	1.09	ns
P.S. 175	8	655.25	49.18	9	674.25	65.04	.65	ns
Trinity	8	648.25	91.26	9	591.62	85.61	1.27	ns
Total	33	650.75	79.28	33	639.75	70.72	.59	ns

*Gross Equivalent SAT scores not included in the total

In three of the schools, the experimental group scored slightly higher than the control while in the other two schools, the reverse was true. None of the differences were statistically significant.

A similar school by school analysis was also conducted for the math scores. The results are presented in Table 25.

Table 25

t Tests of Mean Differences in Post-test Math Scores

School	Exp			Control			Sig
	N	Mean	SD	N	Mean	SD	t	
St. Frances	9	659.11	108.87	9	683.66	112.52	.47	ns
Primrose	8	528.12	73.68	8	549.25	58.85	.63	ns
P.S. 175	8	596.62	116.03	8	624.12	98.72	.51	ns
Trinity	8	578.25	112.03	8	574.25	103.59	.07	ns
Total	33	592.60	110.36	33	610.12	105.92	.65	ns

The subjects in the control group tended to score slig ly higher than those in the experimental group. Since their initial scores were also slightly, although not significantly higher no change in relative performance can be noted.

A detailed analysis of the scores of subjects in all five schools on the Silver Test was performed for total, and subtest scores. The results are presented in Tables 26 through 29.

Table 26

t Tests of Mean Differences in Post-test Total Silver Scores

School	Exp			Control			Sig
	N	Mean	SD	N	Mean	SD	t	
Windward	9	29.70	6.97	9	27.30	7.19	.75	ns
St.Frances	9	33.77	3.27	9	27.22	6.35	2.75	.05
Primrose	8	26.62	5.06	8	26.62	5.18	.00	ns
P.S. 175	8	24.87	3.83	8	27.87	9.84	.80	ns
Trinity	8	30.62	5.70	8	28.37	7.68	.66	ns
Total	42	29.25	5.86	42	27.46	7.04	1.28	ns

Table 27

t Tests of Mean Differences in Drawing from Imagination Post-test Scores

School	Exp			Control			Sig
	N	Mean	SD	N	Mean	SD	t	
Windward	9	3.44	.69	9	2.91	1.15	1.24	ns
St.Frances	9	3.77	.41	9	3.22	.64	2.16	.05
Primrose	8	3.38	.65	8	3.17	.53	.71	ns
P.S. 175	8	2.87	.42	8	2.95	.85	.22	ns
Trinity	8	2.92	1.43	8	3.18	1.11	.40	ns
Total	42	3.30	.83	42	3.09	.86	1.12	ns

Table 28

t Tests of Mean Differences in Drawing from Observation Post-test Scores

School	Exp			Control			Sig
	N	Mean	SD	N	Mean	SD	t	
Windward	9	2.90	1.25	9	3.13	1.57	.36	ns
St.Frances	9	4.06	1.45	9	2.92	1.67	1.54	ns
Primrose	8	2.07	.98	8	2.33	.79	.58	ns
P.S. 175	8	2.96	.89	8	2.55	1.21	.77	ns
Trinity	8	4.20	.59	8	3.06	.56	3.93	.01
Total	42	3.24	1.31	42	2.81	1.25	1.54	ns

Table 29

t Tests of Mean Differences Predictive Drawing Post-test Scores

School	Exp			Control			Sig
	N	Mean	SD	N	Mean	SD	*t*	
Windward	9	3.48	1.13	9	2.93	.79	1.25	ns
St.Frances	9	3.36	.64	9	2.81	.75	1.67	ns
Primrose	8	3.31	.38	8	3.17	.72	.47	ns
P.S. 175	8	2.40	.77	8	3.02	1.17	1.25	ns
Trinity	8	2.90	.80	8	3.12	1.32	.41	ns
Total	42	3-12	.85	42	3.00	.94	.57	

In general, the scores of experimental subjects tended to be higher than those of control group subjects. Only in three instances, however, were these differences statistically significant. At St. Frances School, both the total score and drawing from imagination score were significantly higher for experimental subjects. Trinity School experimental subjects scored significantly higher in drawing from observation.

