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THE IMPACT OF AN INTENSE PROGRAM
OF SPATIAL AND TEMPORAL CONCEPTS
ON THE MEASURED INTELLIGENCE
OF PRESCHOOL CHILDREN

DISSERTATION
Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

by
Thomas Joseph Palardy, B.S., M.A.

* * * * * *

The Ohio State University
1973

Reading Committee
Dr. Alexander Frazier
Dr. Loren Tomlinson
Dr. Edwin Novak

Approved by

Adviser
College of Education
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VITA

April 30, 1944  Born - Springfield, Ohio

1965 . . . .  B.S., The Ohio State University, Columbus, Ohio

1965-1967 ..  Elementary Teacher, Southeast Elementary School, Crestline, Ohio

1967-1968 ..  Reading Teacher, Federal Program Title III, Springfield, Ohio

1968-1970 ..  Junior High Teacher, Hayward Junior High School, Springfield, Ohio

1969 . . . .  M.A., The Ohio State University, Columbus, Ohio

1971-1973 ..  Preschool Teacher, Federal Program Title I, Springfield, Ohio

FIELDS OF STUDY

Major Fields:  Early and Middle Childhood Education

Studies in Early Childhood Education.  Professor Alexander Frazier

Studies in Early and Middle Childhood Education.  Professor Loren Tomlinson

Studies in Reading.  Professor Charles Huelsman
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CHAPTER I

INTRODUCTION

Problem Area

Historically, intelligence has been viewed as a fixed capacity or as pre-determined developmentally. Under both positions, intelligence was considered a product of heredity. Within the second half of this century, this concept of intelligence has been seriously challenged. It has been postulated and argued that intelligence is neither fixed nor pre-determined. A current theory is that environment and experience interact with heredity to determine intellectual capability. (Hunt, 1961) Orphanage studies and identical twin research seem to indicate that experience is important in maximizing intellectual functioning. (Dennis, 1957) How much effect environment and experience have on intellectual development remains a major controversy in psychology, child development, and education. Zigler believes that stressing the environmental impact on intellectual capacity results in an unrealistic attitude. Human intelligence is not as plastic as some may wish to believe; genetic endowment plays the major role in
intelligence if the individual is assured minimal stimulation. (Zigler, 1968)

Although the controversy has not been settled, the field of early childhood education was stimulated in the 1960's by Bloom's analysis of the research which designated the early years of a child's life as a critical period in the development of intellectual abilities. (Bloom, 1964) Since that time there has been much concern over the importance of early childhood experiences and early educational programs on the intellectual development of young children.

Attending and participating in early educational programs has often been studied as a factor in raising intelligence. However, such research shows conflicting results, whether nursery school, preschool, or Head Start programs were involved. Welman's famous and controversial early study of the impact of nursery school attendance on intelligence is indicative. Welman studied 625 children enrolled in the Iowa Child Welfare Research Station Nursery School between September 1921 and June 1938. In the various years of nursery school attendance, the children made average gains of 6.6 points on the Stanford-Binet Test of Mental Maturity. (Welman, 1940) If left unchallenged, these restable average gains in measured intelligence would highly recommend nursery school attendance. However, the findings have been often criticized.
Most recently, Goodenough and Mauer compared the test records of 147 children who attended the nursery school at the Institute of Child Welfare at the University of Minnesota with those of a control group of 260 children who had no nursery school training. None of the comparisons made between the two groups indicated an accelerated effect upon the intelligence of the children who attended the nursery school as judged by the Minnesota Preschool Scale. (Goodenough and Mauer, 1940)

Also, many studies of children enrolled in Head Start have been conducted in recent years by different investigators in widely different parts of the country. Intellectual gains of five to ten points were reported in some of the early findings. However, other research reports that no significant gains in intelligence were attained by Head Start children. (Butler, 1970)

Despite research reports which deny the thesis that preschool attendance influences intelligence, there is enough empirical support for the thesis to warrant closer examination.

A small but growing body of research is concerned with comparing the effects of different approaches to early childhood education on the growth of intelligence. This research has been inspired by the disparity in earlier research and by a belief that particular approaches to teaching young children may make a difference.
The Bereiter-Englemann program provides a highly organized approach to language development. The research indicates that this program does produce intellectual gains, but these gains are not consistently significantly superior to those made in other preschool programs. (Bereiter-Englemann, 1966)

Results from the Karnes program and from the Weikert program, also well organized departures from the conventional program, are similar to those of Bereiter-Englemann. Gains in intelligence are attained, but it is difficult to pinpoint the exact causes. Furthermore, the lack of adequate controls minimize possible generalizations.

The research which compares programs does add to the belief that intellectual gains can be fostered by early childhood education. However, the research usually views early educational programs in a broad manner. The precise educational experiences that promote intellectual gains are still largely unidentified and unstudied.

Therefore, in the field of early childhood education there is a major need to continue research by systematically analyzing specific curriculum areas to expose those that may be able to provide content or experiences to foster intellectual growth.
Problem Statement

A need exists to study specific curricular experiences in recognized early childhood areas to determine the effects on intelligence. This study has selected a curriculum area considered common to early childhood education programs. The area is concept development.

Concept development is often linked to intellectual development. (Hunt, 1961; Hess, 1953; Deutsch, 1964; and Fowler, 1965) For the present study, spatial and temporal concepts were chosen as typical of the concepts usually found in preschool materials and preschool programs. Those used were taken from the Bohem Test of Basic Concepts.

Three teaching methodologies were identified as appropriate for teaching concepts: direct teaching, play or dramatic play activities, and art or craft activities. Bereiter and Englemann (1966) emphasize direct teaching in their program. Under this theoretical framework, concepts are taught through by techniques that involve teacher presentation and immediate pupil response, often by the whole group. Direct teaching as used in this study focuses upon teaching without the use of an intervening vehicle of instruction. Fowler (1965) emphasized "focal structures" in his concept development program. He set up the social and physical world so that a child's play or dramatic play would bring him into contact with specific concepts. Art
projects and craft projects have long been used with young children to foster the development of specific concepts. All of these approaches were combined into an intensive program designed to teach spatial and temporal concepts.

Will the structuring of spatial and temporal concepts into an intense preschool program have an impact on the measured intelligence of preschool children? That is the problem of our study. New and innovative programs for young children, such as those which emphasize concept development, need to be described and investigated to determine if gains are made and to determine whether further empirical research is warranted.

In this research, then, an intensive program for preschool children concentrating on concepts of space and time was presented. The program had three components: direct teaching was used to present the concepts; play or dramatic play activities; and art or craft activities provided experience that incorporated the use of the spatial and temporal concepts.

In order to measure the effect of the program described, the preschool Title I students in Springfield, Ohio, were invited to participate in the program. The program lasted for six weeks and concentrated on the following thirty concepts:
Treatment Group A represented the experimental condition. The teacher was presented plans and materials for instruction and was provided a schedule of daily events to follow. The teacher used direct teaching, play or dramatic play activities, and art or craft activities designed to teach spatial and temporal concepts.

Treatment Group B represented the control condition. The teacher adapted a nature unit and selected materials for the control condition curriculum. The teacher was instructed to plan direct teaching, play or dramatic play activities, and art or craft activities in the same proportions as Treatment Group A. No attempt was made in incorporate spatial and temporal concepts into the curriculum of Treatment Group B. The lesson plans were checked to determine if they met the necessary criteria.

The students were pretested and posttested by trained examiners on intelligence quotient as measured by the Stanford-Binet Test of Mental Maturity and on concept development as measured by the Bohem Test of Basic Concepts.
In analyzing the data, the students were blocked by sex and by age to determine differential effects of the program on sex and age. Analysis of variance and covariance procedures were employed to analyze the data obtained.

The specific purposes of this study are to assess the impact of an intense program of spatial and temporal concepts on the measured intelligence of preschool children and to assess the intense program's effect on their measured concept development.

**Hypotheses to be Tested**

The hypotheses for this study have been stated in the null form for convenience in applying statistical tests.

1. There will be no significant difference in measured intelligence between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis.

2. There will be no significant difference in measured intelligence between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis when classified according to sex.
3. There will be no significant difference in measured intelligence between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program when classified according to age.

4. There will be no significant treatment x sex interaction in measured intelligence between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis.

5. There will be no significant treatment x age interaction in measured intelligence between preschool students who have participated in an intense program of spatial and temporal concept and preschool students who have participated in a similar program without the concept emphasis.

6. There will be no significant sex x age interaction in measured intelligence between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis.

7. There will be no significant treatment x sex x age interaction in measured intelligence between preschool students who have participated in an intense program of
spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis.

8. There will be no significant difference in measured concept development between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis.

9. There will be no significant difference in measured concept development between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis when classified according to sex.

10. There will be no significant difference in measured concept development between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis when classified according to age.

11. There will be no significant treatment x sex interaction in measured concept development between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who
have participated in a similar program without the concept emphasis.

12. There will be no significant treatment x age interaction in measured concept development between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis.

13. There will be no significant sex x age interaction in measured concept development between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis.

14. There will be no significant treatment x sex x age interaction in measured concept development between preschool students who have participated in an intense program of spatial and temporal concepts and preschool students who have participated in a similar program without the concept emphasis.

Assumptions and Limitations

The concepts included in this study were taken directly from the Bohem Test of Basic Concepts. These concepts were chosen by Bohem on the basis of frequent
appearance in preschool and primary grade curriculum materials. It is assumed that the results from this research could be generalized to programs for similar children since the same concepts appear frequently in preschool and primary grade curriculum materials.

The research which centers upon boosting intelligence has most often sampled disadvantaged children. The present study also samples disadvantaged children as illustrated by the criteria for selection to be described in Chapter III. Although non-disadvantaged preschool children might profit from the concept program, it is assumed that it is not appropriate to generalize the results of the present study to non-disadvantaged preschool children.

In the present study, experienced para-professionals served as teachers for the experimental and the control groups. Handling preschool classes had been part of their experience as well as enacting the curriculum assignments devised by professionals. During this study, certified personnel was available to assist when necessary, to observe how the program was progressing, and to make appropriate changes.

In the experimental group where the preschool children used the concept-based program, it was assumed that the subjects would change measurable as indicated by both instruments used in this experiment.
A limitation of the study was the fact that no attempt was made to identify and test a second control group of preschool children that did not attend either the experimental or the control program. The addition of such a group is a popular procedure although it adds more information about the value of preschool attendance than about curriculum per se.

Another limitation to the study was the sample size. It was assumed that the sample size was sufficient to demonstrate significant differences. An increase in sample size would have increased statistical power.

Despite the aforementioned limitations, it was determined that major factors which might have a differentiating effect on preschool children's measured intelligence or conceptual development were statistically equated through randomization processes. As a consequence, it was thought that any significant difference between Treatment Group A and Treatment Group B could be attributed, in a large measure at least, to the experimental and the control program.

