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ABSTRACT

The recognition that children's cognitive skills are evident in visual as well as verbal conventions has led to the construction of the Silver Test of Cognitive and Creative Skills (STCCS) for the assessment and development of children's cognitive abilities. Research on cognition, the role of language in cognition, and left and right brain hemisphere thinking has led to the following conclusions: (1) even children with inadequate language may be able to construct visual models of reality and represent their experiences nonverbally by drawing images of them; (2) intellectual ability is largely independent of language; (3) language is structured by the development of logical ability; (4) people tend to favor one mode of hemispheric thinking over another; and (5) individuals successful at solving problems tend to use visual thinking as one means of solving problems. Based on findings such as these, the STCCS consists of three main tasks: drawing from imagination, drawing from observation, and predictive drawing. The test is designed to assess children with cognitive or creative strengths who may do poorly on traditional measures of intelligence or achievement. Examples of the use of the STCCS in assessment are provided. Teaching procedures derived from three structures underlying the assessment tasks are described and illustrated. In conclusion, six studies using the STCCS to assess or to develop children's cognitive skills are summarily discussed. (Author/RH)

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DEVELOPING COGNITIVE SKILLS THROUGH ART

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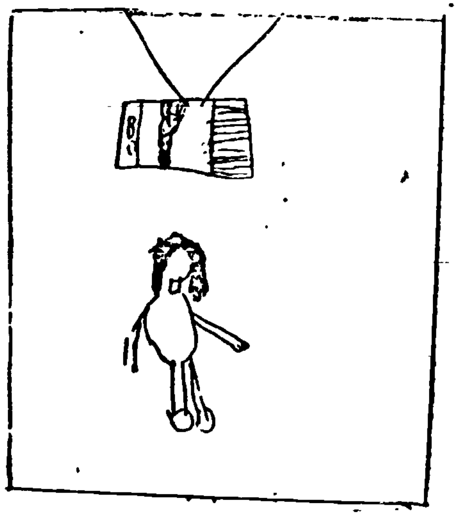

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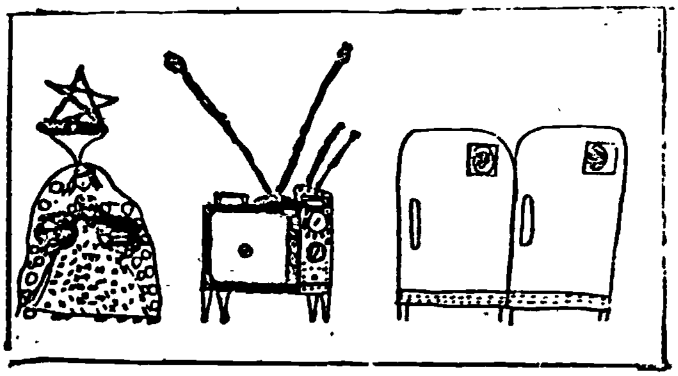

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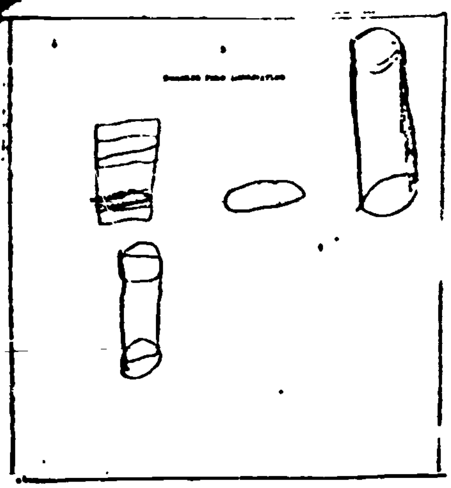

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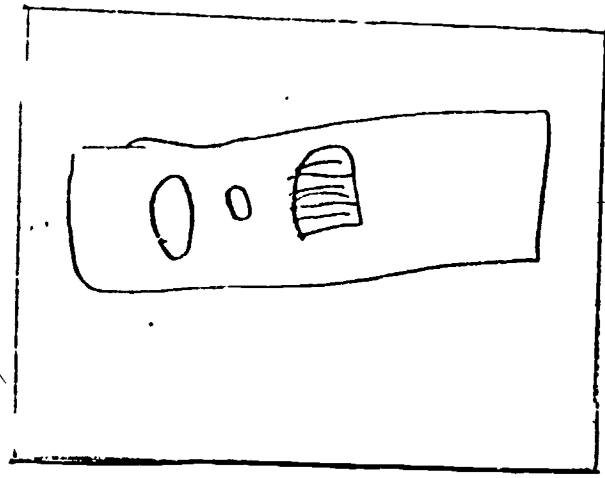

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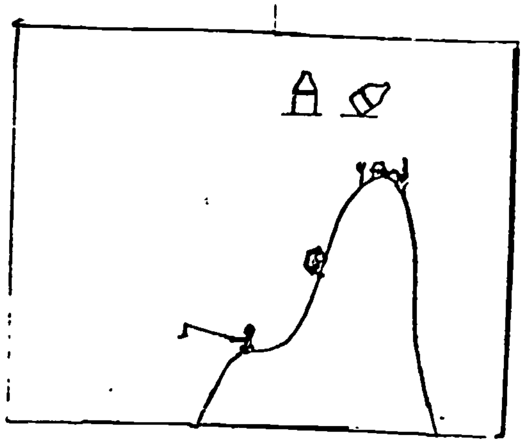

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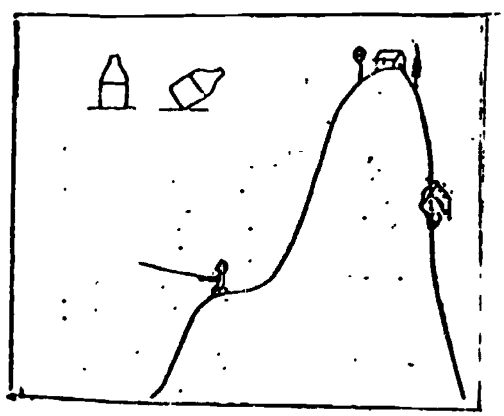

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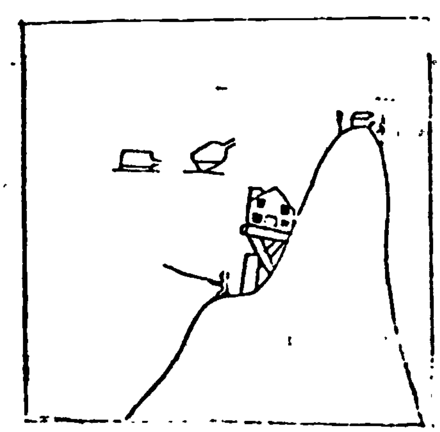

