6-1973

# The Effectiveness of Montessori Sensorial Materials With Preschool Children

Dorothy Raney Chitwood
*University of Tennessee - Knoxville*

To the Graduate Council:

I am submitting herewith a thesis written by Dorothy Raney Chitwood entitled "The Effectiveness of Montessori Sensorial Materials With Preschool Children." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Child and Family Studies.

Ruth Highberger, Major Professor

We have read this thesis and recommend its acceptance:

Priscilla White, Arthur E. Gravatt

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

May 8, 1973

To the Graduate Council:

I am submitting herewith a thesis written by Dorothy Raney Chitwood entitled "The Effectiveness of Montessori Sensorial Materials with Preschool Children." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Child Development and Family Relationships.

Ruth Richberger
Major Professor

We have read this thesis
and recommend its acceptance:

Priscilla White

Gretchen E. Grant

Accepted for the Council:

Dutton A. Smith
Vice Chancellor for
Graduate Studies and Research

# THE EFFECTIVENESS OF MONTESSORI SENSORIAL MATERIALS WITH PRESCHOOL CHILDREN

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A Thesis

Presented to

the Graduate Council of

The University of Tennessee

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In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Dorothy Raney Chitwood

June 1973

ACKNOWLEDGMENT

The writer wishes to express deep appreciation to Dr. Ruth Highberger, Professor of Child Development and Family Relationships, for her unending guidance and assistance throughout the preparation of this thesis. Gratitude is also extended to Dr. Arthur Gravatt, Head of the Department of Child Development and Family Relationships, and to Dr. Priscilla White, Assistant Professor of Child Development and Family Relationships, for their worthy appraisals and assistance.

Special thanks are also extended to Mrs. Dorothy Campbell, Director of the University of Tennessee Day Care Center, and to the children with which the writer enjoyed working during her graduate assistantship. Both made this study possible.

Sincere appreciation is expressed to the writer's husband, Charlie, for his patience and encouragement and to her parents who gave her constant support.

## ABSTRACT

The purpose of this study was to compare the perception and sensorimotor development of preschool children who used specific Montessori sensorial materials. Based on the literature, it was assumed that: 1. Because of the development and accentuation of form and tactile stimulation in the preschool child, extensive use of Montessori equipment designed in form for tactile and visual exploration and learning would influence development of visual perception. 2. With the perceptual-motor training of the Montessori sensorial materials, the subjects would make gains in fine motor coordination.

It was hypothesized that the gains in scores on the Marianne Frostig Developmental Test of Visual Perception and the Animal House and Block Design subtests on the Wechsler Preschool and Primary Scale of Intelligence would be positively related to length of time spent with Montessori sensorial materials offered to children at a special time over a period of ten weeks in a day care program.

The subjects for this study were 15 preschool children, 8 girls and 7 boys ranging in age from 50 months to 71 months with a mean age of 60 months. The subjects were attending the University of Tennessee Day Care Center. The day care children were selected because of their exposure to the Montessori materials and because they were considered to be homogeneous in middle socio-economic backgrounds. The subjects had opportunity to select the Montessori materials for a 45 minute period five days a week for a 10 week period. The children had a

choice of working with the materials or participating in a free play period in a regular playroom. Records were kept of the time spent with the materials. The materials were organized, demonstrated, and used according to the Montessori method of education. The writer and a student teacher demonstrated the materials to the children and worked with the children during the experimental period.

The instruments used for evaluating progress in form perception and fine motor coordination were the Marianne Frostig Developmental Test of Visual Perception and the Animal House and Block Design subtests of the Wechsler Preschool and Primary Scale of Intelligence.

The Spearman rank correlation coefficient was used to correlate differences in pretest and posttest scores with time spent working with the Montessori materials. Frostig scores and WPPSI Animal House and Block Design scores were all separately correlated with time spent with Montessori materials. Raw score correlations ranged from -.06 to .39. Scale score correlations ranged from -.13 to .16. The scores did not correlate significantly with time. The hypothesis was rejected.