Definitions

Throughout the course of this study, several terms are used which need to be carefully defined in order to facilitate common understanding.
Intelligence (IQ) test.—As used in this study, an IQ test is a standardized measure of a student's ability to classify, follow directions, reason quantitatively, comprehend verbal concepts, and reason by analogy. The intelligence test used in this study was the Stanford-Binet Test of Mental Maturity.

Basic concept.—As used in this study, a concept is a term which (a) occurs with considerable frequency in preschool and primary grade curriculum materials, (b) is seldom if ever explicitly defined, and (c) represents relatively abstract ideas. (Bohem, 1970)

Basic concept test.—As used in this study, a basic concept test is a standardized measure of children's mastery of concepts considered necessary for achievement in the first years of school. The concept test used in this study was the Boehm Test of Basic Concepts. (Bohem, 1970)

Direct teaching.—As used in this study, direct teaching is a technique which presents that which is to be learned without the use of an intervening vehicle of instruction.

Play or dramatic play.—As used in this study, play or dramatic play is a teaching technique which utilizes games and imaginary or lifelike play situations as vehicles of instruction.
Art or Craft.-- As used in this study art or craft activities comprise experiences used as vehicles of instruction.

Procedures

A sample of twenty-nine (29) preschool children from a population of one hundred sixty (160) children enrolled in a Title I preschool in Springfield, Ohio, participated in this study. The children were randomly assigned to an experimental group (Group A) and a control group (Group B).

Direct teaching, play or dramatic play activities, and art or craft activities were the teaching techniques used in both the experimental and the control groups. However, the experimental group emphasized spatial and temporal concepts while the control group concentrated on an area of interest.

Two teachers were randomly chosen and randomly assigned; one to Group A, the other to Group B. Three aides served both groups, dividing their time as equally between them as possible.

A pretest and a posttest Stanford Binet Test of Mental Maturity was individually administered to the children in both treatment groups, and a $2 \times 2 \times 2$ analysis of variance with the independent variables of treatment group, sex, and age was performed on the gain scores to determine if there were significant differences between and among groups. Using the same independent variables, a $2 \times 2 \times 2$ analysis of
variance was performed on the posttest I.Q. with pretest I.Q. used as a covariabl.

A pretest and post-test Bohem Test of Basic Concepts was individually administered to the children in both treatment groups, and a $2 \times 2 \times 2$ analysis of variance with the independent variables of treatment group, sex, and age was performed on the gain scores to determine if there were significant differences between and among groups. In addition to this statistical technique, a $2 \times 2 \times 2$ analysis of variance with the independent variables of treatment group, sex, and age was performed on the posttest Bohem scores with pretest Bohem scores used as a covariable.

Organization of the Report

This report is organized into five chapters. Chapter I is a general introduction to the study. It has presented the problem area, a statement of the problem, the hypotheses to be tested, some conceptual assumptions and limitations, and definitions of terms. Chapter II includes a review of the related literature. Chapter III presents a description of the procedures used in the study. The findings of the study are reported in Chapter IV. Chapter V presents a summary of the study, the conclusions drawn from the findings, and some recommendations for additional research.
CHAPTER II

REVIEW OF RELATED LITERATURE

The central purpose of this study is to determine the effects of an intense program of spatial and temporal concepts on the measured intelligence of preschool children. Many themes in the psychological and educational literature on intelligence may be thought to support such an attempt, but five would seem to be of crucial importance:

1. Development of the concept of I.Q.
2. Deprivation and institutionalization studies.
3. Early nursery school studies.
4. The critical period hypothesis.
5. Current research on impact of preschool programs on intelligence.

The literature on these themes is reviewed here to find theoretical and empirical evidence that may be related to the present study.

Development of I.Q. Concept

Darwin's theory of natural selection and biological evolution as presented in Origin of the Species is viewed by Hunt (1961) and Stott and Ball (1965) as the root of
notion of fixed intelligence. A cousin of Darwin's, Sir Francis Galton, theorized that men of great reputation and prominence in Great Britain came from relatively few families. In his study of *Hereditary Genius*, Galton concluded that genius is inherited (Hunt, 1961). Also, he began to devote his energies to assessing inherited capacity through "anthropomorphic measures," including sensory and motor tests, immediate memory tests, etc. Galton reasoned that since human characteristics are inherited, and humanity could be improved by selective breeding.

In the early Twentieth Century, Binet began testing intelligence after he was commissioned by the French Ministry of Public Instruction to study the problem of retardation. Binet and his co-worker, Simon, criticized Galton's approach as being too concerned with simple sensory and motor responses. They, instead, looked toward measurement of more complex functions, such as memory, imagination, comprehension, and esthetic appreciation. However, Binet did not view intelligence as a fixed capacity. He thought that such a view was deplorable and brutally pessimistic. He held that the capacity to learn could improve with instruction. (Binet 1909, p. 54)

When the mental testing movement came to America, two prominent psychologists supported the concept of genetically fixed intelligence. Goddard, who brought the
Binet-Simon scale to America, translated it, and used it in studying the feeble-minded at the Vineland Training School, was a strong believer in fixed intelligence. He re-standardized and published in 1910 an adaptation of this scale in America. (Goddard 1910)

The concept of "intelligence Quotient" introduced by Stern in 1914 was used by Terman in his Stanford revisions of the Binet scale.

The formula of intelligence quotient equals mental age divided by chronological age gave power to the view of genetically fixed intelligence, since with this formula the intelligence quotient scores could remain constant for an individual as he grew from infancy to adulthood. In fact, "the index proved to be so reliable and valid that it has survived to the present day and still conveys the concept of fixed capacity."

Another viewpoint closely related to that of fixed intelligence holds that the process of maturation determines not only intellectual capacity but also its course and pattern of development. Hunt (1961) labels this view "predeterminism."

The roots of predeterminism go back to Rousseau and his followers, who held that all human development consists of regulated stages. Furthermore, they believed that the stages of human development correspond to the
stages of evolution of the human species. G. Stanley Hall held the recapitulative theory and elaborated the idea of developmental stages. His pupil, Arnold Gesell, became a full-time student of maturation. At the Yale Institute of Behavioral Studies, Gesell developed and reported normative studies of child development. He also studied the effect of training on single motor activities, such as stair climbing. His research indicated that motor training does not speed the attainment of certain skills. Gesell's research concurred with the belief in genetically predetermined intelligence and his work, undoubtedly, has been used to support the belief that an individual's intelligence is uninfluenced by his environment.

**Deprivation and Institutionalization Studies**

The belief in fixed or predetermined intelligence has been to some extent questioned in studies of children who have been institutionalized or who have suffered from extreme deprivation.

Dennis (1957) studied the causes of retardation in institutionalized children where the variety of stimulation was minimal. He found that only 42 per cent of the children could sit alone at two years of age and only 15 per cent could walk alone at four years of age.

Onset of walking was also studied in Hopi Indian
children (Dennis and Dennis, 1940) by asking their mothers what age their children had started to walk. Some of the Hopi children had been strapped to a cradle board and carried most of the days of early infancy as was traditional Hopi practice. Other Hopi mothers had abandoned this practice. Mean age for walking did not differ significantly for the Hopi children who had been strapped to cradle boards and those children who had not. The researchers concluded that walking was a skill which occurs with minimal stimulation.

The research on motor skills is often generalized to imply that mental abilities follow similar lines of development. The validity of this practice may be questionable, but child development theory often holds that different growth aspects are highly correlated. The Dennis studies and similar studies are included in reviews of the literature on intelligence by several authorities. (Hunt, 1961; Butler, 1970; Stott and Ball, 1965)

Several studies have been conducted which analyze intelligence quotient in orphanage children. One often quoted study was conducted by Skeels, Dye, and Skodak. (1939) The experimental group consisted of 13 children in an overcrowded orphanage. The children were under three years of age and had a mean I.Q. of 64. They were
subsequently placed in an institution for the mentally retarded. Older female inmates of this institution became mother-surrogates to the children. They talked to, played with, and trained the children. Nursery school and kindergarten materials were provided. The control group in the study consisted of 12 orphanage youngsters who had been judged normal in mental development. These children had been tested prior to two years of age and had obtained a mean I.Q. of 86.1. By the age of four the children in the experimental group had gained from 7 to 58 I.Q. points, while the control group children had lost between 9 and 45 I.Q. points. This study is often cited as providing dramatic evidence that extremes in environment can indeed influence intelligence.

Skeels' (1937) follow-up study is also considered to offer evidence of the importance of environment in intellectual development. He reports that 11 of the 13 experimental children were placed in adoptive homes. Their mean I.Q. became 95.9. The control group mean was then 66.1.

Spitz (1949) studied the development quotient D.Q. consisting of six aspects of personality, in two groups of infants; one group was cared for one hour a day at a "nursery" by their mothers who were confined in a penal
institution, the other group was raised at a home for infants whose mothers could not support them. Spitz judged that these children received adequate food, housing, and material care but the staff was heavily overworked and had little time to devote to other needs of the children. The children who were cared for by their mothers an hour a day showed an average D.Q. of 95; the staff-raised children had a D.Q. of 130. However, by the age of 8 to 10 months, the average D.Q. of the mother-raised children had risen to 110, while the staff-cared-for children had plummetted to 72.

Children who were brought to Creche, an orphanage in Beirut, were compared to children brought to the Well Baby Clinic of the American University Hospital of Beirut by Dennis and Najarian. (1957) Stimulation and attention at Creche was minimal. Comparisons between the two groups indicated significant differences in favor of the Well Baby Clinic children from the ages of 3 to 12 months. However, older children, ages 4.5 to 6, who had been raised in Creche showed normal scores on a battery of tests. Dennis and Najarian argue that environmental stimulation is necessary because it provides opportunities for learning and that retardation due to deprivation need not be permanent. They seem to contend that intellectual capacity
develops despite deprivation; opportunities to use intellectual abilities correct the effects of deprivation.

Pasamanick (1946) seems to concur with this conclusion. He found that when institutionalized Negro infants received additional attention, they began to reverse the effects of deprivation.

However, research conducted by Goldfarb (1945) compares children institutionalized from early infancy until placed in foster homes around the age of three with children placed in foster homes at early infancy. Educational difficulties were found in 42.5 per cent of the institutionalized children and in 15.0 per cent of the children placed in foster homes at early infancy. Goldfarb held the view that a lag in mental development caused by deprivation could not be offset.

It is not surprising that studies of children in extremely deprived situations do not resolve the issue about the role of environment in the development of intellectual abilities. The research is curtailed by poor research controls, population and sampling inadequacies, small subject numbers, and inadequate or inappropriate testing. Also the research is limited to extreme situations, and ethical considerations rule out any possibilities of duplication with truly adequate research procedures.
Certainly most of the research finds that extreme deprivation can have harmful effects on children's intellectual capacity and even may retard the development of motor skills. However, a change to a richer environment seems to offset some of the effects of deprivation. Thus, environment remains a factor in the development of intellectual capacity. However, it is difficult to determine from the studies whether intellectual capacity and intellectual ability should be used synonymously. In either case, this research emphasizes the role of environment in intellectual functioning. The nature of an environment that allows intelligence to develop or that enhances the learnings that maximize intellectual ability needs to be specified.