EXP	IQ Post	Reading Post	Math Post	Silver Total Post	IMagination Post	Observation Post	Predictive Post
Windward	no post test	4.41 2.62	no post test	29.70 6.97	3.44 .69	12.90 1.25	3.48 1.13
St. Francis	100.11 6.43	702.11 72.72	659.11 108.87	33.77 3.27	3.77 .41	4.06 1.45	3.36 .64
Primrose	94.25 11.08	591.0 66.66	528.12 73.68	26.62 5.06	3.38 .65	2.07 .98	3.31 .38
PS 175	91.37 11.17	655.25 49.18	596.62 116.03	24.87 3.83	2.87 .42	2.96 .89	2.40 .77
Trinity	97.00 7.83	648.25 91.26	578.25 112.03	30.62 5.70	2.92 1.43	4.20 .59	2.90 .80
Total	95.81 9.43	650.75 79.28	592.60 110.36	29.25 5.86	3.30 .83	3.24 1.31	3.12 .85
CONT							
Windward		3.76 1.21		27.30 7.19	2.91 1.15	3.13 1.57	2.93 .79
St. Francis	94.55 10.54	669.36 63.06	683.66 112.52	27.22 6.35	3.22 .64	2.92 1.67	2.81 .75
Primrose	94.12 12.56	620.12 34.43	549.25 58.85	26.62 5.18	3.17 .53	2.33 .79	3.17 .72
Trinity	93.25 17.60	591.62 85.61	574.25 103.59	28.37 7.68	3.18 1.11	3.06 .56	3.12 1.32
P.S. 175	101.75 15.15	674.25 65.04	624.12 98.72	27.87 9.84	2.95 .85	2.55 1.21	3.02 1.17
Total	95.87 13.84	639.75 70.72	610.12 105.92	27.46 7.04	3.09 .86	2.81 1.25	3.00 .94

Case Studies

Case studies can provide information that eludes quantification. Although the gains that were made by some children were not reflected in their post test scores, they were evident in gains in their classroom behaviors. The following is a case in point.

Ricky - A Case Study by Judith Itzler, M.A., A.T.R.

Ricky can be described as a sturdy, robust, and childishly jovial eleven year old boy. He has been attending a private school for children with learning disabilities for the past four years. An early diagnosis of psycho-motor epilepsy and hyperkinesis meant that daily medication was a necessary part of his school routine. This year, however, under close medical supervision, Ricky's medication was being reduced, and then eliminated entirely.

Because his problems had always included extreme distractibility, I felt it would be a special challenge to help him monitor his behavior and focus his attention on particular art tasks for any length of time. My fears proved unfounded since his achievements and ability to concentrate in the art room seemed to improve as the year progressed.

Ricky is a child whose WISC-R scores followed the same pattern of the proposed recategorization made by Smith et al (1977), i.e., his highest scores fell in the area of spatial skills; next were his scores in conceptual skills; and his lowest scores, in sequential skills.

There is a slight tremor in his hand movements, but despite this, his dexterity remains surprisingly intact. Moreover, Ricky's interest and enthusiam were contagious, and he really seemed to enjoy this new approach to art in which he would not be penalized, or made to feel inferior, because of his motor difficulties.

During the administration of the Silver post test, Ricky became so involved in his drawing from imagination that, when an untimely fire alarm sounded, he had to be persuaded to leave the room. More surprisingly, upon his return, he picked up his pencil and continued from the point at which he had been interrupted, working in absolute silence and complete concentration.