It was concluded that more appropriate tests for measuring visual perception and fine motor coordination and a longer period of time for the experimental period could have improved the study. Also, because of apparent overall gains on test scores, unrelated to time spent with the materials, many other possible environmental stimuli could have affected visual perception and fine motor coordination improvement.

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# CHAPTER I

## INTRODUCTION AND RELATED RESEARCH

There is a need for continued study of education, especially early education, because an important part of the future can depend on education. Young children possess profound, unconscious energy for knowledge. They are sensitive and absorbent to their environment. Therefore, education that aides the natural development of the young child, without forcing knowledge, and which produces a natural desire to learn can be of great benefit.

The young child of three to six must have the right conditions and the right help to produce a natural desire for learning. Maria Montessori prepared this natural environment, and in it she placed materials which interested and stimulated the senses of the child three to six. These materials as well as other things in the environment gave the child sense impressions. Montessori devised a method for educating the senses. The mind needed to be educated as to how to discriminate and appreciate. This type of education was only possible by activity, and thus the Montessori sensorial materials. The child could see with his hands. By first using materials that gave strongly contrasting sensations and then grading various series, the child learned to contrast, differentiate, and distinguish different sense impressions, and then to categorize them. The child thus began to become conscious of his environment (St. Nicholas, 1970).

Although perception and sensorimotor coordination have been studied extensively, the application of these concepts to a specific,

structured setting has been adapted and applied uniquely in the Montessori method of education. Unfortunately, little effort has been made to analyze and test Montessori type experiences in the preschool setting (Edmondson, 1966; Gardner, 1967; Pitcher, 1968). This study tried to evaluate the efficacy of the sensorial materials employed in this method.

A plethora of literature on compensatory methods for educating the young can be found ranging from traditional to highly structured and accelerated programs (Pitcher, 1968). Some theories of past educators and philosophers could be incorporated into Maria Montessori's theories and method of early childhood education (Travers, 1968). The adaptation of freedom within a prepared environment (Montessori, 1917) and the implementation of specific learning materials (Montessori, 1914) have been distinctly characteristic of the Montessori method.

Sensorial materials, especially those pertaining to the tactile and visual senses, were developed and adapted by Montessori into specifically formed equipment (Montessori, 1914). These materials have been Americanized, but used in a wide variety of environments and methods. Researchers found that Montessori children in comparison to traditional nursery school children were less creative, more task oriented, more inclined to describe objects in terms of physical characteristics, and geometrically oriented in drawing (Dreyer & Rigler, 1969). McCormick and Schnobrich (1969) found that ego and superego increased while impulsivity decreased with age in Montessori preschools. McCormick and Schnobrich (1971) found that perceptual-motor training in Montessori preschools could increase attention skills and control impulsivity.

Criticism has abounded concerning the lack of creativity, imagination, and freedom of behavior and materials (Beyer, 1966; Edmondson, 1966; Gardner, 1967; Pitcher, 1968; Plank, 1962; Schill, 1966). Yet, there are those that believe that this method can be beneficial to child development and adaptable to the eclectic society (Banta, 1972; Gardner, 1967; Morra, 1967; Pitcher, 1968; Plank, 1962).

Repetitive learning has proven to be of paramount importance in the early years, due to children's extreme sensitivity to their environment and their great desire to learn (Banta, 1972). Montessori (1912) stated that learning was work, yet it was play to the child.

## Cognitive and Social Learning

Through exercises in problem solving it is believed that the child learns to discover on his own and then generalize from his discovery. Materials that are organized to stimulate a person's interest and cognitive structure could help the child develop toward memory images (Bruner, 1961). A specific programmed or structured environment could influence cognition and socialization through assimilation of understandable facts and experiences, and accomodation of new materials (Baldwin, 1965). This environment could, however, be affected highly by the teacher (Glasser, Reynolds, and Fullick, 1966; Morra, 1967) and her method of implementing and organizing the learning materials (Banta, 1962; Montessori, 1967; Plank, 1962).