**Early Nursery School Studies**

Beginning in the 1930's it was questioned whether educational experiences could directly influence intelligence. Nursery school became the test spot.

Research reports by Wellman and her associates (Wellman, 1934, 1937, 1938; Wellman and Coffey, 1936; Criesey, 1937; Skeels and Filmore, 1937; Skeels, 1938) have become labeled as the Iowa studies. This research supported the theory that young children's environment could stimulate intellectual development.
Wellman herself studied the children enrolled in the nursery school at the Iowa Child Welfare Research Station between September 1921 and June 1938. She selected 652 children for whom there were complete records. The Stanford-Binet or the Kuhlman-Binet had been given to the children in the fall and in the spring of each nursery school year. The average gain on the spring test was 6.6. The gains were distributed throughout all ages; however, the youngest children tended to gain most.

Wellman also summarized the results of published and unpublished studies at the Iowa Child Welfare Research Station. She reported that principal gains in I.Q. were cumulative over the first two years of preschool attendance. Non-attenders did not gain. The parents' cultural status could not account for the changes in I.Q.

The influence of Gessell and the child study movement, with an emphasis on the role of maturation in learning, was strong at this point historically. Consequently, such research was skeptically received. The findings are, for example, highly criticized by Goodenough and Mauer (1960), who analyzed test records of 147 children who attended the University of Minnesota Nursery School and 260 children with no nursery school experience. None of the comparisons from standardized intelligence tests indicated an accelerated effect upon the intel-
ligence for nursery school children. Goodenough contended that the Iowa research inadequately controlled basic variables, used faulty statistical procedures, and failed to account for the effects of regression. She was a respected authority on intelligence and tried to remain objective.

One bitter attack of the Iowa research comes from Simpson (1939), whose paper "The Wandering I.Q.: Is It Time To Settle Down?" claimed that miracles worked in Iowa could not be duplicated in other parts of the country. The tone of Simpson's article suggests that he had set out to expose unprofessionalism.

In fact, the majority of the contemporary studies (Jones and Jordensen, 1940; Frandsen and Barlow, 1940; Kawin and Hoefer, 1931; Peterson, 1937; and McHugh, 1943) did not concur with the Iowa studies. When Elizabeth Fuller (1960) reviewed the literature on the relationship of early childhood education to general intelligence, she concluded that the early nursery school studies largely agreed that the effects of early school attendance upon mental growth were minimal or non-existent. She points out that the index is subject to error, the results of studies vary, the interpretation of the results vary, and many other factors produce lack of agreement.
Critical Period Hypothesis

In order to understand current views of intelligence in early childhood education, recognition of the importance of the critical period hypothesis is warranted.

The term "critical period" is used to describe a period beyond which a given behavior will not appear or a period during which an organism is maximally susceptible to external or internal forces. Most of this research has been conducted with animals. However, the implication that human development may also contain critical periods has influenced recent thinking on intelligence.

The first definition of "critical period" was derived from research on imprinting in birds (Hess, 1959), socialization in dogs (Scott, 1958), and parental behavior in monkeys (Harlow, 1958). In human development, this aspect of the "critical period" hypothesis seems akin to the developmental tasks posed by Havighurst. (1952)

The second phase of defining critical period is illustrated by a study by Landauer and Whiting (1964), which suggests that height in humans can be altered by early stimulation. The research in a cross-cultured analysis reported two inches in height differences between those adults who had as infants been subjected to stabbing or molding experiences and those adults who had not. Although this research had undoubtedly imposing limitations, it
does pose questions for the educator or psychologist who wishes to generalize.

Levine (1960) experimented with the cortex development of rats. He found that rats receiving electrical shocks during a given critical period developed into larger specimens containing larger, heavier cortexes.

Critical periods most often happen during periods of rapid development. In human development, rapid growth occurs during infancy and early childhood. Therefore, if critical periods exist for humans, it is logical that they would occur during the early years. Furthermore, if mental development is in some way controlled by these critical periods, then infancy and early childhood are periods in which children's intelligence would most likely be susceptible to environmental forces. Thus, intellectual development of the young child has become a crucial concern.

In this manner of thought, the field of early childhood education was spurred by Benjamin Bloom, who reports in his often quoted work *Stability and Change in Human Characteristics* (1964) that the majority of the variance in intelligence quotient is set at a young age. Bloom states that intelligence is a developing function and that the stability of measured intelligence increases with age.
Current Research

The expansion of knowledge, Sputnik's threat to U.S. supremacy, social injustice to minority groups, the war on poverty, and contributions to education and psychological literature by Hunt (1961) as well as Bloom (1964) have added reasons to renew the investigation of intelligence.

In general, Hunt evaluated the evidence which sustained belief in fixed intelligence and predetermined development of intelligence, argued that a reinterpretation was warranted, and concluded that support of these theories was unjustified. Hunt supported an interaction theory of intelligence and wrote of finding the proper "match" between the individual and environmental experiences to foster intelligence.

Equality of the races became mixed with arguments about intelligence, and emotions again entered the debate. A central figure in the controversy was Jensen, who believed that genetic factors must be included in the investigation of the conditions, processes, and limits of environmental influences on human behavior. Jensen (1969) estimated that 81 per cent of measured intelligence is inherited. He further reasoned that inherited traits could be common not only to individuals but to groups of individuals.
The extreme positions that have developed on the controversy are partly due to Jensen and the hot debate which followed his work. But the long unsettled intelligence controversies and current research on intelligence also have contributed. Zigler (1958) attempted to clarify the debate by suggesting that the extreme believers in environmental influences on intelligence could be labeled as naive environmentalists, while those who hold strong developmental, anti-environmental positions could be named neo-Gesellians.

A currently acceptable view on intelligence is interactionism, which holds that genetic factors and environmental factors contribute to the development of intellectual abilities.

In recent years, the field of early childhood education has offered many programs attempting to alleviate social deprivation effects. A product of these attempts and other early education programs has been new literature on intelligence. Compensatory education studies, however, demonstrate mixed results.

Cawley (1958) studied the population of three Head Start centers in a full-year program. He divided the population into three groups on the basis of Stanford-Binet scores. The high group had a posttest mean I.Q. of 103.24, the middle group had a posttest mean I.Q. of 88.76, and the low group had a posttest mean I.Q. of 73.42.
All posttest means were significantly higher than corresponding pretest measures. However, the trend in gains suggested that although the low group showed significant gains, the higher group showed greater gains.

Alpern (1966) studied a program for culturally disadvantaged children sponsored by a community house. The school goals were to (a) develop positive attitudes toward the concept of school learning, (b) increase the children's communication skills, and (c) increase knowledge of middle class experience and values. Two groups containing 22 children each were matched for intelligence, sex, and readiness as measured by the Metropolitan Readiness Test. The experimental groups attended the nursery school program three times a week while the control group did not attend nursery school. At the end of the first year: (a) both groups made significant gains in all readiness measures between the pretesting and the posttesting; (b) no significant differences were found between the groups on any of the readiness measures; and (c) no significant differences in intelligence were found between the groups. Alpern concluded that this type of preschool experience failed to attain gains on the factors representing the goals of the program.

A successful compensatory education program was reported by the Institute for Research in Behavioral
Sciences, Fresno, California. (1969) Its goal was language development. Classes met three hours daily, five times a week. A five children to one adult ratio was maintained, and the sessions consisted of small group activities. During the first year pilot project, nearly every child's I.Q. increased by 10 to 20 points. Gains, however, were negligible for the second year of the program. The test results for the third year were divided into ethnic groups (Caucasian, Negro, and Mexican American). An analysis of variance was used on the pretest and posttest means, and a "t" test of significance of difference between correlated means was used to test the significance of each ethnic group's gains. The results showed that all the groups gained significantly and that the ethnic groups differed significantly on the pretest but not on the posttest. The same procedure was used in evaluating the fourth year of the program, with all groups gaining significantly. The program was judged as being successful in raising the intelligence of preschool children.

The Perry Preschool Project in Ypsilanti, Michigan, is one of a series of successful compensatory education programs reported by the American Institute in Behavioral Sciences. (1969) The program consisted of a two-year, three-hour-a-day cognitively oriented program, weekly 90-minute home visits, and group meetings with the parents
of the preschoolers. Negro disadvantaged children and functionally retarded children of three and four years, whose Stanford-Binet scores were not above 85.0 were the subjects. About 42 children participated in the program each year for four years. The first three waves of students used a verbal bombardment instructional methodology. The program emphasized an intense language environment, thinking skills, impulse controls, and task orientation. Thematic units were used to develop learning activities in sensory perception concept development, language development, and memorization.

During the 1965-1966 school year, the fourth wave of children received Piagetian oriented curriculum. This program stressed the interim objectives of developing and responding or using temporal relations, spatial relations, seriation, and classification. The terminal objective of this program was identical to that of the program for first four waves of children; namely, to foster intellectual growth.

The Stanford-Binet, the Peabody Picture Vocabulary Test, and the Leiter International Performance scale were given when a wave of children entered school and each spring from prekindergarten through third grade. The results favored the experimental over a control group in these measures when the means for all five waves were combined.
Overcoming the effects of poverty by teaching specific cognitive skills were the goals of many programs, including Head Start programs.

The work of Francis Palmer (1968) at the City University of New York Institute for Child Development and Experimental Education used 240 Negro males, ages 2 and 3, from various social levels in Manhattan. The children were enrolled in either a discovery group (free play) or a training group (concept teaching). A control group of 70 youngsters was used for assessment purposes. No differences in performance could be found as a function of social class among children 2-0, 2-8, and 3-0. By the age of 3-8, differences were beginning to emerge, but they were still insignificant. The research implies that social class need not influence intellective performance if intervention takes place early enough, and that ages 3 to 3 years 8 months may not be too late.

Other research, however, disagrees with this finding. Hodes found that participation in Head Start to be related to improvement in conceptual maturity, but to that participation in Head Start could not overcome the effects of poverty. (Butler 1970)

In reviewing the literature on the impact of Head Start, several investigators (Butler, 1970, Brazziel, 1967; Crooks, 1967; Osborn, 1967) report that approximately
two-thirds of the studies on file in the Office of Economic Opportunity found significant increase in I.Q. or significant I.Q. superiority of Head Start participants over non-participants.

Intelligence, then, as demonstrated by some research, does seem to respond to early educational experiences. Controversy, of course, continues. The arguments concerning whether changes in performance can be judged as changes in capacity are still far from answered.