In a very organized yet imaginative manner, Ricky drew a cross-section of a house with a variety of activities taking place in each room. His title, "Different Events in the House," was not only appropriate but all inclusive. He depicted an exercise room with

three people engaged in different activities; a dining room with an elaborately set table, and a person walking toward a refrigerator "getting something for dinner"; another room showing a seated person watching TV; and finally, a bedroom with a person lying in bed. When questioned about this last room, Ricky said the person was not sleeping..."he's just thinking about a lot of things... he's just thinking."

This attitude of valuing his own thinking had been continuously emphasized during the art sessions. The word "imagination" had been discussed and explored so that all the children, like Ricky, would understand that their ideas would be of primary importance rather than artistic technique. Associative thinking and visual articulation were clearly evident in this drawing and in many other drawings Ricky produced.

In Ricky's school, the children were too impaired to be able to take the Otis Lennon or Metropolitan Tests. Their scores on the Stamford Diagnostic Reading and Math Tests, (administered by teachers in their school), were used instead. Ricky's reading score in 1979 was at the 4.2 grade level; in 1980, following the art program, his score was 4.1 with the usual time limit, 5.1 without a time limit. In math, his score improved slightly from 4.2 to 4.7, and in the Silver Test, from 29 to 30 in total scores.

The ability to concentrate and focus his attention (without the aid of medication), the self-confidence he was able to exhibit in his artwork, and the increased level of conceptual and creative thinking were the benefits that this child was able to derive from the art program.

Debra - A Case Study by Eldora Boeve, M.S. Ed.

At the beginning of our special art classes, 10-year old Debra, like all of the ten children who were enrolled, was described as having learning disabilities, emotional difficulties, and as functioning at a very low level academically. Her IQ was reported as 87.

Debra's teachers described her as difficult to contain in a classroom, lacking in self-control, frequently acting out, often involved in fighting with her peers without being able to explain why. One teacher said, "she is neglected, rejected, unwanted." The school psychologist reported, "Debra is an unkempt-looking child, is far-sighted, wears glasses, has many problems with relationships, feels negative self-worth."

In the beginning, her teachers told me that Debra would have difficulty in focusing her attention, but from the start she showed an interest and ability to concentrate that continued throughout our twelve sessions. She never was a disciplinary problem, and missed only one class, because of sickness. Later, her classroom teacher, who was greatly interested in our art techniques, said, "Debra was highly motivated by the art class--concerned, never wanted to miss a session." Her L.D. specialist said she was "most

enthusiastic--wished there could be more art classes."

Debra entered each art exercise eagerly, moved quickly from drawing and painting small, limited and specific subjects into larger, more sweeping and abstract effects, using up to 24 x 30" surfaces. She became deeply involved in her painting, expressing herself verbally more freely as time went along, and developed a real camaraderie with others in the class, sharing humor often

After the art program had ended, the children in Debra's school were given the Iowa Tests of Basic Skills, as they do every year. Debra's reading score showed singular improvement: from 2.6 in 1979 to 4.9 in 1980. Her percentage improvement was 88.5% (even though she had the lowest score of the 14 girls in her sixth grade class). The class as a whole had a 27% gain.

These gains were also reflected in her post test scores in the project. On the Metropolitan Reading test, her pre-test score was at grade level 3.6; post test: grade level 5.1. On the math test, her pre-test score was 2.1; post test, 8.5. On the Otis Lennon test, her IQ improved from 86 on the pre-test to 103 on the post test. On the Silver Test her total scores improved from 28 on the pre-test to 34 on the post test.

Thus there has been substantial improvement in Debra's academic performance during the past year, as well as in her appearance and social behavior, self-image, and most definitely in the quality of her art productions. There is no way to measure statistically the dynamics responsible for the changes. But all interested in Debra's welfare have commented on her positive responses to the art procedures and her use and enjoyment of them.

Teachers and principal were included in discussions of what was happening to Debra and the other children in the art class as the months progressed. All agreed that such a program has great potential in developing not only cognitive skills but also personality strengths and adaptations.