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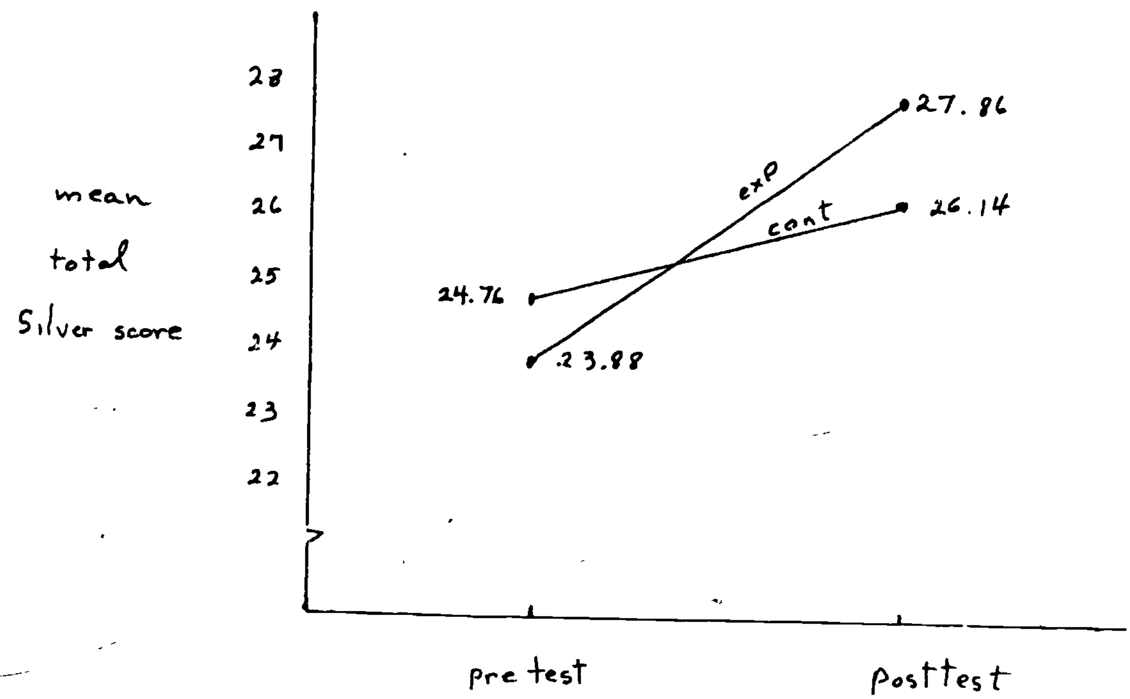

[a] Both posttest scores differed significantly from pretest scores ($p. < .05$). In addition, the experimental group's posttest scores differed significantly from the combination of the other three groups of scores.

DEVELOPING COGNITIVE SKILLS THROUGH ART[1]

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This chapter presents teaching and testing procedures based on the premise that cognitive skills can be evident in visual as well as verbal conventions, and that these skills, traditionally identified, assessed, and developed through words, can also be identified, assessed, and developed through drawings. Procedures have been developed to form the Silver Test of Cognitive and Creative Skills. In addition to a description of this test and approach to testing, this chapter provides pertinent literature, the rationale of the test, a summary of six studies which have utilized the test, and implications of the test's uses for the educational practitioner.

BACKGROUND LITERATURE

Cognition

Bruner (1966) explained cognition as a means of organizing the barrage of stimuli from the outside world. We reduce the barrage by constructing models--imaginary representations. We match a few milliseconds of new experience to a stored model, then predict what will happen next from that model. For example, we may glimpse a shape and a snatch of movement, then respond to the model we happen to match --a night watchman, a burgler. In other words, thought is carried out by representing reality vicariously and economically. As Bruner pointed out, we represent with the aid of "intellectual prosthetic devices," such as language, but there are pictorial devices as well. "It is still true that a thousand words scarcely exhaust the richness of a single image" (Bruner, 1966, pp. 16-19).

Children's drawings are pictorial devices that can represent reality vicariously and economically, and thus reflect their thinking. Children with inadequate language are deprived of many opportunities to represent their experiences. Without language, children lack a major device for constructing models of reality. This alone could account for cognitive deficiency. But if children's visuo-spatial capacities are intact, they may be able to construct visual models of reality, and represent their experiences nonverbally by drawing images of them.

The Role of Language in Cognition

Language is obviously related to thinking; whether it is essential to thinking has been debated. There is evidence that language and thought develop independently, that language follows rather than precedes logical thinking, and that even though language expands and facilitates thought, high level thinking can and does proceed without it (see for example, Arnheim, 1969; Furth, 1966; Torrance, 1962; Piaget, 1970).

A recurrent theme in the writing of Piaget is that logical thinking exists before the appearance of language, which occurs around the middle of the second year. By the beginning of their second year children are capable of repeating and generalizing their actions. If they have learned to pull a blanket to reach a toy on top of it, they are capable of pulling the blanket to reach anything else. They can also generalize by using a stick to move a distant object or by pulling a string to reach what is attached.

Furth (1966) reviewed over 50 empirical studies comparing performances of deaf and hearing populations on conceptual tasks involving both abstract and concrete material, as well as tasks involving memory and visual perception. He concluded that intellectual ability is largely independent of language.

Sinclair-de-Zwart (1969), a linguist who originally thought that the operational level of children would reflect their linguistic level, performed two experiments to determine the relationships between these levels in children ages 5 to 8. She established two groups: conservers, who realized that when liquid was poured from one glass to a glass of another shape the quantity did not change; and nonconservers, who judged the quantity according to the appearance of the containers. In her first experiment she asked the children to describe simple objects. She found that the conservers kept in mind both objects at once while the nonconservers failed to do so. In her second experiment she taught the nonconservers to describe the objects in the same terms used by the conservers, then examined them to see whether this training had affected their development. In every case there was only minimal progress after linguistic training, and she concluded that language is not the source of logic, but is on the contrary structured by logic. If this conclusion is so, the usual assumption of causal relationships may be reversed. It is usually assumed that improving a child's language will improve his thinking, but higher levels of thinking may be the cause as well as the consequence of improved language skills, and nonverbal procedures may cause levels of language to rise.

The function of language in the thinking of normal children is primarily to pin down their perceptions, organize their experiences, and understand and control their environments, according to Strauss and Kephart (1955). By labeling her perceptions with a word, the hearing child can make them usable again and again. 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 it, obtain it imaginatively without having to lift a finger, so to speak. Furthermore, by hearing about the experiences of other people, children can obtain information that otherwise they would have to obtain by themselves. Thus, they can compare themselves with others and use the experiences of others, without having to have the experiences themselves.

Can art symbols serve these same functions of language, not only for normal children but also for children with inadequate language? Like language symbols, art symbols are a way of labeling perceptions and experiences. Art symbols can represent particular subjects or classes of subjects. For example, a painting of a man 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. Cnildren with inadequate language are handicapped in representing their thought effectively, but even though their capacity for language may be impaired, their capacity for symbolizing may be intact. These children may be able to represent their thoughts nonverbally by drawing them.