A small, but growing, body of research compares the effects of different preschool programs on I.Q. Susan Gray began a five-year study with 61 preschool Negro children in 1962. The population was selected on the basis of poor housing, low educational level of parents, and generally unskilled labor by parents. The children were randomly assigned to three groups. One group entered the program three summers prior to entrance into the first grade. The second group entered the intervention program two summers prior to first grade. The third group did not participate in the intervention program. A fourth control group was chosen from a relatively similar city 60 miles away. The program lasted for 10 weeks in the summer. The goal was to offset the deficits usually observed in disadvantaged children. The program was followed by home visits by a specifically trained worker for a nine-month
period to help the mother sustain and increase any gains the child might have made during the summer months. The four groups entered first grade in 1964. The three from the same city entered the same school. The data suggest that the earliest and maximum exposure to the training program resulted in the largest I.Q. gains. In the first grade, all groups improved, then showed a decline that was viewed as a massive effect of the environment and the school situation. Significant differences on the Stanford-Binet as well as the Peabody Picture Vocabulary Test and the Metropolitan Readiness Test remained during the first two grades of school. At the end of the fourth grade, the differences were no longer significant.

Gray (1969) notes a diffusion effect since only one child in the control group had not had consistent contact with experimental families. A diffusion effect from older to younger siblings was also noted. Younger siblings who were old enough to test in 1964 were again tested in 1966. Siblings closer in age to the experimental children were significantly superior on both the 1964 and 1966 testing to the younger siblings from the control groups. Gray views these data as related to intervention techniques taught the mother.

The Institute for Developmental Studies (1968) has conducted research on a preschool program which has a major
goal of compensating for some of the detrimental effects of living in a disadvantaged environment. The program was conducted in conjunction with the New York Public School System. Participants entered at pre-kindergarten level and continued through the third grade. Control groups fell into three categories. Self-selected controls met the same criteria as the experimentals but were excluded from the program on a random basis. Another group of control children came from the same background as the other two groups but began their schooling in the regular kindergarten. The third control group came from the same background and began to attend school in regular nonenriched first grades. Six waves or groups of children have been tested. The first wave began the program in 1962; the last in 1967. Both the experimental and the control groups were administered the Stanford-Binet and the Peabody Picture Vocabulary Test prior to pre-kindergarten, following pre-kindergarten, and following kindergarten. The experimental and the self-selected control groups were equivalent on both measures at pretest. The posttest indicated significant gains for the experimental groups. The Reading Prognosis indicated superiority for the experimental group at the end of kindergarten, and six subtests of the Illinois Test of Psycho-Linguistic Ability, given to a sample group of first, second, and third
graders, showed significant superiority of the experimental groups over the controls. The results tend to indicate that intervention programs for disadvantaged youngsters can have a substantially positive influence.

David Weikart (1967) designed a two-year preschool program to offset the effects of cultural deprivation on mental development. The program began by a "verbal bombardment" approach but has shifted to a more Piagetism approach. The intervention consisted of a 2½-hour morning class and a visit in the home for each child one afternoon per week. During the first home visits, the teacher interacted with the youngsters while the mother observed. Later, the mother interacted with her own child under the teacher's guidance. Weikart's population consisted of three- and four-year-old "educable mentally retarded" youngsters with an initial mean I.Q. varying from 78 to 80 for the different groups. Three groups or waves completed two years of the intervention program by 1967, and each wave had demonstrated spurts in I.Q. during the first year of preschool attendance. Waves 0, 1, and 2 gained 12.8 mean I.Q. points at age 4 and 11.5 mean I.Q. points at age 3 during the first year. Waves 0 and 1 lost 2.1 and 1.5 mean I.Q. points, respectively, during the second year. Weikart viewed the losses as indicating a need to strengthen the curriculum. Only the third
wave maintained significant superiority over the control groups through the second year of preschool.

Karnes (1968) compared five different intervention programs:

1. A traditional nursery school for disadvantaged children designed to develop social skills.

2. The Karnes' program, a highly structured program designed to alleviate learning deficiencies, which consists of game-like activities, motor-sensory manipulations, and specific content in mathematics, language arts, social studies, and science.

3. The Bereiter-Englemann program, also highly structured, stressing teaching by means of direct verbal interaction, with instruction in language, reading, and arithmetic.

4. A Montessori program, using ample Montessori material under a qualified Montessori teacher.

5. A community-integrated program, consisting of traditional nursery school programs at four neighborhood centers, with middle class children and two or three disadvantaged children and professional preschool teachers.

The Karnes program and the Bereiter-Englemann program demonstrated significant superiority in Binet means over
the other three approaches. The highly structured Karnes and Bereiter-Englemann programs were not significantly different from each other. Karnes also concludes that age three rather than age four is the most effective time for intervention.

Seifert (1969) matched 32 youngsters on the basis of initial intelligence and socio-economic level in his investigation of verbal interaction in Weikert's moderately structured cognitive curriculum and Bereiter and Englemann's highly structured language curriculum. There were little differences in verbal interaction and no significant differences on Stanford-Binet scores between the two groups. The children in both programs, however, gained 30 I.Q. points more than a matched control group of non-preschool children.

Nimnicht (1967) studied a preschool program called the New Nursery School. The population was three- and four-year-old children with Spanish surnames. The program had four goals; (1) to develop a positive self-image, (2) to increase sensory and perceptual abilities, (3) to improve language ability, and (4) to improve problem-solving and concept-formation abilities. Nimnicht describes the school's organization as an autotelic responsive environment which supports a task for its own sake rather than with outside motivation.

The experimental group had a mean I.Q. between 83
and 93 (some of the children were not testable) when they entered the New Nursery School. The control group's mean I.Q. was 84. The experimental group's pottest mean was 84. The mean scores on the Metropolitan Reading Readiness Test, which was administered one year after the children left the New Nursery School, were 79 for the experimental group and 64 for the control group. Follow-up data indicated that those who had been in the New Nursery School only one year began to level off in their growth rate during first grade. This was thought to be a consequence of classrooms where the children could not demonstrate their abilities.

The Bereiter-Englemann program has the long range goal of "teaching skills that potentially lead to maximum upward social mobility." (1966) During the program, an hour a day is spent on academic skills. "The children spend twenty minutes on reading, twenty minutes on arithmetic, and twenty minutes on language. They work in small groups - one teacher to four to six children. The children move from subject to subject as they would in a departmentalized high school. The teachers specialize. One teaches arithmetic; and another teaches reading. The remaining time is spent in music, art, seat work,
and less structured activities. Systematic reinforcement of desirable behavior is used.

Research on this program demonstrated that the experimental group consisting of 15 four-year-olds who had participated for two years in the preschool achieved significantly greater I.Q. gains than the control group who participated in a different type of preschool program at the end of both the first and second year. Experimental group gains were 17 I.Q. points for the first year followed by a loss of 8.6 I.Q. points after the second year. Control group gains were 8.07 I.Q. points after the first year, followed by a decrease of 2.96 points after the second year.

In addition to the differing attempts to compensate for the effects of poverty the last few years have held further controversies about the nature of intelligence, the adequacy of I.Q. as a measurement of intelligence, the inheritability of intellectual capacity, and the possibility of education changing intelligence.

Jensen (1972) continues his stance that genetics account for the majority of the variability in intelligence. He bases his argument on complex correlations and intercorrelations of the populations of primary and secondary familial mental retardation studies and
identical twins reared apart studies. His position, for example, with identical twins reared apart is that the data on monozygotic twins reared apart can still be viewed as representing normally distributed samples of the same population. In general, Jensen views Environment as representing a threshold below which deprivation can have a marked negative effect on intelligence, but above the threshold environment makes little difference.

Jensen's position is supported by impressive statistics and impressive educational and psychological authorities. Stockley (1972), in addition to supporting Jensen's claim of genetic determination of intelligence, holds that an obligation exists to use scientific knowledge about intelligence in order to better society. He even proposes a voluntary sterilization bonus program for those with hereditary disadvantages such as a low I.Q. Carl Bereiter (1970) also seems to support major hereditary influence on intelligence. He holds that heredity x environment interaction can make substantial gains in I.Q., but these gains should not be interpreted as altering the spread on individual differences. Bereiter calls for education to face "cultural pluralism without separation or segregation." (1970, p. 298)

The position that intelligence is for the most part
genetically set continues to be highly contested on statistical, theoretical, educational, and ethical grounds.

In his analysis of the data of identical twins reared apart Fehr (1969) does not find support for the inheritability of intelligence.

An alternative interpretation of the relationship between heredity and intelligence is presented in a complicated argument by Sanday (1973), the contention is that variability in a trait is due to "genetic factors relative to environmental factors." If an environment is held constant, the heritability estimate for the population will naturally be high and visa versa. She feels that I.Q. testing could indicate the homogeneity of the environment and, with evaluation of I.Q. scores, indicate whether or not the environment was favorable to I.Q. development.

Stinchcombe (1969) argues that the effects of environment are cumulative, and attempts to separate into proportions the effects of heredity and environment are suspect.

A central figure in the Jensen debate, Gage (1972) claims that the issue is not the hereditability index but how much I.Q. can be boosted. Gage also feels that although compensatory education has been tried, it should
be continued rather than dropped and that when science finds crucial environmental variables, I.Q. changes will be substantial.

Defense for compensatory and early childhood education's inability to consistently demonstrate lasting I.Q. gains is certainly found in the literature of the past several years. Zach (1972) suggests that many programs to raise I.Q. were put together under emergency conditions. Consequently, educators almost expected the programs to fail in the pursuit. Anastasiow (1969) also contends that early childhood education programs have not been developed adequately for valid assessment. He believes that much more work needs to be done to determine the nature of those environmental simulations which can make the most of inherited potential.

Intelligence measurement has, of course, been accused of cultural bias. Implications that minority groups are of inferior mental ability have to some degree diminished the acceptance of I.Q. as a measure of intellectual capacity. Mercer (1973) points to cultural bias in intelligence measurement. She cites a sociological survey intended to identify those who were mentally retarded. She found that 300 per cent more Mexican-Americans and 50 per cent more blacks were identified than proportionally
would be expected in the respective populations. She also reports that blacks and Mexican-Americans who demonstrated the highest I.Q. scores came from families that shared environmental characteristics with Anglo-American families.

Time may be needed to evaluate mental measurement's sociological implications. A moratorium on I.Q. testing is being observed in some U.S. cities and in the state of California. Some professional organizations have adopted a similar position. In 1970 the American Personnel and guidance Association proposed a halt on mental testing. Jesell (1972) presents a compromise by suggesting limited use of mental tests and limited access to mental test results.

And so problems concerning the concept of intelligence and intelligence testing exist. But the fields of education and psychology have not halted their search for understanding mental abilities. Further analysis of the factors of intelligence is being sought for increased understanding and educational improvement. Meeker (1969) suggests that education make better use of Guilford's (1967) Structure-of-Intellect model with its five operations (cognition, memory, divergent production, convergent production, and evaluation), four
contents (figural, symbolic, semantic, and behavioral), and six products (units, classes, relations, systems, transformations, and implications). Jacobs and Van-deventer (1972) concur with this suggestion. They posit that if educators can train for a specific limited category of intelligence and assess that the training has transferred to a defined universe, intelligence has increased.