Through social and cognitive learning, should children be prepared for future economic and social development (Morra, 1967), or in Piaget's theory does this develop with the child? Kohlberg (1968)

found that Head Start children attending a Montessori middle class preschool increased 17 IQ points over a period of four months. The children were measured by the Stanford Binet, and there was a correlation of .65 between IQ increase and attention increase. These cognitive gains could influence social development. Structured preschool instruction not only allowed for development of cognitive associations, but also assimilation and accomodation of cognitive socialization, thus producing a well-adjusted interrelationship between cognition and human behavior (Baldwin, 1965). Through cognitive development, intellectual skills such as attention, noninterruption, concentration, and privacy could be learned and then also applied to social skills in aiding social development (Maccoby, 1968). Schooling effectiveness allowed for application of combinatorial reasoning and perceptive abstraction of learned visual and tactual manipulations (Goodnow and Bethon, 1966). Not all structured methods of preschool training were completely effective or significant (Glaser et al., 1966; Sontag, Sella, and Thorndike, 1969). Kohlberg (1968) felt the outstanding feature of the Montessori education in cognitive development was the training through direct sensory experiences.

Tactual and Visual Training

The stress of sensorial materials, after an adaptation of practical life exercises concerned with adapting the child to a prepared environment, has been the basis for further exploration of mathematics, reading, and grammar in the Montessori environment

(Montessori, 1912; St. Nicholas, 1970). The tactual and visual senses were stressed excessively through materials formed in specific and varied ways, and this was especially significant since color and form development was revealed to occur during the child's preschool age (Corah, 1966; Kagan and Lemkin, 1961; Suchman and Trabasso, 1966).

Pick (1965) found tactual modality discrimination of form superior to visual, while Blank and Altman (1968) found tactual reversal learning easier and more rapid. The ability to transfer concepts from vision to touch, without verbalization, allowed researchers to speculate that children retain some nonverbal sensory images, which Pick (1965) called memory models, in cross-modal transfer (Blank, Altman, and Bridger, 1968; Blank and Bridger, 1966). Some researchers, however, found that verbalization (Gellerman, 1933) and naming of objects (Cantor, 1955) could influence form discrimination learning.

Age has proven to make a significant difference in visual and tactual development. Tactual dominance systematically decreased with age, while the visual developmental trend increased with age (Birch and Lefford, 1967; Fisher, 1965; Pick, 1964). Perception also increased with age (Birch and Lefford, 1964; Gaines, 1969; Ghent, 1956; Lobb, 1965).

Russian investigators showed that visual exploration was relatively absent in the preschool child and that touch taught vision (Pick, 1964). Young children identified objects by touch and preferred irregular form and linear shapes (Fisher, 1965). Gaines (1969) found that symmetrical and asymmetrical shapes were not differentiated in

difficulty for nursery, kindergarten, and first grade children, yet they were able to discriminate the shapes above chance, the older children being superior. Cruddon (1941) found that asymmetrical figures were more difficult to abstract in children with a mean age of 71 months. Perseverance, sex, IQ, and learning of past knowledge and corrected errors also affected successful abstraction.

## Perceptual-Motor Development

Perceptual-motor development is definitely associated with visual and tactual form cognition. Muscular skills, especially in hand and tactile manipulation, are believed to enable one to react with and learn from the environment (Montessori, 1912). The use of the hands was determined to be the means of the developing brain to achieve skilled tactile discrimination (Smith, 1927). Deprivation of visual senses in doves caused retardation in learning, possibly also associated with difficulty in visual motor coordination (Siegel, 1953a). Siegel (1953b) hypothesized that the tactile motor-kinesthetic level dominates the early stages of perception. Perceptual-motor development of the normal child was shown to allow perceptual analysis and discrimination; yet motor handicaps, for example, cerebral palsied children, could deter and retard perceptual analysis abilities (Birch and Lefford, 1964). The Hopi Indian infants, who were restricted in movement because of cradle boards carried by their mothers, walked at the same age as a comparable tribe, who did not use cradle boards and allowed children freedom of movement (Dennis and Dennis, 1940). Dennis (1960) found, however, only 8 percent of Iran orphan children, who had been restricted to cribs in

one institution, could walk between the ages of two and three. Ninety-four percent of the orphans in another institution, who had been allowed to move about and play with toys, adults, and other children, walked between ages two and three. Perhaps the contrast in findings could be attributed to the ability of the Indian children to continue to use the visual and auditory senses in the environment while moving around with the mother, and also the fact that the Hopi infants were allowed to move when the mother had time to watch the child.