Left and Right Brain Hemisphere Thinking

A consideration of the different modes of thinking of the left and right hemispheres of the brain would seem relevant to this discussion, for although verbal-analytical thinking (left brain thinking) predominates in our educational system, it may be that this dominance handicaps students (and teachers) whose preferred mode of thinking is visual-spatial (right brain thinking).

The left hemisphere of the brain seems t be specialized not only for language, but also for analytical and sequential thinking. It is associated with concepts and intellect, science and mathematics, logic and history. Talking, writing, reading, and understanding verbal messages are accomplished more effectively through the left hemisphere.

The right hemisphere of the brain seems to be specialized not only for spatial thinking and visual-motor skills, but also for processing information simultaneously or holistically. It is associated with intuition and creativity, art and metaphor, music, poetry and dance. Manipulating objects and recognizing faces and patterns are accomplished more effectively through the right hemisphere.

Although our society (and thus our education system) values more highly the verbal and analytical skills of left hemisphere thinking, we need and make use of both brain hemispheres. (Physicists, for example, often use graphical methods to simplify complicated mathematical calculations.) Both hemispheres of the brain share much of their information through nerve fibers that cross over from one hemisphere to the other. In this manner, patterns and incoming information are relayed widely throughout the brain.

Studies have shown that people tend to favor one mode of hemispheric thinking over the other. Preferred modes are established early in life and for some, visual thinking is the preferred mode (Witkin, 1962). Such individuals tend to solve problems through right hemisphere activity while others tend to solve problems through left hemisphere activity. To illustrate, imagine that it is now 3:40 p.m. What time will it be in half an hour? One person translates the problem into arithmetical quantities, another translates it into images in which he or she visualizes the face of a clock (Arnheim, 1969).

According to Lutz (1978), there is evidence that visual thinking is a crucial and central part of the creative process. In reviewing statements by highly creative scientists, she noted that Michael Faraday, the father of field theory, visualized the electric and magnetic lines of force. Einstein reported his reliance on mental imagery rather than language, and Kebule discovered the benzine ring through a vision of a series of atoms linked in a chain and biting its tail like a snake

Lutz also cited a study by Martindale (1975) of brain wave activity which provides some evidence that creativity is related to activity of the right brain hemisphere. This study found that people classified as "low creative" showed very little brain wave activity in either hemisphere when presented with creative tasks--they seemed to use their brains in the same way regardless of whether or not the task was creative. The alpha brain wave activity of "medium creative" people indicated that they primarily used the left hemisphere. "Creative" individuals were found to produce large amounts of alpha brain waves in both hemispheres when presented with a creative task. The balance of this brain activity between the two hemispheres was near equal, suggesting that creative individuals use both modes of hemispheric thinking.

Moses (1980) recently explored the effects of instruction in visual thinking on performance in mathematics. Students in fifth grade, ninth grade, and in college were tested before and after 12 weeks of instruction in seeing, imagining, and drawing two- and three-dimensional figures. All activities focused on the visual mode of thought rather than on the analytical. Four tests were used to measure spatial visualization, reasoning, problem solving, and cognition. Instruction in visual thinking was found to improve spatial and reasoning abilities: males were better at spatial

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tasks and females were better at reasoning tasks. Further instruction, however, was found to lessen this difference in abilities between males and females. Problem-solving was also found to correlate significantly with spatial skills, reasoning skills, and degree of visuality. Thus, individuals who were successful at solving problems tended to use visual thinking as one means of solving problems. In conclusion, Moses observed that creative visual thinking "is sorely missed in the typical classroom schedule."

RATIONALE BEHIND THE DEVELOPMENT OF THE SILVER TEST OF COGNITIVE AND CREATIVE SKILLS

The considerations outlined above led us to question whether it might be useful to consider a new mode of teaching and a new type of assessment instrument in which visual-spatial activities, notably art activities, could be used to develop, reinforce, and assess children's cognitive skills. The author reasoned that such a method might more readily develop and assess the cognitive skills of those children who, for one reason or another, rely more on visual-spatial modes of thinking than on verbal-analytical modes of thinking. As noted above, traditional methods of teaching have long been based upon activities favoring the latter mode of thinking. The same would seem true of traditional tests of assessing cognitive skills such as the Otis Lennon School Ability Test.

Independent Structures

The Silver Test of Cognitive and Creative Skills is based upon three independent concepts or structures, identified as fundamental in mathematics by the Bourbaki group of mathematicians (see Piaget, 1970). 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

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the idea of a group and applies to numbers and classifications. The third structure 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 (1970) has found them in primitive form in the thinking of unimpaired children as young as 6 or 7 years of age.

The same three structures appear, in slightly different form, in recent studies by investigators concerned with learning disabilities in reading. One of these investigators, Bannatyne (1971), found that children with dyslexia usually obtain higher scores on certain WISC subtests that, 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 the WISC subtests that involve the ability to manipulate spatial images conceptually. These subtests--Similarities, Comprehension, and Vocabulary --form his Conceptual category. In one study, involving 87 learning-disabled children of ages 8 to 11, he found that 70% had Spatial scores greater than their Conceptual scores. Because the WISC test is standardized, only 50% of normal children would have Spatial scores greater than their verbal Conceptual scores. Bannatyne also found that these children almost always do worse on WISC subtests involving ability to sequence (Arithmetic, Coding, and Digit Span subtests--his Sequencing category).

Bannatyne reasoned that it would be ueful to regroup the subtests into Spatial, Conceptual, and Sequential categories rather than into the traditional Verbal and Performance categories, and subsequent studies by other investigators have confirmed his findings and supported his hypothesis. Rugel (1974), for example, 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.

Smith, Coleman, and Dokecki (1977) administered the WISC-R test to 208 school-verified learning-disabled children, recategorizing the subtests in the manner suggested by Bannatyne. The mean Spatial score obtained was significantly greater than the mean Conceptual score, which, in turn, exceeded the Sequential scores.

These 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 (including those with dyslexia, minimal brain dysfunction, emotional disturbance, and cultural deprivation). In their discussion of the significance of finding that these children possess in common high visual-spatial skills, moderate conceptual skills, and low sequential skills, these investigators noted that a cognitive approach to diagnosis and remediation has received little attention compared to perceptual and psycholinguistic approaches. They suggested 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 developing cognitive skills. As Bannatyne (1971) observed, learning-disabled children have intellectual abilities of a visual-spatial nature that are not being recongized, allowed for, or trained, since the emphasis is usually on linguistic rather than visual-spatial education.

Creativity

Another concern in the deve'opment of the Silver Test was the concept of creativity. Many investigators (e.g., Torrance, 1962) have found that creative individuals share traits such as originality, fluency, flexibility, independence, sensitivity to problems, and playfulness (the ability to toy with ideas and concepts). Originality seems to receive the greatest emphasis. Whereas analytical thinking proceeds inductively or deductively toward a correct, conventional solution, creative thinking proceeds divergently, making unusual associations and perceiving relationships in apparently diverse elements.