However, new frameworks for thinking about intelligence are also open to criticism. Carroll (1968) challenges Guilford's model, arguing that his system of classification is in many respects arbitrary and that substantial correlations of ability with success in typical academic situations can be demonstrated in only a few ability factors.

The theories of Piaget are also being closely evaluated in the search for a framework for education and research. In this manner, Cunningham (1972) calls for joining Piagetian and classical psychological evidence. Piaget's tasks are considered by Gaudia (1972) as possible material for establishing construct validity in intelligence measurement.

A recent development in intelligence measurement is the neural efficiency analyzer. Tracy (1972) interviews
John Ertl, who believes that human intelligence can be analyzed in the electrical activities of the brain and who has conceptualized and marketed the neural efficiency analyzer. Ertl contends that analysis of brain waves is a more valid means of determining intelligence than standard psychological mental measurements.

Along with the controversies, the further analysis of structure of the intellect, and new measurement devices, research on intellectual growth and change continues. Some of this research deserves careful attention and possible replication. Jacobson, Berger, Bergman, Millham, and Greeson (1971) reported rapid concept learning and substantial increases in I.Q. in a 20-hour reinforcement program devised by the investigators. Furthermore, the follow-up study by Jacobson and Greeson (1972) conducted 14 months later demonstrated that 27 of the 36 participants retained most of their initial I.Q. gains. Retention was related to experimental condition and initial I.Q.

Summary and Conclusion

Intelligence was widely considered in the first half of the twentieth century to be genetically fixed or even genetically predetermined. However, some controversy existed. Some research dealing with orphanage
children or children who had somehow been deprived questioned the role of environment in intellectual development.

Furthermore, in the late 1920's and 1930's some research on the effects of nursery school attendance revealed I.Q. gains. Such findings were attacked and generally discredited.

In the 1960's and 1970's, attempts to offset the effects of poverty have resulted in renewed concern about education's role for minority groups and the poor. From adoption of the critical period rationale, the time for changing intelligence has been identified as the early years. Hence, a renewed interest in nursery school's effect on I.Q. has developed. Early educational experiences have become newly recognized as environmental forces capable of possibly influencing intelligence.

Studies of simple participation in nursery school and Head Start have shown some promise in this regard, but there have been dissonant findings. The focus of the concern has changed to what programs for the young best meet the goal of advancing measured I.Q. The literature holds several programs as successful, but it has, of yet, not sorted out, enumerated, and described the teaching techniques or the curricula which influence measured intelligence.
The literature builds a framework for the present study, which represents an attempt to measure the effects on measured intelligence of a program designed to isolate and intensify a curricular area in programs for young children while controlling teaching techniques.
CHAPTER III

METHODOLOGY OF THE STUDY

It was the purpose of this study to investigate the effects of an intense program of spatial and temporal concepts designed and used with preschool children. The effect of the program on intelligence quotient of the preschool children was of particular interest in this experiment. The effect of the program on the concept development of preschool children was also of interest. The sample, the program, and the procedures will be described in the present chapter.

Population

The population of this study consisted of one hundred sixty (160) three-and four-year old preschool children who had been enrolled in the 1971-1972 Title I pre-kindergarten programs in Springfield, Ohio. In order to enter a Title I program designed for three-year-olds, a child had to be three by September 30, 1971. In order to enter a program for four-year-olds, a child had to be four by September 30, 1971.
In addition to the age factor, the criteria used to select the 1971-1972 project children were based on the following environmental, economic, and personal factors:

1. Limited family income as indicated by need for Aid for Dependent Children, general relief or other welfare assistance.
2. Family residence in Title I Target Area.
3. Low value or sub-standard housing conditions.
4. Dependency upon public services such as Child Welfare or Clark County Welfare Department.
5. Absence of mother or father from the home.
6. Frequent mobility of the family.
7. Educational deprivation evident in the home.
8. Extreme shyness, aggressiveness, or withdrawal characteristics evident in the child.
9. Referral or recommendation of social service agencies, home-liaison, doctor or nurse, school psychologist, etc.

The pre-kindergarten teachers screened and evaluated applicants and other likely children in the target areas, using the above criteria to select the children who would participate in the 1971-1972 Title I pre-kindergarten programs.
Selection of Sample

In May, 1972, form letters (Appendix A) were sent to the five Title I preschool teachers in Springfield, Ohio. The forms extended an invitation to all the parents who had children participating in Title I Pre-kindergartens to send their youngsters to a preschool program running from June 19 to July 28, 1972. A total of fifty-two (52) youngsters had enrolled by June 9, 1972, deadline for enrollment. However, only thirty (30) children participated in the actual program. The others became disinterested, had transportation problems, or were unavailable as the program started. These thirty (30) children were randomly assigned to the experimental and the control group. A table of random numbers was used for this selection. The first fifteen (15) children selected by means of the random process were placed into the control group. The remaining fifteen (15) children became the experimental group.

Thirty (30) children started the program and twenty-nine (29) completed it. The mortality was in the experimental group. During the 1971-1972 school year, this child had attended an afternoon pre-kindergarten session. She consistently overslept for this program, which was held in the morning. All the remaining children in both the experimental and the control groups attended at least eighty per cent (80%) of the sessions.
The Experimental Program

An intensive program designed to teach specific spatial and temporal concepts was developed by the experimenter. The program was designed to last six weeks. It contained three (3) main parts: Direct teaching, play or dramatic play activities, and art or craft activities.

The direct teaching aspect of the program relied heavily upon verbal transmission of each concept, with efforts made to have children repeat the concept's name. The classroom organization for this aspect of the program consisted of daily whole group instruction plus individual or small group instruction when needed to facilitate learning and to manipulate teaching materials in order to demonstrate the involved concept. When teaching about the concept "behind," for example, the teacher attempted to have the children vocalize the word "behind" and place an object "behind" another specified object.

The play aspect of the curriculum attempted to involve the child in a game, socio-dramatic activity, or play activity in which the child would naturally come in contact with the concept which was being taught. The teacher would verbalize the concept when it was necessary to reinforce the concept's name. When a game was played illustrating the concept "behind," the children passed and held objects "behind" their backs.
The art or craft aspect of the program consisted of an activity which either illustrated the concept being taught or required the children to utilize a concept in order to complete the art or craft activity. Verbalization of the concept was again used. The concept "behind" was taught during this segment of the program by pasting objects in front of or "behind" other designated objects in order to complete a picture.

Besides the conceptual learnings, the experimental program included typical preschool activities in the sessions. These included free play, snacks, sharing, songs, and fingerplays.

The program devoted one morning to each concept which was treated in the three previously described manners.

The following was the daily schedule for the experimental group:

8:15 - 8:30 Arrival
8:30 - 8:50 Free play
8:50 - 9:25 Direct teaching
9:25 - 9:50 Play or dramatic play involving concepts
9:50 - 10:00 Restroom
10:00 - 10:15 Snack
10:15 - 10:20 Rest period
10:20 - 10:40 Story or library time
10:40 - 11:15 Art or craft activities involving concepts
11:15 Dismissal
The Control Program

The control group engaged in the same basic types of activities as the experimental group. Direct teaching, games and play activities, and art or craft activities were used in the same proportions as in the experimental group. However, the control group selected nature as a center of interest and conducted activities which incorporated nature themes. They did not teach spatial and temporal concepts or use materials designed to teach spatial and temporal concepts.

The following was the daily schedule for the control group:

8:15 - 8:30 Arrival
8:30 - 8:50 Free play
8:50 - 9:25 Direct teaching
9:25 - 9:50 Play or dramatic play
9:50 - 10:00 Restroom
10:00 - 10:15 Snack
10:15 - 10:20 Rest period
10:20 - 10:40 Story or library time
10:40 - 11:15 Art or craft activities
11:15 Dismissal
From three experienced para-professionals who had a mean of six (6) years experience with preschool children, two (2) were selected by randomization, one to teach the experimental group and one to teach the control group. The remaining para-professional, along with the experimenter and his wife, both of whom were certified teachers, served as aides. The work of the aides consisted of preparing and arranging materials, handling paperwork, assisting in calming over-active or disruptive children, serving the children snacks, cleaning, and assisting the teachers in the daily routine without assuming the teaching role. The three aides evenly distributed their time between the experimental and control groups. This was possible since the rooms housing the experimental and the control groups were located next to each other.

**Students' Chronological Age**

This study involved two age groups; namely, a $3\frac{1}{2}$ - $4\frac{1}{2}$-year-old group of preschool children who had participated in the Title I preschool programs for three-year-olds during the 1971-1972 school year and a $4\frac{1}{2}$ - $5\frac{1}{2}$-year-old group of preschool children who had participated in the Title I preschool program for four-year-olds during the 1971-1972 school year. For purposes of this study the younger age
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<th></th>
<th>EXPERIMENTAL GROUP</th>
<th>CONTROL GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>(1) 3\frac{1}{2} - 4\frac{1}{2}-year-olds 3.75</td>
<td>(3) 3\frac{1}{2} - 4\frac{1}{2}-year-olds 4.14</td>
</tr>
<tr>
<td></td>
<td>(8) 4\frac{1}{2} - 5\frac{1}{2}-year-olds 5.21</td>
<td>(7) 4\frac{1}{2} - 5\frac{1}{2}-year-olds 5.26</td>
</tr>
<tr>
<td></td>
<td>Total 5.05</td>
<td>Total 4.92</td>
</tr>
<tr>
<td>Girls</td>
<td>(2) 3\frac{1}{2} - 4\frac{1}{2}-year-olds 4.00</td>
<td>(1) 3\frac{1}{2} - 4\frac{1}{2}-year-olds 3.83</td>
</tr>
<tr>
<td></td>
<td>(3) 4\frac{1}{2} - 5\frac{1}{2}-year-olds 5.27</td>
<td>(4) 4\frac{1}{2} - 5\frac{1}{2}-year-olds 5.35</td>
</tr>
<tr>
<td></td>
<td>Total 4.76</td>
<td>Total 5.04</td>
</tr>
</tbody>
</table>

EXPERIMENTAL GROUP MEAN 4.95  CONTROL GROUP MEAN 4.96

Parentheses enclose number of children in each group.
group will be designated as the 3½ - 4½-year-olds and the older age group will be designated as the 4½ - 5½-year olds.

The mean chronological age of the experimental and the control group are presented in Table 1. It was thought that no observed differences existed in the two groups relative to this factor.

**Students' Race and Sex**

Table 2 illustrates the race of the sample preschool children. The process of randomly assigning students to the experimental and the control groups was used to minimize the effect of race as a confounding variable in the experiment. Children who participated in the experiment were Negro or Caucasian. Ten (10) of the children were Negro. Nineteen (19) were Caucasian.