The apprehension of color and form perception through the senses allows for continued understanding and cognitive awareness. Rapid analytic perception was found to occur between the ages of five and eight divided between major advances at ages five through six and seven through eight (Birch and Lefford, 1967). Quinton (1967) has suggested that perception is the relationship of material objects to the senses. Perception is not usually direct knowledge, but rather an abstraction of interaction with objects. The transfer of direct contact with objects to the attention of experience increases awareness of experience. The accuracy of the description of objects depends upon the environment of the experience and the circumstances of the perception.

A preference for color discrimination as opposed to form was found to be apparent in the very young child (Corah, 1966; Corah and Gospodinoff, 1966; Suchman and Trabasso, 1966). In comparison of shapes differing in color and form the very young child tended to match color rather than form. By the age of four the preference for form began to appear (Suchman and Trabasso, 1966) and a definite preference was proven discernable by age six (Kagan and Lemkin, 1961;

Lee, 1965). Therefore, concept and age were found to be definitely significant in color and form preference (Lee, 1965). A preference of form over size by age six has been shown (Kagan and Lemkin, 1961), and also by age six, color and size were found less important than form (Lee, 1965). Size at this age was also learned earlier than number (Bresenahan, Ivey, and Shapiro, 1961).

In part-whole relationships, the four, five, and six year olds discriminated toward parts rather than whole forms (Corah and Gospodinoff, 1966; Elkind, Koegler, and Go, 1964). The part-whole integration was found to be understood by a majority of children by age nine (Elkind et al., 1964). Thus, progress from centration to complete decentration could be affected by age.

Witte and Meek (1970) trained preschool children to differentiate form and color by verbalizing small differences in the stimuli. In testing the children against a nontrained control group, they found that this type of concept training was possible at an early age and could be beneficial in future concept learning.

## Concept Learning

Conceptual learning can be a function of training as Schell (1971) trained preschool children of four and five in unidimension concepts and shifting of concepts. The control group failed to meet certain criteria, since these concepts were not usually observed in the repertoire of that age group. Olson (1966) found the preschool child was receptive and responsive to stimuli in the environment. Cognitive development required successive encounters with these stimuli

and successive increases of representative experiences allowing for abstraction. In attempting to understand a concept, the child's strategies or decisions changed as the repertoire of concepts were understood. The child first hypothesized at random and then his strategy became more organized, and he began to find alternatives to several hypotheses before testing the correctness. He tested this in an experiment with young children in the construction of diagonals. As age increased, so did ability to abstract and conceptualize. Olson (1970) agreed with Montessori in that he found this conceptualizing did not necessarily have to be verbal.

In concept learning, the act of knowing is perceiving. Perception of form according to Gestalt theory begins at birth. By four months the child can identify a class of objects and between six and twelve months tactile exploration begins. By nine months the baby realizes the permanence of objects and between one and three years imagery appears to be very important. Tactile handling of forms seems to be greatly significant in the interaction of tactile and visual discrimination (Vernon, 1970).

The young child was found to progress from practical space at two and one-half, object for activity and at age three to subjective space, objects for self interest. In objective space, at age four, the object instead of the activity dominates (Meyer, 1940). Intersensory modalities of visual, haptic, and kinesthetic senses have been shown to affect form perception. By age five, the visual-haptic sense can discriminate identical and nonidentical forms with few errors. Visual, haptic, and kinesthetic transmission is, however, not developed.

Therefore, transmission of a pair of sensory modalities at a certain age does not insure intersensory efficiency of other senses at that age (Birch and Lefford, 1963).