THE TEST INSTRUMENT

The Silver Test of Cognitive and Creative Skills consists of three main subtests or tasks: drawing from imagination, drawing from observation, and predictive drawing. The test is designed to assess a child's understanding of concepts of space, sequential order, and class inclusion, without the child having to speak or write if need be. One goal is to enable teachers to identify children with cognitive or creative strengths who may do poorly on traditional tests of intelligence or achivement. Another goal is to provide a pre-posttest instrument for measuring the progress of individuals or the effectiveness of instructional programs.

1) Drawing from Imagination: The purpose of this task is to assess ability to represent concepts of class or function and to assess creative skills. The concept of a class or category of objects involves the ability to select and combine into a context, such as selecting words and combining them into sentences. According to linguist Roman Jackobson (1964), selecting and combining are the two fundamental operations underlying

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verbal behavior. The two fundamental kinds of language disorder--receptive disorders and expressive disorders--are linked with verbal selection and combination. Jakobson defines receptive disorders as a disturbance in ability to make selections and expressive disorders as a 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 would seem fundamental to emotional adjustment, for impairment of concept formation is one of the main ways in which neurological damage impinges on thinking.

To determine ability in the drawing task, students are asked to select two images (one from each page of stimulus drawings), and to combine them into narrative drawings of their own. A rating scale is used to assess the meaning or content of the drawing response (ability to select), the form of the response (ability to combine), and its creativity (ability to represent).

To illustrate, Sarah, age 7, selected images of a girl and a television set, and titled her drawing, "Watching TV" (see Figure 1). Her drawing was scored[2] at the intermediate level for ability to select (on the basis of function rather than class). It received a low score for ability to combine

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because the subjects in her drawing were combined on the basis of proximity rather than along a base line which is scored at the intermediate level and is typical of 7-year-olds. In ability to represent, her drawing received an intermediate score because she changed or elaborated on the stimulus drawings but was not particularly original, expressive, or playful.

(place Figure 1 about here)

Figure 2 was made by Daniel, age 9, who selected images of a bride, refirgerator, and television, and titled his drawing, "Wedding Presents." Daniel transformed the stimulus drawing of a bride, creating a full-length frontal view and inventing a remarkable costume. He also gave her an elaborate TV set and either two refrigerators or a refrigerator and freezer. This drawing received an intermediate score for ability to select and combine, and a high score for ability to represent, being highly inventive and imaginative.

(place Figure 2 about here)

In contrast, Betty, age 13, did not, at first, relate the subjects she selected in either size or placement. Then, as she finished her drawing (Figure 3), she added the dog on a leash, thus relating the dog to the girl. Her drawing shows low levels of ability to select, combine, and represent. Betty is learning-disabled.

(place Figure 3 about here)

2) <u>Drawing from Observation</u>: The purpose of this task is to assess concepts of space. In tracing the development of concepts of space, Piaget and Inhelder (1967) observed that initially young children regard each object in isolation from all other objects, but that eventually they

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arrive at a coordinated system embracing objects in three directions - left-right, before-behind, and above-below. To determine ability in spatial concepts, students are asked to draw an arrangement of four objects. Their responses are scored for ability to discern and represent horizontal, vertical, and depth relationships.

Figure 4 is a drawing made from observation by Ben, age 6. In the drawing, objects are represented accurately in height and width. Ben was aware that the narrowest cylinder was in front of and to the right of the widest cylinder, and that the tallest cylinder was farthest to the right. His drawing does not show, however, that the cylinder was actually further forward than the pebble. In contrast, Sarah's drawing (Figure 5), also made from observations, received low scores because none of the objects is represented accurately in terms of the relationships outlined in Figure 4.

(place Figures 4 and 5 about here)

3) <u>Predictive Drawing</u>: The ability to sequence and conserve is assessed in this third task. According to Piaget (1970), up to the age of about 7, children are typically unable to order systematically. 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 7. Piaget and Inhelder (1967) have claimed that the first natural system of reference involves horizontals and verticals, the most stable framework of every-day experience, and that it is important to find out if a child can spontaneously use such a system of reference. Piaget and Inhelder further noted that as adults we are so accustomed to think in terms of horizontals and verticals that they may seem self-evident. Children of 4 or 5, however, when asked to draw trees

and houses on the outline of a moutain, draw them inside the outline. Children of 5 or 6 draw trees perpendicular to the incline, and not until the age of 8 or 9 they do tend to draw them upright. As for horizontal concepts, the 4-year-olds scribble round shapes when asked to draw the way water would look in the outline of a bottle. In the next stage, they draw lines parallel to the base of the bottle even when the bottle is tilted. At a later stage, these children draw an oblique line in the tilted bottles. Eventually, the lines become less oblique and more horizontal until, at about the age of 9, children immediately draw a horizontal line. Thus, among the tasks in Predictive Drawing, students are asked to draw lines in a glass to show how it would look as it is gradually emptied. This task is used to determine ability to order. To determine ability to predict changes in appearance (conserve), students are asked to draw the way a house would look if moved to a steep slope, and how a half-filled bottle would look if tilted.

Figure 6 is a predictive drawing done by Erin, age 6. In the drawing, the house is drawn perpendicular to the slope and the line inside the tilted bottle is drawn parallel to the base of the bottle. Virtually the same mistakes are evident in Figure 7 which was drawn by an adult in a workshop for teachers. Figure 8 was drawn by George, age 13, a boy with both receptive and expressive language impairment. George's drawing indicates that he knew that water remains horizontal regardless of the tilt of its container, and that a house remains vertical (in this case, supported by posts) even on a steep slope.

(place Figures 6, 7, and 8 about here)

Teaching Procedures

This approach to teaching is related to four goals:

(1) To widen a person's range of communication by extending his or her communication beyond language to include the nonverbal meanings of visual art. In other words, the aim is to provide an additional channel for conveying thought and feelings.

(2) To invite exploratory, active learning rather than passive reception of information by presenting tasks in ways that let students make mistakes and correct them. For example, corrections should not be made by the teacher on a student's work. Instead, suggestions should be offered on a separate sheet of paper and the final decision on what to do with a particular task left to the student.

(3) To provide self-rewarding experiences through work that enables a student to overcome technical difficulties by by himself or herself with minimal help from the teacher when needed. Once a child is absorbed in work, he or she should be protected from interruptions, including those of teachers. The time to intervene is when a child is struggling with a brush that is too large or too small, for example, or whenever the teacher can forsee and prevent discomfort or distraction.

(4) To foster self-confidence. Because of the subjectivity involved, art experience provides special opportunities for both building self-confidence and tearing it down. A drawing is accessible to the evaluation of anyone who sees it and feels qualified to judge. Thus, teachers need to provide a classroom atmosphere which fosters self-confidence and mutual respect.

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While the tasks used for teaching purposes are based on the same three structures underlying the assessment tasks, media other than pencil and paper are used when teaching. This is particularly so of the task designed to develop concepts of sequence and conservation, and which corresponds to the Predictive Drawing task of the assessment measure.