Table 2 also illustrates the sex of the sample preschool children. Sex was a criterion variable within this experiment. Random assignment of the children to the groups was used to statistically equate the groups by this variable.

**Socio-Economic Class**

The Federal Preschool Title I programs are located in designated poverty target areas. The children were selected for preschool programs on the basis of the
### TABLE 2

**STUDENTS' RACE AND SEX IN EXPERIMENTAL AND CONTROL GROUPS**

<table>
<thead>
<tr>
<th></th>
<th><strong>EXPERIMENTAL GROUP</strong></th>
<th><strong>CONTROL GROUP</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boys</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Negro</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td><strong>Girls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Negro</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

**EXPERIMENTAL GROUP TOTAL 14**  **CONTROL GROUP TOTAL 15**
criteria mentioned earlier in the chapter. Most of the children in the population and the sample came from families receiving financial aid. The children in the program would be classified as coming from lower socio-economic families.

Testing and Instrumentation

The major instrument used in this research was the Stanford-Binet Test of Mental Maturity. Since the age of the students in the sample prohibited group assessment, individual testing was conducted during the initial and final weeks of the program.

The Stanford-Binet was conducted by two qualified psychologists. One psychologist conducted the pretest; the other psychologist conducted the posttest Stanford-Binet. The tests were independent of each other. Both psychologists were experienced in individual intelligence assessment, and each had been trained in the use of the Stanford-Binet.

The order of testing was randomly assigned in both the pretest and the posttest in order to mathematically eliminate time of testing from becoming a contaminating variable relative to the instrumentation.

The Bohem Test of Basic Concepts is designed to measure children's mastery of certain concepts considered
necessary for school success. The concepts are classified under the categories of space, time, quantity, and miscellaneous. The norms for the test are based on 9737 children and are classified kindergarten, grade 1 and grade 2 children of low, middle and high socio-economic class.

The Bohem Test of Basic Concepts was administered by two (2) para-professionals who had been trained to administer the instrument. One of the para-professionals conducted the pretest; the other the posttest. The pre-test and the posttest were independent. The Bohem Test of Basic Concepts was individually administered. The order of testing was randomized over the sample. The pretesting was completed during the first two days of the program. The posttesting was conducted during the last two days of the program.

This experiment employed a completely randomized $2 \times 2 \times 2$ factorial design as described by Dayton (1970) and Hays (1963). A $2 \times 2 \times 2$ analysis of variance of I.Q. gain scores and a $2 \times 2 \times 2$ analysis of variance of posttest I.Q. with pretest I.Q. as a covariable were used to test the hypotheses concerned with measured intelligence. A $2 \times 2 \times 2$ analysis of variance of Bohem gain scores and a $2 \times 2 \times 2$ analysis of variance of posttest Bohem scores with pretest Bohem scores as a covariable were used to test the measured concept development hypotheses.
The hypotheses in this experiment were stated in the null form. Alpha level was set at .05. If the data drawn from the analysis of variance and the analysis of covariance do not allow the rejection of a null hypothesis then that null hypothesis will be accepted with the understanding that accepting the null hypothesis does not constitute statistical evidence that the null hypothesis is true. If the observed data indicates that the probability of such data occurring by chance is small (.05) that null hypotheses will be rejected and an alternative hypothesis indicating significant observed differences will be accepted as a reasonable statement about the sample groups.

Summary

It was the major purpose of this investigation to determine the effect of an intense program of spatial and temporal concepts on the measured intelligence of preschool children. In order to accomplish this goal, all the participants in Title I preschools were invited to join a six-week summer program. Those who responded were randomly assigned to an experimental and a control group.

The Stanford-Binet Test of Mental Maturity and the Bohem Test of Basic Concepts were administered as pretests and posttests. The order of testing was randomized. An
analysis of variance was computed on gain scores of both instruments with treatment variation, sex, and age as independent variables. Also an analysis of variance was computed on the posttest scores of each measure with the pretest scores used as a covariable. All computations were completed on the Manova program at The Ohio State University Computer Center.
CHAPTER IV

PRESENTATION AND INTERPRETATION OF THE DATA

This chapter is organized into three sections. The first section presents and interprets the data on measured intelligence. The second section presents and interprets the data on measured concept development. The third section contains a brief summary of the findings.

Effect on Intelligence Quotient

The major purpose of this study was to determine the effect of an intense program of spatial and temporal concepts on the measured intelligence of preschool children. It will be recalled that seven hypotheses concerning the effect of the program on measured intelligence were stated in the null form.

Intelligence was measured by individually administered Stanford-Binet Test of Mental Maturity.

A $2 \times 2 \times 2$ analysis of variance of I.Q. gain scores and a $2 \times 2 \times 2$ analysis of variance of posttest I.Q. with pretest I.Q. as a covariable were the statistical methods used to test all hypotheses. Levels of
significance were set at .05 and significant values were
determined by means of an F test. A completely randomized
design was used to statistically equate all cells.

In order to facilitate the interpretation of the
data, the seven hypotheses concerned with measured intelli-
gence will be restated.

1. There is no significant difference in measured
intelligence between preschool children who have partici-
pated in an intense program of spatial and temporal
concepts and preschool children who have participated in
a similar program without the concept emphasis.

2. There is no significant difference in measured
intelligence between preschool children who have partici-
pated in an intense program of spatial and temporal
concepts and preschool children who have participated in
a similar program without the concept emphasis when
classified according to sex.

3. There is no significant difference in measured
intelligence between preschool children who have partici-
pated in an intense program of spatial and temporal
concepts and preschool children who have participated in
a similar program without the concept emphasis when
classified according to age.

4. There is no significant treatment x sex inter-
action in measured intelligence between preschool children
who have participated in an intense program of spatial and
temporal concept and preschool children who have partici­
pated in a similar program without the concept emphasis.

5. There is no significant treatment x age inter­
action in measured intelligence between preschool
children who have participated in an intense program of
spatial and temporal concept and preschool children who
have participated in a similar program without the concept
emphasis.

6. There is no significant sex x age interaction
in measured intelligence between preschool children who
have participated in an intense program of spatial and
temporal concept and preschool children who have partici­
pated in a similar program without the concept emphasis.

7. There is no significant treatment x sex x age
interaction in measured intelligence between preschool
children who have participated in an intense program of
spatial and temporal concepts and preschool children who
have participated in a similar program without the concept
emphasis.

The means and standard deviations of the children's
gains in measured intelligence are presented in Table 5.

Table 4 shows a 2 x 2 x 2 analysis of variance in
which intelligence quotient gain scores, the dependent
variable, are analyzed according to treatment, sex and age.
### TABLE 3

MEANS AND STANDARD DEVIATIONS OF INTELLIGENCE QUOTIENTS AND INTELLIGENCE QUOTIENT GAIN SCORES

<table>
<thead>
<tr>
<th>Treatment A</th>
<th></th>
<th>PRE IQ</th>
<th>POST IQ</th>
<th>IQ GAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys 3½ - 4½</td>
<td>M</td>
<td>97.000</td>
<td>98.000</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4½ - 5½</td>
<td>M</td>
<td>99.375</td>
<td>102.875</td>
<td>3.500</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>12.839</td>
<td>12.933</td>
<td>4.000</td>
</tr>
<tr>
<td>Girls 3½ - 4½</td>
<td>M</td>
<td>87.500</td>
<td>102.500</td>
<td>20.000</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>3.536</td>
<td>3.536</td>
<td>14.142</td>
</tr>
<tr>
<td>4½ - 5½</td>
<td>M</td>
<td>82.000</td>
<td>83.667</td>
<td>1.667</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>19.079</td>
<td>20.599</td>
<td>1.528</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment B</th>
<th></th>
<th>PRE IQ</th>
<th>POST IQ</th>
<th>IQ GAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys 3½ - 4½</td>
<td>M</td>
<td>91.000</td>
<td>96.000</td>
<td>5.000</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>9.000</td>
<td>13.229</td>
<td>5.568</td>
</tr>
<tr>
<td>4½ - 5½</td>
<td>M</td>
<td>97.714</td>
<td>100.143</td>
<td>2.429</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>8.883</td>
<td>10.057</td>
<td>5.793</td>
</tr>
<tr>
<td>Girls 3½ - 4½</td>
<td>M</td>
<td>90.000</td>
<td>103.000</td>
<td>13.000</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4½ - 5½</td>
<td>M</td>
<td>97.500</td>
<td>92.750</td>
<td>-4.750</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>12.557</td>
<td>16.681</td>
<td>4.646</td>
</tr>
</tbody>
</table>

**Note** - All values rounded to the nearest thousandth.
TABLE 4

ANALYSIS OF VARIANCE OF INTELLIGENCE QUOTIENT GAIN SCORES
BY TREATMENT, SEX, AND AGE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>ms</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Cells</td>
<td>21</td>
<td>30.721</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>1</td>
<td>91.381</td>
<td>2.975</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>2.329</td>
<td>0.076</td>
</tr>
<tr>
<td>Age</td>
<td>1</td>
<td>401.544</td>
<td>13.071 *</td>
</tr>
<tr>
<td>Treatment x Sex</td>
<td>1</td>
<td>78.773</td>
<td>2.564</td>
</tr>
<tr>
<td>Treatment x Age</td>
<td>1</td>
<td>8.914</td>
<td>0.290</td>
</tr>
<tr>
<td>Sex x Age</td>
<td>1</td>
<td>346.420</td>
<td>11.276 *</td>
</tr>
<tr>
<td>Treatment x Sex x Age</td>
<td>1</td>
<td>8.679</td>
<td>0.283</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note - All values rounded to the nearest thousandth.

*P < .01
Table 8 shows a 2 x 2 x 2 analysis of variance of posttest I.Q. with treatment, sex, and age as the independent and with pretest I.Q. as a covariable.

It can be seen in Table 4, as shown by the 2.975 value of F for the treatment variation, and in Table 8, as shown by the 2.562 value of F for the treatment variation, that there was no significant difference in intelligence quotient gain scores between the fourteen (14) preschool students in the experimental group and the fifteen (15) preschool students in the control group. As a consequence, the null hypotheses of no significant difference in measured intelligence between the two groups was accepted. The conclusion can be drawn that the treatment, taken by itself, did not result in significantly different intelligence quotients or intelligence quotient gain scores for the experimental and the control group. It should be noted, however, that the F values pertaining to the treatment factor approximate significance in both the analysis of variance I.Q. gain scores (F=2.975; P<.099) and the analysis of variance of posttest I.Q. with pretest I.Q. as a covariable (F=2.562; P<.125).

Table 4 and Table 8 also show, as indicated by the respective F values of .076 and 0.000 for the sex variable, that there was no significant difference in intelligence quotient among the nine (9) Group A boys and five (5)
Group A girls, the ten (10) Group B boys and the five (5) Group B girls. As a result, the null hypothesis of no significant difference in intelligence quotient gain scores between students classified according to sex was accepted. The conclusion can be drawn, therefore, that sex, taken by itself, did no result in significantly different intelligence quotients or intelligence quotient gain scores for the boys and the girls in the two groups.