There is empirical evidence that Montessori children are more task oriented, more inclined toward objects and shapes, and that Montessori training can substantially increase IQ (Dreyer and Rigler, 1969; Kohlberg, 1968). McCormick and Schnobrich (1969) (1971) found that ego and superego increased while impulsivity decreased in Montessori preschools, and perceptual motor training could increase attention skills and control impulsivity. Tactual and visual perception were found to be important modes of education, with tactual discrimination learning accentuated at an early age, age also influencing perceptual development (Birch and Lefford, 1964, 1967; Blank and Altman, 1968; Fisher, 1965; Gaines, 1969; Ghent, 1956; Lobb, 1965; Pick, 1964, 1965). The tactile motor-kinesthetic development dominated the early ages (Birch and Lefford, 1964; Dennis and Dennis, 1960; Siegel, 1953b). Color perception and then form perception developed in the young child (Corah, 1966; Corah and Gospodinoff, 1966; Kagan and Lemkin, 1961; Lee, 1965; Suchman and Trabasso, 1966). Parts rather than wholes were found to dominate (Corah and Gospodinoff, 1966; Elkind, Koegler, and Go, 1964). Learning was found to occur through perception even beginning at birth (Vernon, 1970). By the age of four and five, transfer of sensory modalities was evident (Meyer, 1940; Birch and Lefford, 1963).

Manual activity is necessary in intellectual development for the young child. Conscious knowledge should be obtained by the senses

from the impressions received. With sensorial materials designed for learning in the early periods of education, subsequent education can be made easier. Children who will in time have to learn to adapt to our elaborate culture need help in forming strong foundations for future intellectual education.

## Purpose of the Present Study

The purpose of this study was to compare the perception and sensorimotor development of preschool children who used specific Montessori sensorial materials. Based on the literature, it was assumed that: 1. Because of the development and accentuation of form and tactile stimulation in the preschool child, extensive use of Montessori equipment designed in form for tactile and visual exploration and learning would influence development of visual perception. 2. With the perceptual-motor training of the Montessori sensorial materials, the subjects would make gains in fine motor coordination.

It was hypothesized that the gains in scores on the Marianne Frostig Developmental Test of Visual Perception (Frostig, 1966) and the Animal House and Block Design subtests on the Wechsler Preschool and Primary Scale of Intelligence (Wechsler, 1967) would be positively related to length of time spent with Montessori sensorial materials offered to children at a special time over a period of ten weeks in a day care program.

# CHAPTER II

# METHODOLOGY

## Subjects

The subjects were 15 preschool children, 8 girls and 7 boys attending the University of Tennessee Day Care Center. At the beginning of the study the subjects ranged in age from 50 months to 71 months with a mean age of 60 months. Since parents of the children enrolled were students, the children were considered homogeneous in middle socio-economic backgrounds.

## Materials

The Montessori sensorial materials used were manufactured by the A. Daigger Company of Chicago. This educational company makes Montessori designed and replicated equipment. Materials were organized, demonstrated, and used according to the Montessori teaching methods of education (Montessori, 1914; St. Nicholas, 1970). The writer and a student teacher demonstrated the materials and worked with the children. The materials included the: pink tower, broad stair, four blocks of knobbed cylinders, four sets of knobless cylinders, long stair, geometric cabinet and form cards, sound cylinders, 64 colored tablets, fabric materials, 5 dressing frames, baric tablets, thermic bottles, and metal insets.

## Measurement for Testing

The Marianne Frostig Developmental Test of Visual Perception was chosen to measure perception and fine motor coordination. The

test is a pencil paper test which measures five areas: eye-motor coordination, figure-ground, constancy of shape, position in space, and spatial relationships. Only the portion recommended for nursery school children was used for the Frostig test. The Animal House and Block Design subtests of the Wechsler Preschool and Primary Scale of Intelligence were used also to measure perception and motor coordination.