Drawing and Painting from Imagination: To develop concepts of class inclusion, stimulus drawings are used.[3] These are 50 drawings on 3x5 cards presented in groups according to category - people, animals, places, things.

In the first lesson, the teacher presents the categories of people and things in adjacent groups. He or she then asks the children to select one drawing from each group and to draw a narrative picture:

> Make your drawing tell a story about the picture ideas you chose. Show what is happening. Don't just copy these drawings. Change them. Draw your own way. Draw other things too, to have your picture more interesting.

When the drawings are finished, they are discussed in such a way as to reinforce associative thinking. Working with groups of children, the teacher holds up their drawings one at a time and encourages each child to talk about her or his work. Key words are written as titles.

In later lessons, the other categories of stimulus drawings, and other art materials and techniques are introduced. In most of the art classes, the teacher encourages the children to draw or paint from imagination. The stimulus drawings remain available, but it is not long before most children prefer their own ideas. Of their own work, emphasis is on originality, on appreciation, the content or meaning of the work produced, and particularly on the interactions between subjects and the content.

Drawing and Painting from Observation: To develop concepts of space, emphasis is placed on the form rather than content of the work produced, particularly the left-right, above-below, and front-back relationships. In the first lesson, designed to focus attention on spatial relationships, the teacher asks the children to sketch an orange and a cylinder made by rolling and taping a sheet of green construction paper. The arrangement is presented below eye leve in the center of the room. When the children have finished sketching, the teacher asks them to change seats with classmates on other sides of the arrangement and to sketch it again. To reinforce thinking, the teacher may call attention to spatial relationships. For example, she or he may point out that the orange is on the left when seen from one point of view, and on the right from another. However, the teacher should encourage students to find other spatial relationships themselves. In later lessons, the children draw and paint other subjects from observation.

Painting Used to Develop Concepts of Sequential Order

The teacher demonstrates mixing a series of blue tints by placing a dab of white poster paint on the upper right-hand corner of a sheet of paper and a dab of blue on the upper left-hand corner. With a palette knife or stick, he or she then mixes a series of tints between the two main colours by adding more and more white to tints of blue. The teacher then asks the children to see how many tints they can mix on their own papers. Later, red and yellow are added to the palette and the teacher encourages the children to invent colors of their own.

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Modeling Clay

Modeling clay can be used to develop concepts of space, sequence, and class inclusion. The "brick" technique--forming clay into small blocks and pressing them together--is used to build human, animal, and other forms which can be associated with one another. The "slab" technique--placing lumps of clay between parallel sticks and rolling them flat--is used to build boxes or houses. The "coil" technique--rolling clay into "snakes" or balls of different size--is used to develop abilities to conserve and to sequence.

With all of the above tasks, teachers can keep logs of classroom observations. By dating, numbering, and scoring key drawings or paintings, teachers are able to both assess a child's ability and note changes in that ability.

STUDIES WHICH HAVE USED THE SILVER TEST

The Silver Test has been used in a number of studies, designed both to assess children's cognitive skills and to develop children's cognitive skills. Six of these studies are briefly presented here, two of which were conducted by researchers other than the author and her colleagues.

1. Handicapped and Normal Children (1972-73)*

In this study in which the teaching and testing procedures of the Silver Test were initially developed (for a fuller report see Silver, 1973, 1978), one teacher worked with an experimental group of thirty-four 7- to 15-year-old language and hearing impaired children, during the school year 1972-73. The children were a randomly selected 50% sample from 12 classes in a school for the language and hearing impaired. The remaining

*The results of this study are presented in Tables 1 to 3.

34 children from these classes served as a control group. Experimental subjects attended art classes once a week for 11 weeks in the fall, and nine weeks in the spring. To compare handicapped with normal (non-handicapped) children, the test was later administered to 68 normal children in a suburban public school. The test was given to this group once only.

Drawing from Imagination (see Table 1): In this task, the experimental group showed significant improvement ($p < .01$) in the combined abilities of selecting, combining, and representing. They also performed significantly better ($p < .01$) than the control group on the posttest for each of the three tasks.

A comparison of the mean scores of 63 of the normal children with the pretest mean scores of the 34 experimental and 34 control handicapped children revealed no significant differences between the groups. However, posttest scores of the 34 handicapped experimental group children were significantly superior ($p < .05$) to the scores of the normal children.

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Insert Table 1 about here

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Drawing from Observation (see Table 2): The experimental group of handicapped children improved significantly ($p < .01$) on this task. The control group did not improve. No significant difference was found between handicapped and normal children. The handicapped experimental group did have higher mean scores on the posttest, however.

Predictive Drawing (see Table 3): A comparison of the mean scores of the handicapped experimental children before and after the art program showed sgnificant improvement ($p < .01$) on this task in both horizontal and vertical concepts. The handicapped control children did not improve significantly.

Prior to receiving the art program, the mean scores of the handicapped experimental group were found to be significantly lower than the mean scores of the normal children. After the art program, however, while no sigificant difference was found between the group in horizontal concepts, in vertical concepts the handicapped children improved to a degree that was significantly superior ($p < .05$) to that of the normal children.

During the course of this study, the question of whether art for therapeutic purposes might undermine art education and interfere with aesthetic development arose. A preliminary attempt was made within this study to provide some answers.

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Insert Table 2 about here

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To determine whether emphasis on cognitive skills interferes with the development of art skills, two judges were asked to evaluate drawings and paintings produced by the children in the fall program experimental group. The judges were a college instructor of art and an art-therapist registered by the American Art Therapy Association.

For each of the 18 children in the experimental group, the judges evaluated three drawings or paintings: the child's first work, last work, and a work produced midway in the art program. The 54 works were identified only by number and were shown in random order to conceal the sequence in which they had been produced.

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Insert Table 3 about here

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Working independently, the judges rated each drawing or painting on a 5 point scale ranging from "commonplace form or content" to "highly skillful, exploratory, or sensitive." They also scored for creative and expressive qualities ranging from "imitative, learned, impersonal" to "highly personal and imaginative."

Both judges found improvements that were significant ($p < .01$). As rated by the art therapist, the mean score for work produced in the first class was 4.44, and the mean score for work produced in the last class was 7.27 (t = 3.13). As rated by the college instructor of art, the mean score for work produced in the first class was 3.66 and the mean score for the work produced in the last class, 6.33 (t = 3.29). Thus the children's art skills improved even though the main purpose of the project was to develop their cognitive skills.

2. Learning Disabled Children (1975)

This second study (see Silver & Lavin, 1977; Silver, 1980) explored whether the teaching and testing procedures of the Silver Test would be useful for children who had an opposite constellation of skills--that is, auditory and language strengths rather than visual-motor strengths--and whether the procedures could be used effectively by others previously unfamiliar with the test (in particular, teachers). Eleven graduate students who had registered for an elective course in using the procedures, worked under faculty supervision with 11 children with visual-motor weaknesses. The children were not systematically selected but were enrolled as their applications were received. There was no control group.