The null hypothesis that no significant differences in measured intelligence between preschool students who had participated in an intense program of concept development and preschool students who had participated in a similar program without the concept emphasis when classified according to age is of interest in this study. An inspection of the F value of 13.071 in Table 4 and the F value of 12.047 for the age variation in Table 8 reveals that this null hypothesis was rejected at the .05 level of confidence. The reasonable statement about the sample accepted upon rejection of the null is the alternative hypothesis. Hence, the alternative hypothesis of significance in the age variation between measured intelligence and the independent variable of age was accepted.

The data in Table 4 and Table 8, while showing that there was significant variation between the dependent variable of intelligence quotient gain scores and the independent
variable of age, do not demonstrate where the significance occurred. In order to show this, an inspection of the mean intelligence quotient gain scores of the 1 Group A 3½ - 4½-year-old boys, the 8 Group A 4½ - 5½-year-old boys, the 2 Group A 3½ - 4½-year-old girls, the 3 Group A 4½ - 5½-year-old girls, the 3 Group B 3½ - 4½-year-old boys, the 7 Group B 4½ - 5½-year-old boys, the 1 Group B 3½ - 4½-year-old girls, and the 4 Group B 4½ - 5½-year-old girls. These scores are presented in Table 5.

Inspection of Table 5 reveals that the Group A 3½ - 4½-year-old girls and the Group B 3½ - 4½-year-old girls made higher mean intelligence quotient gain scores than the Group A 3½ - 4½-year-old boys, the Group A 4½ - 5½-year-old boys, the Group A 4½ - 5½-year-old girls, and Group B 3½ - 4½-year-old boys and the Group B 4½ - 5½-year-old boys, while these five groups attained means that were similar. The Group B 4½ - 5½-year-old girls' mean intelligence gain score was lower than the other seven groups. Table 5 also reveals that the three groups that achieved the highest mean intelligence quotient gain scores contained the 3½ - 4½-year-old preschool children. At the .05 level of confidence, then, the independent variable, age, accounts for differences among the groups, and, as stated above, the differences were statistically significant.
An examination of the 2.564 value of F for the treatment x sex variation in Table 4 and an examination of the F value of 2.336 for the treatment x sex in Table 8 reveals that there was no significant difference in measured intelligence among the 9 Group A boys, 5 Group A girls, 10 Group B boys, and 5 Group B girls. As a result, the null hypothesis of no significant treatment x sex interaction was accepted. One can conclude, on the basis of this finding, that the combined effect of the two independent variables, treatment group variation and children's sex, did not result in significantly different intelligence quotient scores for the four preschool groups.

The .290 value of F for the treatment x age variation shown in Table 4 and the .021 value of F for the treatment x age variation shown in Table 10 indicate that there was no significant difference in intelligence quotient gain scores among the Group A 3½ - 4½-year-old preschool children, the Group A 4½ - 5½-year-old preschool children and the Group B 4½ - 5½-year-old preschool children. Consequently, the null hypothesis of no significant treatment x age interaction was accepted. It must be concluded, therefore, that the combined effect of the two independent variables of treatment groups and children's ages did not result in significantly different intelligence quotient scores among the combined levels of the two independent variables.
In terms of this study, the conclusion can be drawn from the above findings that a significant difference \( (F = 13.071; \ P < .01) \) in intelligence quotient gain scores was evident among the sample groups when classified according to age. Stated in another way, being \( 3\frac{1}{2}-4\frac{1}{2} \) years of age and participating in the described preschool programs of either treatment group resulted in higher mean intelligence quotient gain scores than being \( 4\frac{1}{2}-5\frac{1}{2} \) years of age and participating in the described programs of either treatment group. The analysis of covariance shown in Table 8 indicates that adjusting the posttest I.Q. scores by using pretest I.Q. as a covariable also results in differences that would occur by chance less than one time out of a hundred.

**Table 5**

**Mean Intelligence Quotient Gain Scores**

<table>
<thead>
<tr>
<th></th>
<th>GIRLS</th>
<th>BOYS</th>
<th>GIRLS</th>
<th>BOYS</th>
<th>GIRLS</th>
<th>GIRLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=2</td>
<td>N=1</td>
<td>N=3</td>
<td>N=7</td>
<td>N=8</td>
<td>N=8</td>
<td>N=1</td>
</tr>
<tr>
<td>-4.75</td>
<td>+1</td>
<td>+1.68</td>
<td>+2.43</td>
<td>+3.5</td>
<td>+5</td>
<td>+13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GR. B</th>
<th>GR. A</th>
<th>GR. A</th>
<th>GR. B</th>
<th>GR. A</th>
<th>GR. B</th>
<th>GR. B</th>
<th>GR. A</th>
</tr>
</thead>
<tbody>
<tr>
<td>4(\frac{1}{2})-5(\frac{1}{2})</td>
<td>3(\frac{1}{2})-4(\frac{1}{2})</td>
<td>4(\frac{1}{2})-5(\frac{1}{2})</td>
<td>4(\frac{1}{2})-5(\frac{1}{2})</td>
<td>3(\frac{1}{2})-4(\frac{1}{2})</td>
<td>3(\frac{1}{2})-4(\frac{1}{2})</td>
<td>3(\frac{1}{2})-4(\frac{1}{2})</td>
<td>3(\frac{1}{2})-4(\frac{1}{2})</td>
</tr>
</tbody>
</table>
Examination of the sex x age variation in Table 4 which has an F value of 11.276, and an examination of the sex x age variation in Table 8, which has an F value of 10.464, reveal that the null hypothesis of no significant sex x age interaction was rejected. The alternative hypothesis of significant interaction between intelligence quotient scores and the combined independent variables of preschool children's sex and preschool children's age was accepted.

Although the data in Table 4 and Table 8 reveal significant sex x age interaction between the dependent variable of intelligence quotient gain scores and the combined independent variables of preschool children's sex and preschool children's age, they do not show what the interaction produced. In order to show this, an inspection of the mean intelligence quotient gain scores in Table 5 is again necessary.

Inspection of Table 5 shows that Group A preschool girls 3½ - 4½-years old and Group B preschool girls 3½ - 4½ years old attained much higher intelligence quotient gain scores than the Group A preschool boys 3½ - 4½ years old, the Group A preschool boys 4½ - 5½ years old, the Group A preschool girls 4½ - 5½ years old, the Group B preschool boys 3½ - 4½ years old, the Group B preschool boys 4½ - 5½ years old or the Group B preschool girls 4½ - 5½ years old. Therefore, the interaction of preschool
children's sex and preschool children's age resulted in higher mean intelligence quotient gain scores for the Group A preschool girls 3½ - 4½ years old and the Group B preschool girls 3½ - 4½ years old.

From the above findings, the conclusion can be drawn that the significant interaction of preschool children's sex and preschool children's age resulted in marked differences \( (F = 11.276; P < .01) \). The Group A preschool girls 3½ - 4½ years old and the Group B preschool girls 3½ - 4½ years old achieved higher intelligence quotient gain scores than the preschool children of the other six groups. In other words, being 3½ - 4½ years old and being female resulted in higher intelligence quotient gain scores than any other sex x age combination in the study. The probability of this occurring by chance is less than one time out of a hundred. Table 8 shows a similar probability \( (F = 10.464; P < .01) \) for the sex x age variation.

An examination of the F value of .283 in Table 4 and an examination of the F value of .000 in Table 8 reveal that no significant interaction between measured intelligence quotient scores and the combined independent variables of treatment group variation, preschool children's sex, and preschool children's age could be found. The null hypothesis of no significant interaction between preschool students who had participated in an intense program of
spatial and temporal concepts and preschool students who had participated in a similar program without the concept emphasis when classified by treatment group variation, sex, and age was accepted.

The treatment x sex x age variation is of major interest in this study since the age variation and the sex x age variation show significance.

**Effect on Concept Development**

It was also of importance in this study to determine the effect of the intense program of spatial and temporal concepts on measured concept development of young children. Seven hypothesis, concerning the effect of the program on measured concept development, were stated in the null form.

Concept development was measured by individually administered Bohem Test of Basic Concepts.

A 2 x 2 x 2 analysis of variance on Bohem Test of Basic Concepts and a 2 x 2 x 2 analysis of variance of posttest Bohem scores with pretest scores used as a co-variable were the statistical techniques used to test all hypotheses. The levels of significance were again set at .05 and significant values were determined by F tests.

The seven hypotheses (8-14) concerned with concept development were:
8. There is no significant difference in measured concept development between preschool children who have participated in an intense program of spatial and temporal concepts and preschool children who have participated in a similar program without the concept emphasis.

9. There is no significant difference in measured concept development between preschool children who have participated in an intense program of concept development and preschool children who have participated in a similar program without the concept emphasis when classified according to sex.

10. There is no significant difference in measured concept development between preschool children who have participated in an intense program of spatial and temporal concepts and preschool children who have participated in a similar program without the concept emphasis when classified according to age.

11. There is no significant treatment x sex interaction in measured concept development between preschool children who have participated in an intense program of spatial and temporal concepts and preschool children who have participated in a similar program without the concept emphasis.

12. There is no significant treatment x age interaction in measured concept development between preschool
children who have participated in an intense program of spatial and temporal concepts and preschool children who have participated in a similar program without the concept emphasis.

13. There is no significant sex x age interaction in measured concept development between preschool children who have participated in an intense program of spatial and temporal concept and preschool children who have participated in a similar program without the concept emphasis.

14. There is no significant treatment x sex x age interaction between preschool children who have participated in an intense program of spatial and temporal concepts and preschool children who have participated in a similar program without the concept emphasis.

Table 6 shows the data from a 2 x 2 x 2 analysis of variance in which the dependent variable is Bohem Test of Basic Concepts gain scores and the independent variables are treatment, sex, and age.

Table 9 shows the data from a 2 x 2 x 2 analysis of variance in which the dependent variable is posttest Bohem scores with pre-test Bohem scores used as a co-variable and treatment, sex, and age are the independent variables.