The factors we isolated as being most significant were: 1. the use of an outline of art procedures such as ours, specifically structured but with room for adaptations; 2. small classes, with opportunities for individual attention; 3. a quiet and subdued atmosphere, non-threatening, not over-stimulating; 4. no predetermined norms, no competition, no judgments -- freedom of exploration and experimentation. I myself feel very strongly that this process -- of using one's hands and mind with art materials--can be adapted for all ages and circumstances, and can be a most valuable instrument in developing self-awareness and strengths.

Pat - A Case Study by Karen Hayes, M.A.

Children who participated in this study had not been exposed to any type of formal art classes due to a reduced budget. Any

art experience prior to this project were given to them by their homeroom teachers.

The positive gains that resulted from this project were evident to the children, parents and teachers alike. Far beyond any of our specific objectives, I feel that perhaps the most significant gains for these children were the self confidence and the positive self image that were developed through the art experience. These children, some for the first time, were allowed to express their feelings and emotions and develop their art skills and creative abilities in a positive way.

A case in point is Pat, an eight year old boy in the third grade. Pat is from Italy, and up to the present time had met with mostly frustrating experiences in school due to a language barrier. Pat scored very poorly on achievement tests. At first, he experienced difficulty in selecting stimulus drawings and was extremely shy. He also experienced difficulty selecting and combining images through drawing, as well as through language. Once this anxiety was eliminated, Pat started to become sure of himself and began to pay particular attention to detail. He labeled everything in his drawings. This gave him confidence because he was able to show that he knew the names of different objects and also helped him develop thought patterns. He was beginning to think and express himself in whole ideas rather than fragmentary parts. Pat experienced much frustration when he had to write whole, complete sentences. He could verbally tell you what he meant but he became easily frustrated and distracted which frequently resulted in stuttering. When writing a composition, Pat's thoughts and sentences jumped from one topic to the next.

The experiences that Pat received in the following twelve weeks were instrumental to the gains that he made during the year. By developing and reinforcing associative, sequential and spatial thinking and by encouraging exploratory learning in a positive, stress-free environment, Pat was able to make tremendous gains. As a final project Pat made a roll movie of nine pictures. He wrote sentences to describe each picture in a complete sentence and was able to share his project very enthusiastically with his fellow students. In Pat's final drawing from imagination, he labeled only the important parts of his drawing and wrote a series of sentences to express his thoughts. His abilities to select, combine and draw from imagination had increased remarkably. So did his scores on his S.R.A. Achievement tests at the end of the year.

While we know that it would take a miracle for this child or any child, to improve drastically in such a short period of time, the work and the help that he experienced from this project definitely contributed to his growth and the growth of all the children in this art class. Although he did not show improvement in the Metropolitan Reading Test (grade level 2.8 in the pre-test and 2.6 in the post test), he had a slight gain in the Math test (from 2.7 to 3.3). His IQ, however, improved from 89 to 108, as measured

by the Otis Lennon test; and his score on the Silver Test improved from a total of 20 to a total of 32.

Marvin - A Case Study by Phyllis Wohlberg, M.A., A.T.R.

"How come we are drawing and painting all the time? I thought this was going to be a reading program," said a student from school X, whom we will call Marvin.

Marvin was one of the experimental students in a school that did not have an art department. My once-a-week visit had been presented (by the school) as part of the reading program, supportive in developing cognitive and communication skills for those children who were a year behind in reading and math.

Each session had a task designed to facilitate cognitive development in imagination, spatial concepts, and sequential ordering.

The following will be a verbal description of a few of Marvin's pictures, selected from the beginning, middle, and last sessions, to serve as an example corresponding to simular developments shown in the artwork by other students in this program.