## Procedure

The Frostig and Wechsler pretests and posttests were given by the writer to the children individually with an 11 week intervening period. Except for one week when the center was closed, the subjects were exposed to the materials during this time. Testing for the subjects was done in a small isolated room of the day care center. The subjects were given opportunity to use the materials for a 45 minute period five days a week for the ten week period. The subjects had a choice of working with the materials or choosing free play in another room. Time spent with materials was recorded. Children not actively involved with the Montessori materials were encouraged to return to the regular playroom. The Montessori materials were set up each day in a spare room used for eating and group activities.

# CHAPTER III

## RESULTS

The Frostig test and the WPPSI Animal House and Block Design subtests were scored by the writer after all pretests and posttests had been administered. A graduate assistant independently scored the Frostig tests. Two sets of scores were compared. The interrater reliability was 97.8 percent. This reliability was determined by the following formula:

$$\frac{\text{Agreements}}{\text{Agreements} + \text{Disagreements}}$$

Frostig raw scores, and scaled scores changed to perceptual quotients, and WPPSI raw and scaled scores for Animal House and Block Design subtests were correlated with time spent with the Montessori materials. The Spearman rank correlation coefficient was used to show relationship between changes on the Frostig test and WPPSI subtests, pretests and posttests and time spent using the materials. Time the subjects spent with the materials ranged from 80 minutes to 1,375 minutes (22.9 hours). The maximum time possible was 2,250 minutes (37.5 hours).

Separate raw and scale score correlations were computed, because of noted discrepancies between the scores due to several raw scores being above scaled score and perceptual quotient ceilings on the Frostig test. Five pretest raw scores and ten posttest raw scores were above this ceiling. The Constancy of Shape subtest was the only subtest causing this problem, but this also caused some scaled scores to rank

above the interpreted perceptual quotient ceiling. On one subject's test, the Constancy of Shape subtest score did not rank above this scaled ceiling but the total scaled score was above the perceptual quotient ceiling.

Subjects aged four years to four years eleven months taking the Frostig test were assigned specific scaled scores on the Spatial Relationships subtest. This subtest was scored differently, automatically giving ten maximum points, because this part of the test was considered too difficult for that age level. This affected scale scores and thus perceptual quotient correlations, but not correlations for raw scores.

The subtests of the Frostig were not correlated individually. The two individual subtests, Animal House and Block Design, of the WPPSI were correlated individually because these tests were only two subtests of five performance tests of the WPPSI.

Table I presents the Spearman rank correlation coefficients for raw and scaled scores of the Frostig test and the Animal House and Block Design subtests of the WPPSI. The following formula (Siegel, 1956) was used:

$$r_s = 1 - \frac{6\sum_{i=1}^{N} d_i^2}{N^3-N}$$

$d_i$ = absolute difference between test rank and time rank

N = number of subjects

TABLE I

CORRELATION COEFFICIENTS OF FROSTIG AND WPPSI ANIMAL HOUSE AND BLOCK DESIGN SUBTESTS WITH TIME SPENT WITH MONTESSORI MATERIALS

| Index | N | r |
|---|---|---|
| Frostig (Raw Score) | 15 | .39 |
| Frostig (Scale Score) | 15 | .04 |
| WPPSI-Animal House (Raw Score) | 15 | -.06 |
| WPSSI-Animal House (Scale Score) | 15 | -.13 |
| WPPSI-Block Design (Raw Score) | 15 | .14 |
| WPPSI-Block Design (Scale Score) | 15 | .16 |

None of the above correlations were significant at the .05 level. Significance at this level required correlations between .425 and .426.

On ranking the Frostig raw scores, there were four individuals that tied at one or more scores, and on scaled perceptual quotient scores there were ten ties. On the WPPSI Animal House subtest, there were eight individuals that tied at one or more scores on the raw scores and two on the scaled scores. On the WPPSI Block Design there were four individuals that tied at one or more raw scores and four on the scaled scores. Tied scores made correlating more difficult because of the poor spread. The formula (Siegel, 1956) used for correcting for ties was:

$$r_s = \frac{\sum x^2 + \sum y^2 - \sum d^2}{2\sqrt{\sum x^2 \sum y^2}}$$

$$\sum x^2 = \frac{N^3 - N}{12} - \sum tx$$

$$\sum y^2 = \frac{N^3 - N}{12} - \sum ty$$

None of the correlations was significant. Significance at the .05 level required correlation of between .425 and .456. Table I describes the correlated scores.