After 10 weekly 1-hour art classes, the children improved significantly in the three areas of cognition: drawing from imagination ($p < .01$), drawing from observation ($p < .05$), and sequencing ($p < .01$). These results suggest that the Silver Test is a useful remedial aid for such children and that it can be successfully used practition‹‹s initially unfamiliar with the test.

3. Normal Children (1978)

In this third study (see Silver & Lavin, 1978; Silver, 1980) the question of whether the Silver Test could be used successfully with normal children who had special educational needs was investigated. Another group of 11 graduate students worked with 11 children selected by school administrators as achieving below grade level academically for a variety of reasons. Again, there was no control group. These children made significant gains in the three areas of cognition: drawing from imagination ($p < .01$), predictive drawing ($p < .05$), and drawing from observation ($p < .05$). Thus, these results again would seem to verify the usefulness of the Silver Test as a remedial aid.

4. Normal and Learning-Disabled Children in a Variety of Schools (1979-80)

This study, which was supporteu by a grant from the National Institute of Education had two aims: (1) to explore the degree to which the Silver Test measures cognitive skills by examining the relationship between this test and six traditional tests of intelligence or achievement; and (2) to attempt verification of the results of previous studies which used the Silver Test by using a more controlled research design, a more diverse population, and a wider variety of settings. (A fuller report of this study

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is given in Silver, Lavin, Boeve, Hayes, Itzler, O'Brien, Terner, & Wohlberg, 1980.)

Otis Lennon School Ability Test: The Silver Test and the Otis Lennon School Ability Test were administered by researchers in the study to 99 normal second and third grade children, drawn from two of the schools included in the project. The tests were also administered (in a third school) by a teacher who volunteered to take part in the study. Significant relationships were found between two of the Silver 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 Test.

WISC Performance IQ Scores: The sample in this study was drawn from two schools for deaf children and a school for children with language and learning disabilities. In two of the schools, the test was administered by volunteer teachers. Significant correlations were found between the WISC Performance IQ scores of 65 children and their total and subtest scores on the Silver Test.

Metropolitan Achievement Test (MAT): A significant relationship was found between MAT Reading scores and total Silver Test scores of 79 normal children drawn from the two schools involved in the study. Significant relationships were also found between MAT Reading scores and two subtests of the Silver Test--Drawing from Imagination and Predictive Drawing. There was no significant relationship between MAT Math scores and total Silver Test scores.

SRA Math Achievement Scores: Significant relationships were found between SRA Math scores of 65 normal children and their scores on the Drawing from Imagination and Predictive Drawing subtests of the Silver

Test. There was no significant relationship between the total Silver Test scores and the SRA Math scores, or between the Drawing from Observation subtests and the SRA Math scores.

Iowa Test of Basic Skills: While significant correlations were found between the scores of 20 normal children on the Iowa Composite and Math Tests and the total Silver Test, Drawing from Imagination, and Drawing from Observation subtests, no significant correlations were found for Predictive Drawing.

Canadian Cognitive Abilities Test (CCAT): The Silver Test was administered to a class of normal second grade Canadian children and these scores were compared to their scores on the CCAT. Significant correlations were found between the CCAT and Drawing from Imagination. No significant correlations were found between scores on the CCAT and scores on the Drawing from Observation and Predictive Drawing subtests.

As noted above, the second part of this study examined the effectiveness of the Silver Test with a more diverse population. This part of the study involved a sample of 84 children, ages 7 to 11, who had been nominated by school administrators on the basis of being at least one year below grade level in reading or mathematics. The children were drawn from five schools: one school for learning-disabled children, and four schools for both normal children and children with special educational needs. From this population, the participants were selected on the basis of their scores on the Silver Test. A matched control group received no special treatment. During the course of the program, a number of children were lost for various reasons. Consequently, additional children were randomly removed to equate the number in each group for statistical analysis.

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Five art specialists, one from each school, worked with two groups, each comprising five children, for approximately 40 minutes a week for 12 weeks. During the first 6-week period, all teachers used the same procedures. During the second 6-week period, these teachers adapted the procedures to meet the needs of individual children, and devised procedures of their own. The Silver Test was administered before and after the art program.

As in the earlier studies, the posttest scores of the experimental group showed significant gains over the pretest scores; however, there was no significant difference between posttest scores of experimental and control groups (see Figure 9).

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Insert Figure 9 about here

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After the program ended, the scoring guidelines of the Silver Test were modified and tightened, and all test booklets were rescored blindly. The scores were then re-analyzed, but essentially the same results as those obtained previously were found. However, a school by school analysis of net change scores (the pretest minus the posttest scores) showed significant differences between pre- and posttest scores in the school for learning-disabled children. In this school, the experimental group gains were significantly higher than the control group gains. In the four other schools, the experimental groups gained signficantly but their gains were not significantly higher than control group gains. In each school, however, there were individual children who made dramatic gains in all test scores.

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5. Hayes Study: Normal Children, Grades 1-3 (1978)

Hayes (1978) examined whether a correlation exists between children's drawings and reading achievement. Hayes administered the Silver Test to 75 first, second, and third grade normal children from lower to middle income backgrounds and compared these scores to the children's scores on the Informal Reading Inventory for first graders, and the SRA Reading Form F/Primary II for second and third graders.

Significant correlations were found between the Drawing from Imagination subtest of the Silver Test and reading achievement for the three grades. Correlations between Drawing from Observation and reading achievement were significant for the third grade only, while Predictive Drawing correlated significantly with reading for the first grade only.

6. Moser Study: Learning Disabled Young Adults (1980)

Moser (1980) examined the reliability and validity of the Silver Test. In order to assess reliability, Moser administered the test twice to 12 learning-disabled subjects and computed separate reliability coefficients for each of the subtests. To assess validity, she administered the test to 35 normal subjects and 38 learning-disabled subjects and compared the mean scores. Moser also compared the scores of her 38 subjects on the Wechsler Adult Intelligence Scale (WAIS), the Bender Test, the Draw-A-Man-Test, and the Silver Test.

Moser's results give credence to the reliability and validity of the Silver Test. All of the test-retest correlations were significant ($p < .05$). The learning-disabled group scored lower than the normal control group on the Silver Test ($p < .001$), and on the Draw-A-Man Test ($p < .05$). Significant correlations were found between total and subtest Silver scores

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and scores on the Draw-A-Man, Bender and WAIS tests at the $p < .01$ and $p < .001$ levels.