Marvin's first task was to select two stimulus drawings and draw a picture story. He selected a man's head which he completed into a full figure, adding a newspaper on his chest. Next to the man was a simple two-legged table with a clock. There was no base line. His title was "The man got disturbed by the clock when he was reading his newspaper." Marvin drew his man without details or clothes, but on a descriptive basis (like a seven-year old's drawing). The title was needed to describe what was taking place.

In a later session, when the children had been asked to paint a picture of a water scene, Marvin's painting showed more complete integration of contents. He used the entire paper with the water as base line, painting a boat with a sail and a man standing at the rear of the boat. The man, more detailed in hands, face, and clothes, was holding a long sword. Next to the boat, on the water's surface, was a blue whale. Two large clouds and raindrops covered the upper portion of the paper. This was more like a nine-year-old's work where skyline and base line converge. Marvin's title describes the action that is taking place, "The boatman is attacking the whale."

In the tenth session, Marvin made a large drawing in response to the task of selecting an outdoor scene or object and adding two or more people doing something related to the background. His choice was a large empty school bus. He drew this first in the center and lower half of his paper, added a bus driver, then people in each window, and a road beneath the bus. He also drew a woman holding an umbrella with a child next to her in the left foreground, adding a horizon line directly above the bus across the paper. Next, he drew two large houses on the line and a stop light as well. Rain drops covered the upper sky area. No title was given.

The proportions of people, houses, and bus were quite accurate The placement of subjects was integrated into a unified whole, and there was much detail on the woman, child, and houses.

I believe this picture shows that Marvin can communicate what he has learned conceptually in a visual presentation characteristic of his age (10), showing gains of a perceptual and conceptual process through art.

These gains were reflected in his post test scores. In reading they improved from grade level 3.1 at the beginning of the art program to 3.6; in math, from 4.5 to 6.2; in IQ from 106 to 108. On the Silver Test, his total score gained from 17 on on the pre-test to 28 on the post test.

Alan - A Case Study by Jo-Ann Lizzio O'Brien, M.A., A.T.R.

Alan is a rather petite 8½ year old boy in the third grade who achieved a "below grade level" score of 1.6 in reading on the M.A.T. Alan has been grouped with three other boys from a "special" second grade. It was thought that the second grade boys could benefit from the "example" of "a well-behaved third grader." (Physically, all three second grade boys were taller than Alan and two were his age.) Alan was thought able to work independently.

Alan's early drawings indicate future recurring images--a large tree with a knot hole, a tiny tree, and bat-like birds. These images were present in the pre-test drawings, in sessions using paint, and in work with clay. It is also interesting to note the proportion of one tree to another--usually 10 to 1. Alan's drawings from observation were done in detail and were extremely small--about 1/2 inch high. These representations done in detail indicate time and concentration, however appear in miniature rather than lacking in ability. It seems to have been Alan's choice not to make a noticeable statement.

During the classes, Alan demonstrated his ability to competently handle a variety of art materials thus gaining the focus of those in the group. Building on Alan's media strengths, tasks were modified to afford him the opportunity to work in 3D. Alan used cut paper pop-up pictures to create low relief sculpture. This approach gave him a media challenge in order to remediate observation reversal of left/right. Originally Alan was not able to draw the colored cylinder and orange from two different view points--he was unable to reverse left/right. The post test score of 3.3 seems to indicate growth in Drawing from Observation based on his pre-test score of .6. Depth is still not indicated.

Alan appeared to understand depth, front/back in the 3D use of clay. Clay modeling seemed to be a less restrictive area for Alan. Alan's detailed miniature work in his drawings was also his individual way of working with the clay. He modeled a small person in accurate proportion with a barren tree. The person was carrying a "spear-like" horizontal form. He attached this person

and tree to a small base the size of a half-dollar. Alan elected to form and paint a family of pinch pots. Alan shared his products with the reading resource teacher. She selected a story that parallels this clay production. Alan read aloud how a young Indian boy learned to make traditional functional pieces for the tribe. Alan was pleased to demonstrate his learned skills in both areas thus one reinforcing the other.