It was hypothesized that the gains in scores on the Marianne Frostig Developmental Test of Visual Perception and the Animal House and Block Design subtests on the Wechsler Preschool and Primary Scale of Intelligence would be positively related to length of time spent with Montessori sensorial materials offered to children at a special time in a day care program. The hypothesis was rejected.

# CHAPTER IV

## DISCUSSION

The purpose of this study was to compare the perception and sensorimotor development of preschool children who used specific Montessori sensorial materials. It was hypothesized that the gains in scores on the Marianne Frostig Developmental Test of Visual Perception and the Animal House and Block Design subtests of the Wechsler Preschool and Primary Scale of Intelligence would be positively related to length of time spent with Montessori sensorial materials offered to children at a specific time over a period of ten weeks in a day care program. This hypothesis was rejected. The writer considered several explanations concerning possible reasons for lack of relationship between length of time spent with the Montessori materials and test scores.

Although none of the test scores correlated with the time the subjects spent with the Montessori materials, all of the subjects improved on the raw score posttests except three. Since there was no correlation between the time and scores, yet all subjects except a few improved, the possibility that a variety of other environmental factors could and did influence fine motor coordination and visual perception could be explored.

Research has indicated that tactual and visual perception are important modes of education (Birch and Lefford, 1964, 1967; Blank and Altman, 1968; Fisher, 1965; Gaines, 1969; Ghent, 1956; Lobb, 1965; Pick, 1964, 1965). Tactile motor-kinesthetic development also dominates the

early ages (Birch and Lefford, 1964; Dennis and Dennis, 1960; Siegel, 1953b). Color perception and then form perception develop in the young child (Corah, 1966; Corah and Gospodinoff, 1966; Kagan and Lemkin, 1961; Lee, 1965; Suchman and Trabasso, 1966). Parts rather than wholes dominate learning in the young child (Corah and Gospodinoff, 1966; Elkind, Koegler, and Go, 1964). With this empirical knowledge, some conclusions can be drawn pertaining to this specific research and to the young child in general.

Preschool children probably receive fine motor coordination and visual perception stimuli and learning from a variety of materials and stimulation in their environment, i.e. toys, creative experiences, blocks, household tasks, and outdoor play. If this is true, this could account for an overall increase between pretest and posttest scores, yet no correlation between these scores and the amount of time spent with the Montessori materials. Children were having opportunity for similar learning experiences at home and in the free play period in the day care center.

In retrospect, it appeared to the writer that not enough time lapsed between the pretest and posttest for appreciable improvement of the subjects. Had time available for the study been a factor, a period of six months to a year would have been more appropriate.

Since problems developed in the scoring of the Frostig test, because the ceiling was not high enough, the writer would suggest using another test to measure visual perception and motor coordination. Since more opportunities to develop perception and motor coordination may be found in most middle socio-economic groups, a higher ceiling may be needed.

Other limitations considered were that the WPPSI tests are time tests, and the writer noticed some tension and nervousness in the subjects during the timing, possibly causing lower scores. Since the experiences with the materials employed in the Montessori method were not timed, perhaps this too was a deterrent in scoring appropriately.

It should be noted that on the Frostig, where perceptual quotient can be compared to intelligence quotient, it appeared to the writer that only two children were below average with the pretest scores of 82 and 85. The subject that spent 508 minutes working with the Montessori materials improved 18 points on the scaled score while the subject that spent 232 minutes with the materials showed no improvement on the second test. Some feel that the value of Montessori materials lies in bringing below average scores up to average, as compared to improving above average scores even more. If this is true, perhaps these Montessori materials and tests utilized in this study may be appropriate for low socio-economic subjects.