CONCLUDING OBSERVATIONS

Positive correlations were found in the above studies between scores on the Silver Test and 10 traditional tests of intelligence or achievement. The correlations were of moderate strength significance with the language-oriented tests, and of high significance with the spatially-oriented tests. These findings seem to indicate that the Silver Test is measuring, through the medium of drawing, aspects of cognition that are also measured to some extent by the traditional tests. As such, the Silver Test would seem useful as an instrument for evaluating learning and creativity and for identifying children who have cognitive strengths that may escape detection on language oriented tests. The Silver Test also seems to offer some explanation as to why some children do well on the Silver Test but not on traditional tests of intelligence--the latter use a different medium from that of the Silver Test to tap cognitive skills. Classroom teachers need to be aware that some of their pupils may have capabilities and potentialities easily overlooked by conventional tests. Also, teachers need to be aware that all pupils can benefit from nonverbal activities that call for right brain hemisphere functioning. Thus, children can visualize, imagine, invent, observe, predict, and solve problems through the media of drawing, painting, and modeling. Tasks that are open-ended with many possible correct solutions invite children to discover solutions for themselves, thus facilitating their learning. The tasks can be a particularly helpful means of working with children who rely on right brain hemisphere functioning as a matter of preference or necessity (such as deaf, learning-disabled, or language-impaired children), or any child who has difficulty putting thoughts into words or in understanding what is said.

The findings of studies to date with the Silver Test also suggest that teachers may be able to stimulate cognitive growth without neglecting the usual goals of teaching art, such as developing sensitivity to aesthetic values and the skills required in drawing, painting, and modeling. For example, college instructors who judged children's drawings and paintings in the 1972-73 study with handicapped and normal children, found improvements in skill and creativity to a degree that was statistically significant, even though the main purpose of the project was to develop the children's cognitive skills. This suggests that different educational goals can be pursued concurrently, and that we do not have to sacrifice one developmental need for another. Art therapists can include aesthetic goals without sacrificing spontaneity, and art educators can stimulate cognitive growth without abandoning the traditional goals of art education. Much still remains to be done in the area of developing children's cognitive skills through art. It is hoped that the discussion and the findings of studies using the Silver Test presented here will encouage others to do further research.[4]

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Footnotes

1. Copyright registration for portions of this chapter has previously been obtained by Rawley A. Silver, 1978, 1980, Rye, NY. The author wishes to express her appreciation to John Kleinhans, Ph.D. and Claire Lavin, Ph.D., for their analyses of the statistical data; to Patricia Schachner, Lisa Irving Halprin, Janie Bell, and Norma Ott for volunteering to administer the test to their students; and to Eldora Boeve, Karen Hayes, Judith Itzler, JoAnn O'Brien, Niru Terner, and Phyllis Wohlberg for teaching in the five schools in the NIE Project.
2. Further information about scoring the test may be obtained from Rawley A. Silver, Ed.D., Graduate School, College of New Rochelle, New Rochelle, NY 10580.
3. The stimulus drawings are available from Trillium Books, 1600 Harrison Avenue, Mamaroneck, NY 10543.
4. For those readers who would like to know more about the Silver Test or teaching proedures or who would like to discuss the Silver Test, contact Rawley A. Silver, Ed.D., Graduate School, College of New Rochelle, New Rochelle, NY 10580.

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Table 1: Comparing Mean Performance Scores in Drawing from Imagination by Handicapped Experimental and Control Children, and by Normal Children[a]

Experimental (N = 34)				Control[b] (N = 34)			
Age	Name	Pre	Post	Age	Name	Pre	Post
8	Vi	15	13	7	Ba	9	4
	Je	9	8		Ch		5
	We	3	9	8	Ke	5	4
	Ca	3	15		An	9	10
	Fe	3	10		Jo	13	14
	Ro	3	14		Mi	9	9
	Ev	3	11		Ki	5	5
	Do	5	7	9	Mi		6
	Li	5	4		Di		6
9	Da	11	11		Ro	3	4
	Ra	8	9		Sa	7	14
10	Al	3	12		Ca	3	8
	Ca	5	11		El	7	6
	Ke	15	9	10	Ja		15
11	Ja	9	3		Jo	11	9
	Ru	7	15		Be	3	6
	Je	3	13	11	Pa		9
12	Ep	10	15		He		3
	Ba	3	11		Mi		5
	Ru	5	7		An	12	13
	El	15	13		De		11
	~~Ro~~	15	11		Al		7
	Ja	11	14	12	Ma		9
	Ma	13	14		Fe		5
13	Do	9	13		Ga	13	8
	Sh	3	15		Ev	13	14
	Bi	3	15		Ro	9	8
	Ei	14	15	13	Gl		11
	An	7	7		El		15
14	Ca	13	13		Ma		6
	To	13	15		Jo		15
	Ja	11	12	14	An		3
15	Da	6	13		An		15
	Fd	11	11	15	De		5
	Mean	8.0	11.47			8.18[c]	8.44

Normal children (N = 63)[d]			Normal children (N = 63)[d]		
Age	Name	Score	Age	Name	Score
8	Ni	11		Da	11
	Pa	10		Ji	13
	An	4		To	6
	St	12		Ma	9
	Da	9		Jo	11
	Ca	7		Al	10
	Mi	13	12	La	11
	El	14	13	Ch	7
	Ja	8		Ka	12
	Ja	6		Ro	13
	Da	12		Le	13
	Ch	5		Je	11
	Bo	8		Mi	8
9	Jo	7			
	Li	9		Mi	
	Ho	8		El	7
	Ka	9		Te	8
	Di	10		Er	14
	To	4		Ly	8
	Lo	9		Jo	8
	Al	9		Jo	9
10	Da			We	12
	De	8		An	8
	Ja	8		An	7
	Hu	13		St	
	An	9		Cl	8
	Ma	11		Ju	12
	An	7		Ch	15
11	Th	7	14	Ju	12
	Li	12		An	8
	An	9		Ol	8
	Ma	11		Lo	10
				Mean	9.47

[a] Scored on basis of 1 to 5 points for level of development; 5 = highest level.
[b] Control children who participated in the Fall program did not have pretests, since teaching and evaluating procedures were developed during the term. Their only test for the ability to select, combine, and represent was the Fall program posttest.
[c] For the Spring program only.
[d] Five children were absent when the test was given.

Table 2: Comparing Mean Performance Scores in Drawing from Observation by Handicapped Experimental and Control Children, and by Normal Children

Experimental group (N = 16)				Control group (N = 16)			
Age	Name	Pre	Post	Age	Name	Pre	Post
8	Je	7	11	7	Ba	0	4
	We	6	12	8	Ke	9	4
	Ca	8	11		An	6	4
	Fe	8	7		Jo	6	6
	Ro	10	15		Mi	13	14
	Ev	12	12		Ki	7	8
	Do	10	14	9	Ro	3	7
	Li	10	7		Sa	6	10
10	Al	3	10		Ca	13	10
	Ca	10	12	10	Jo	11	13
	Ke	9	12		Be	13	9
11	Ja	12	10	12	Ga	14	13
12	Ja	12	14		Ev	13	8
	Ma	15	15		Ro	5	9
13	An	6	12	13	El	4	4
14	Ja	12	9		An	14	13
	Mean:	9.37	11.43			8.56	8.50