Alan's interest in clay continued in his solution for an assigned project by his classroom teacher. He created a mountain scene (foreground, middleground, and background) with a stream, house, and a mountain. Trees were attached to the mountain. When this was completed, Alan completed a drawing where previously his lack of interest had been an area of concern. This use of an emphasis on 3D art materials might lead to further measurable changes for Alan and the total experimental group if more than 12 sessions were extended over a longer period of time.

In his post test scores, Alan showed a gain in IQ from 88 to to 104 as measured by the Otis Lennon Test. Reading and Math also showed improvement, from grade level 1.8 on the pre-test to 2.4 on the post test in reading, from 3.1 to 3.5 in math. His total score in the Silver Test remained unchanged at 25.

A Replication in Canada

Norma Ott, the Resource Teacher who had volunteered to give the Silver Test to children in Canada (page 12), was interested in our developmental program as well. Arrangements were made for her to work with one child using the same art procedures used in the project. She was supervised via correspondence and telephone.

The child selected had the highest score on the Silver Drawing from Imagination subtest but a low score on the Canadian Cognitive Abilities Test. Most children did well on both tests or poorly on both (correlations were significant at the .01 level). The next three children with highest scores in Drawing from Imagination had IQ scores ranging between 150 and 123 on the CCAT. The child selected, Jim, scored 91 on the CCAT; only two other children had lower scores. This suggested that Jim had cognitive skills that had escaped detection.

The CCAT was again administered to the children in Jim's school just after his fifth art period. His IQ score had increased from 91 to 99 whereas the scores of the two other low scorers decreased from 97 to 90 and from 87 to 83. The mean IQ scores of the 25 children tested also decreased, from 113 on the pretest to 108 on the posttest.

Discussion

In our three previous studies, we found significant gains in cognitive skills as a result of the experimental teaching techniques within a similar time period. In the present study, the experimental group again improved significantly, but although their gains were higher than control group gains, they were not significantly higher.

It may be because children in the present study were a more heterogeneous group than those studied previously. Some children were so severely handicapped that to expect them to show gains within a twelve week period was unrealistic. Many of the children nominated by school administrators were slow learners. It is possible that these children do not benefit from art experiences as a substitute for language since they are not language-impaired. Rather, they may have a generalized low functioning which does not improve as a result of techniques designed for language-handicapped populations.

It was also our intention to select children with high scores on the Silver Test. Because of the limited number of children with this pattern, some were selected who were not as strong as initially planned.

Our results indicate a certain amount of variability among schools included in the study. Children in the experimental groups in two schools did make significant gains when compared with control groups, as indicated in Tables 26-28. Part of this may have been due to the facts that the time available for art periods varied between 40 and 60 minutes, and that while six weeks of the instructional period were standardized and tightly controlled, the second six weeks were flexible.

In the time period involved in the study, the experimental group as a whole did not gain significantly in reading and math achievement. This is not surprising since even children of normal intelligence would show only a slight change within a short time span of twelve art periods. It is possible that the teaching period must be extended beyond twelve sessions if a differential impact is to be observed.

What is surprising is that some of the experimental group children made substantial gains in IQ or math or reading or classroom behavior, as specified in the case studies and the replication study. This raises intriguing questions that call for further investigation.

The results of the testing program indicate that there is, indeed, a relationship between the Silver Test and other tests of intelligence and achievement. Although moderate, it nevertheless indicates that the Silver Test is measuring cognitive skills. As such, it can serve as an instrument for identifying children who have cognitive skills that escape detection on traditional tests. It also seems to explain why, when we give the test to handicapped children, some do well although they do not do well on traditional measures - we are using a different medium to tap these skills.

The investigations have yielded some promising results. They suggest that it would be worthwhile to continue studying the effectiveness of the teaching techniques and the validity and reliability of the test.

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