It was interesting to note that the two subjects spending the most time, 1,375 minutes and 889 minutes, with the Montessori materials were two of the younger subjects, four years six months and four years two months respectively at the beginning of the testing. Since Montessori sensorial materials can be used with children beginning at age three, perhaps interest and stimulation were more apparent for the younger subjects and thus held attention spans longer. Both of these subjects did increase appreciably from pretest to posttest on raw scores.

A final factor to be considered is that many of the subjects may have been working at maximum or near maximum ability on the pre-test, and therefore posttest scores would only reflect maturation and previous exposure to the test.

# CHAPTER V

## SUMMARY AND CONCLUSIONS

The purpose of this study was to compare the perception and sensorimotor development of preschool children who used specific Montessori sensorial materials. Based on the literature, it was assumed that: 1. Because of the development and accentuation of form and tactile stimulation in the preschool child, extensive use of Montessori equipment designed in form for tactile and visual exploration and learning would influence development of visual perception. 2. With the perceptual-motor training of the Montessori sensorial materials, the subjects would make gains in fine motor co-ordination.

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period five days a week for a ten week period. The children had a choice of working with the materials or participating in a free play period in a regular playroom. Records were kept of the time spent with the materials. The materials were organized, demonstrated, and used according to the Montessori method of education. The writer and a student teacher demonstrated the materials to the children and worked with the children during the experimental period.

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# APPENDIX

TABLE II

RAW SCORE DIFFERENCES AND TIME SPENT
WITH MONTESSORI MATERIALS

| Subjects | Time (Minutes) | Frostig Differences | Animal House Differences | Block Design Differences |
|---|---|---|---|---|
| A | 508 | 18 | 28 | -4 |
| B | 232 | 3 | 18 | 6 |
| C | 453 | 11 | 12 | 4 |
| D | 672 | 12 | 18 | 1 |
| E | 217 | 6 | 30 | 2 |
| F | 652 | -4 | 18 | 4 |
| G | 80 | 10 | 26 | 3 |
| H | 347 | 14 | 18 | 4 |
| I | 475 | 8 | 22 | 6 |
| J | 416 | 9 | 20 | -1 |
| K | 451 | 2 | 16 | -2 |
| L | 97 | 6 | 4 | 8 |
| M | 1375 | 22 | 10 | 10 |
| N | 889 | 11 | 22 | 11 |
| O | 365 | 5 | 10 | 2 |

TABLE III

SCALE SCORE DIFFERENCES AND TIME SPENT
WITH MONTESSORI MATERIALS

| Subjects | Time (Minutes) | Frostig Differences | Animal House Differences | Block Design Differences |
|---|---|---|---|---|
| A | 508 | 18 | 7 | 4 |
| B | 232 | 0 | 3 | 2 |
| C | 453 | 7 | 4 | 2 |
| D | 672 | 0 | 4 | 0 |
| E | 217 | 1 | 5 | 2 |
| F | 652 | 0 | 2 | 4 |
| G | 80 | 1 | 4 | 1 |
| H | 347 | 2 | 6 | 3 |
| I | 475 | 2 | 3 | 3 |
| J | 416 | 6 | 4 | 1 |
| K | 451 | 0 | 4 | -2 |
| L | 97 | 0 | 0 | 6 |
| M | 1375 | 5 | 1 | 6 |
| N | 889 | -2 | 3 | 6 |
| O | 365 | 0 | 1 | 0 |

# VITA

Dorothy Raney Chitwood was born in Nashville, Tennessee, on July 5, 1947. She attended elementary school in that city and was graduated from Hillsboro High School in 1965. The following September she entered Middle Tennessee State University, and in May, 1969, she received a Bachelor of Science degree in Vocational Home Economics. After marriage to T. Charles Chitwood, the writer traveled for three years while her husband was completing his service commitment. During part of this time, she taught in a Montessori preschool day care program and took courses concerning the Montessori method.

She began graduate study in the Department of Child Development and Family Relationships at the University of Tennessee in March, 1972. In April, 1972, she accepted an assistantship as head teacher of the four and five year olds at the University of Tennessee Day Care Center. In June, 1973, she received the Master of Science Degree.