Unimpaired children (N = 63)[b]			Unimpaired children (N = 63)[b]		
Age	Name	Score[a]	Age	Name	Score[a]
8	Ni	13		Da	5
	Pa	8		Ji	8
	An	7		To	10
	St	11		Ma	9
	Da	7		Jo	7
	Ca	6		Al	7
	Mi	10	12	La	16
	El	12	13	Ch	11
	Ja	6		Ka	13
	Ja	16		Ro	15
	Da	10		Le	9
	Ch	4	13	Je	13
	Bo	5		Mi	8
9	Jo	12		Mi	8
	Li	12		El	15
	Ho	5		Te	10
	Ka	14		Er	12
	Di	10		Ly	10
	To	4		Jo	13
	Lo	8		Jo	10
	Al	4		We	14
10	Da	4		An	4
	De	16		An	8
	Ja	13		St	5
	Hu	4		Ci	13
	An	13		Ju	10
	Ma	15		Ch	5
	An	10	14	Ju	8
11	Th	11		An	5
	Li	8		Ol	7
	Ar	12		Lo	16
	Ma	13		Mean:	9.63

[a] Scored on the basis of 1 to 4 points for number of correct representations of left-right, above-below, front-back and proportional relationships in drawing from observation.

[b] Five children were absent when the test was given.

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Table 3: Comparing Mean Perforn ion Scores in Predictive Drawing by Handicapped Experimental and Control Children, and by Normal Children[a]

Experimental group

Fall program ($N = 18$)

Name	Sex	Age	Diagnosis	IQ	Horizontal Pre	Horizontal Post	Vertical Pre	Vertical Post
Do	F	13	ER	Av	3	5	2	3
Sh	F	13	ER	Av	3	5	3	5
Ca	F	14	R	95	4	5	3	4
To	M	14	ER	97	3	4	5	5
Bu	M	13	ER	56	2	5	4	5
Da	M	15	E	100	4	5	4	5
Ed	M	15	E	65	3	4	2	5
Ep	M	12	E	85	3	4	4	5
Ev	F	13	ER	90	2	2	2	5
Sa	F	12	R	86	4	3	3	4
Je	F	11	ER	72	3	5	3	5
El	F	12	ER	140	5	5	5	5
Ro	M	12	E	`N	2	3	5	2
Ri	M	12	ER	77	5	5	5	5
Ru	M	11	R	87	5	3	2	5
Vi	M	8	R	ab Av	3	5	3	4
De	M	9	E	DN	2	5	2	5
Ru	F	9	ER	75	1	1	2	3

Spring program ($N = 16$)

Name	Sex	Age	Diagnosis	IQ	Horizontal Pre	Horizontal Post	Vertical Pre	Vertical Post
Je	M	8	ER	68	2	2	1	[illegible]
We	M	8	E	94	1	2	2	5
Ca	M	8	ER	94	2	4	3	5
Fe	M	8	E	104	2	2	2	4
Al	M	10	E	Av	3	5	1	3
Ro	F	8	R	66	2	4	3	3
Ca	M	10	R	87	5	5	5	5
Ev	M	8	R	96	5	5	2	5
An	M	13	R	72	2	2	2	3
Ja	F	12	E	83	2	2	2	3
Je	F	14	E	100	2	2	3	3
Ma	M	12	ER	50	5	5	5	5
Ja	M	11	ER		3	4	2	2
Ke	M	10	ER	DN	1	2	2	3
Do	F	8	ER	97	2	3	3	3
Li	F	8	ER	86	2	5	2	3
			Combined mean:		2.88	3.76	2.91	4.11
			Combined (sd)[a]:		1.55	1.76	1.47	1.08

Control group

Fall program ($N = 18$)

Name	Sex	Age	Diagnosis	IQ	Horizontal score	Vertical score
Gl	F	13	ER	99	2	1
El	F	13	ER	Av	2	2
De	F	15	ER	65	5	4
An	M	14	ER	79	3	2
Pa	M	11	ER	94	5	5
Ma	M	13	E	74	2	2
Jo	M	13	E	70	5	5
Mi	M	11	E	75	5	4
He	F	11	ER		2	4
Mn	F	12	E		1	2
An	F	11	ER	Av	2	2
De	F	11	ER	73	2	2
Al	M	11	E	Def	2	3
Fe	M	12	E	87	5	5
Mi	M	9	E	92	2	4
Di	M	9	ER	77	2	4
Ja	M	10	E	83	5	2
Cn	F	7	E	57	2	4

Spring program ($N = 16$)

Name	Sex	Age	Diagnosis	IQ	Horizontal Pre	Horizontal Post	Vertical Pre	Vertical Post
Ro	M	9	ER	65	2	2	1	3
Ke	M	8	ER	Av	2	2	2	4
An	M	8	ER	106	5	5	2	3
Jo	M	8	ER	94	3	4	2	5
Su	M	9	ER	77	2	2	3	3
Ba	F	7	R		1	2	3	3
Ca	M	9	R	99	5	3	2	5
Ki	M	8	R	Av	2	4	2	5
Ga	M	12	ER	110	5	5	5	5
Ev	F	12	E	65	2	2	3	5
An	F	14	ER	89	2	2	5	2
M·	M	8	E		5	3	2	2
Ro	M	12	ER	72	2	2	2	3
Jo	M	10	ER	60	2	2	2	3
Il	F	9	R	73	2	2	1	1
He	F	10	ER		2	2	2	5
			Combined mean:		2.88	2.75	2.82	3.44
			Combined (sd)[a]:		2.05	1.27	1.60	1.75

[a] Scored on the basis of 1 to 5 points for level of development.

Normal children ($N = 68$)

tested on e

Age	Name	Horizontal	Vertical	Age	Name	Horizontal	Vertical
8	Ni	4	0		Ma	1	2
	Pa	5	0		Jo	5	5
	An	4	5		Al	1	4
	St	5	4		El	5	4
	Da	4	1		Su	3	2
	Ca	1	0		Jo	3	1
	Mi	1	2		Di	5	1
	El	4	0		Je	4	2
	Ja	4	1		Jo	1	1
	Ja	4	0		Da	3	1
	Da	1	0		Am	4	1
	Ch	5	4	12	La	5	5
	Bo	4	1		Pa	4	4
9	Jo	3	1		Ti	3	2
	L`	4	4		Da	3	4
	Ho	5	5		To	4	1
	Ka	5	0		Ma	2	4
	Di	4	3		Ga	4	5
	To	5	0	13	Ch	5	5
	Lo	5	0		Jo	5	5
	Al	4	0		Mi	3	5
10	Da	1	1		F	5	5
	De	4	4		Bo	5	4
	Ja	4	1		Th	4	4
	Hu	1	5		Ma	5	1
	An	4	3		Ro	4	5
	Ma	5	3		Ka	5	2
	An	5	2		Le	.	3
11	Th	1	3		Je	5	5
	Li	4	4	14	Ju	1	1
	An	3	3		An	5	5
	Ma	5	1		Ol	5	5
	Da	1	1		Lu	5	5
	Ja	5	0				
	To	1	3		Mean scores	3.68	2.56