Table 6 illustrates the 11.190 value of F for the treatment variation, and Table 11 shows a 10.068 value of
## TABLE 6

ANALYSIS OF VARIANCE OF CONCEPT DEVELOPMENT GAIN SCORES
BY TREATMENT, SEX, AND AGE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
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<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Cells</td>
<td>21</td>
<td>2.455</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>1</td>
<td>27.468</td>
<td>11.190 *</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>1.974</td>
<td>0.804</td>
</tr>
<tr>
<td>Age</td>
<td>1</td>
<td>3.000</td>
<td>1.222</td>
</tr>
<tr>
<td>Treatment x Sex</td>
<td>1</td>
<td>1.114</td>
<td>0.454</td>
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<tr>
<td>Treatment x Age</td>
<td>1</td>
<td>0.412</td>
<td>0.168</td>
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<tr>
<td>Sex x Age</td>
<td>1</td>
<td>4.078</td>
<td>1.661</td>
</tr>
<tr>
<td>Treatment x Sex x Age</td>
<td>1</td>
<td>1.165</td>
<td>0.474</td>
</tr>
<tr>
<td>Total</td>
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</table>

Note - All values rounded to the nearest thousandth

*P < .01
<table>
<thead>
<tr>
<th>Treatment A</th>
<th>BOHEM</th>
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<th>BOHEM GAIN</th>
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<tr>
<td><strong>Boys</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$3\frac{1}{2} - 4\frac{1}{2}$ M</td>
<td>7.000</td>
<td>10.000</td>
<td>3.000</td>
</tr>
<tr>
<td>SD</td>
<td></td>
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</tr>
<tr>
<td>$4\frac{1}{2} - 5\frac{1}{2}$ M</td>
<td>10.000</td>
<td>12.000</td>
<td>2.000</td>
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<tr>
<td>SD</td>
<td>3.338</td>
<td>3.295</td>
<td>1.414</td>
</tr>
<tr>
<td><strong>Girls</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$3\frac{1}{2} - 4\frac{1}{2}$ M</td>
<td>5.000</td>
<td>7.500</td>
<td>2.500</td>
</tr>
<tr>
<td>SD</td>
<td>1.414</td>
<td>2.121</td>
<td>0.707</td>
</tr>
<tr>
<td>$4\frac{1}{2} - 5\frac{1}{2}$ M</td>
<td>7.333</td>
<td>9.667</td>
<td>2.333</td>
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<tr>
<td>SD</td>
<td>3.055</td>
<td>3.512</td>
<td>2.517</td>
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<table>
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<tr>
<th>Treatment B</th>
<th>BOHEM</th>
<th>POST BOHEM</th>
<th>BOHEM GAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boys</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$3\frac{1}{2} - 4\frac{1}{2}$ M</td>
<td>5.333</td>
<td>6.667</td>
<td>1.333</td>
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<td>SD</td>
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<td>$4\frac{1}{2} - 5\frac{1}{2}$ M</td>
<td>10.000</td>
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<tr>
<td>SD</td>
<td>0.816</td>
<td>2.149</td>
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<tr>
<td><strong>Girls</strong></td>
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<td>$3\frac{1}{2} - 4\frac{1}{2}$ M</td>
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<td>8.000</td>
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</tr>
<tr>
<td>$4\frac{1}{2} - 5\frac{1}{2}$ M</td>
<td>9.750</td>
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<td>SD</td>
<td>4.500</td>
<td>3.775</td>
<td>1.414</td>
</tr>
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</table>

*Note* - All values rounded to the nearest thousandth.
**TABLE 8**

ANALYSIS OF VARIANCE OF POTTEST INTELLIGENCE QUOTIENT SCORES OF STUDENTS CLASSIFIED BY TREATMENT GROUP VARIATION, SEX, AND AGE, WITH PRETEST INTELLIGENT QUOTIENT SCORES AS A COVARIABLE

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<th>ms</th>
<th>f</th>
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</thead>
<tbody>
<tr>
<td>Within Cells</td>
<td>20</td>
<td>24.315</td>
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</tr>
<tr>
<td>Regression</td>
<td>1</td>
<td>3337.349</td>
<td>137.254*</td>
</tr>
<tr>
<td>Treatment</td>
<td>1</td>
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<tr>
<td>Sex</td>
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<td>-0.004</td>
<td>-0.000</td>
</tr>
<tr>
<td>Age</td>
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<td>292.923</td>
<td>12.047*</td>
</tr>
<tr>
<td>Treatment x Sex</td>
<td>1</td>
<td>56.794</td>
<td>2.336</td>
</tr>
<tr>
<td>Treatment x Age</td>
<td>1</td>
<td>0.504</td>
<td>0.021</td>
</tr>
<tr>
<td>Sex x Age</td>
<td>1</td>
<td>254.422</td>
<td>10.464*</td>
</tr>
<tr>
<td>Treatment x Sex x Age</td>
<td>1</td>
<td>0.008</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Total                  | 28 |       |       |

Note - All values rounded to the nearest thousandth.

*P < .01
**TABLE 9**

ANALYSIS OF VARIANCE OF POSTTEST BOHEM SCORES OF STUDENTS CLASSIFIED BY TREATMENT GROUP VARIATION, SEX, AND AGE, WITH PRETEST BOHEM SCORES AS A COVARIABLE

<table>
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<th>Source</th>
<th>df</th>
<th>ms</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Cells</td>
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<td>2.462</td>
<td></td>
</tr>
<tr>
<td>Regression</td>
<td>1</td>
<td>131.051</td>
<td>53.228*</td>
</tr>
<tr>
<td>Treatment</td>
<td>1</td>
<td>26.120</td>
<td>10.608*</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>1.038</td>
<td>0.422</td>
</tr>
<tr>
<td>Age</td>
<td>1</td>
<td>0.393</td>
<td>0.160</td>
</tr>
<tr>
<td>Treatment x Sex</td>
<td>1</td>
<td>1.990</td>
<td>0.808</td>
</tr>
<tr>
<td>Treatment x Age</td>
<td>1</td>
<td>0.229</td>
<td>0.093</td>
</tr>
<tr>
<td>Sex x Age</td>
<td>1</td>
<td>3.140</td>
<td>1.275</td>
</tr>
<tr>
<td>Treatment x Sex x Age</td>
<td>1</td>
<td>0.880</td>
<td>0.357</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note - All values rounded to the nearest thousandth.

* P<.01
### TABLE 10

**ANALYSIS OF VARIANCE OF POSTTEST BOHEM SCORES OF STUDENTS CLASSIFIED BY TREATMENT GROUP VARIATION, SEX, AND AGE, WITH PRETEST BOHEM SCORES AS A COVARIABLE**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>ms</th>
<th>$f$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Cells</td>
<td>20</td>
<td>2.462</td>
<td></td>
</tr>
<tr>
<td>Regression</td>
<td>1</td>
<td>131.051</td>
<td>53.223*</td>
</tr>
<tr>
<td>Treatment</td>
<td>1</td>
<td>26.120</td>
<td>10.608*</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>1.038</td>
<td>0.422</td>
</tr>
<tr>
<td>Age</td>
<td>1</td>
<td>0.393</td>
<td>0.160</td>
</tr>
<tr>
<td>Treatment x Sex</td>
<td>1</td>
<td>1.990</td>
<td>0.808</td>
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<td>Treatment x Age</td>
<td>1</td>
<td>0.229</td>
<td>0.093</td>
</tr>
<tr>
<td>Sex x Age</td>
<td>1</td>
<td>3.140</td>
<td>1.275</td>
</tr>
<tr>
<td>Treatment x Sex x Age</td>
<td>1</td>
<td>0.880</td>
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<tr>
<td><strong>Total</strong></td>
<td>28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note - All values rounded to the nearest thousandth.*

*P < .01*
F for the treatment variation. Both findings demonstrate a significant difference between the 14 Group A preschool children. Hence, the alternative hypothesis that there is a significant difference between preschool children who have participated in an intense program of spatial and temporal concepts and preschool children who have participated in a similar program without the concept emphasis was accepted.

The conclusion can be reached that the treatment variation, taken alone, resulted in significant differences between Group A and Group B ($F=11.190; P<.01$) in Bohem gain scores and ($F=10.608; P<.01$) in posttest Bohem scores when pretest scores are used as a covariable.

In order to determine the nature of the difference in the treatment variation, an examination of the data in Table 7 is necessary. The mean Bohem Test of Basic Concepts gain scores is significantly higher for the preschool children of Treatment Group A than the mean gain scores for preschool children of Treatment Group B. Furthermore, this difference would occur by chance less than one time in a hundred.

Table 6 shows an $F$ value of .804 for the sex variable, while the data in Table 9 shows an $F$ value of .422 for the sex variable. These findings indicate that there was no significant difference in Bohem Test of Basic Concepts
scores between the preschool boys and the preschool girls. Consequently, the null hypothesis of no significant difference in Bohem Test of Basic Concepts scores between preschool students classified according to sex was accepted. One can conclude, therefore, that sex differences alone did not result in significantly different Bohem Test of Basic Concepts gain scores for the boys and the girls of the two groups.

An examination of Table 6 also shows the 1.222 value of F for the age variable, while an examination of Table 9 shows .160 as the value of F for the age variable. Both statistics reveal that there was no significant difference in Bohem Test of Basic Concepts gain scores between the 3½ - 4½-year-old preschool children and the 4½ - 5½-year-old preschool children. Therefore, the null hypothesis of no significant difference in Bohem Test of Basic Concepts scores in children classified according to age was accepted. The conclusion can be drawn, therefore, that age difference alone did not result in significantly different Bohem Test of Basic Concepts for the 3½ - 4½-year-old preschool children and the 4½ - 5½-year-old preschool children in the two treatment groups.

Inspection of the .454 value of F for the treatment x sex variation in Table 6 and the .808 value of F for the treatment x sex variation in Table 9 reveals that there was
no significant difference in Bohem Test of Basic Concepts scores among the 9 Group A boys, the 5 Group A girls, the 10 Group B boys, and the 5 Group B girls. As a result, the null hypothesis of no significant treatment x sex interaction was accepted. On the basis of this finding, one can conclude that the combined effect of the two independent variables, treatment group variation and preschool children's sex, did not result in significantly different Bohem Test of Basic Concepts scores for the four preschool groups.

The .168 value of F for the treatment x age variation shown in Table 6 and the .093 value of F for the treatment x age variation shown in Table 9 indicate that there was no significant difference in Bohem Test of Basic Concepts gain scores among the 3 Group A 3½ - 4½-year-old preschool children, the 4 Group B 3½ - 4½-year-old preschool children and the 11 Group B 4½ - 5½-year-old preschool children. Consequently, the null hypothesis of no significant treatment x age variation was accepted. It must be concluded, therefore, that the combined effect of the two independent variables, treatment group variation and sex, did not result in significantly different Bohem Test of Basic Concepts scores among these four groups.

Table 6 also shows the 1.661 value of F for the sex x age variation, while Table 9 shows the 1.275 value of F
for the sex x age variation. Both findings demonstrate that there was no significant difference in Bohem Test of Basic Concepts scores among the preschool boys age 3½ – 4½, the preschool girls age 3½ – 4½, the preschool boys age 4½ – 5½, and the preschool girls age 4½ – 5½. Therefore, the null hypothesis of no significant sex x age interaction was accepted.

One can conclude as a result of this finding that the combined effect of the two independent variables, preschool children's sex and preschool children's age did not result in significantly different Bohem Test of Basic Concepts scores for these four groups of children.

Finally, inspection of the F value of .474 in Table 6 for the treatment x sex x age variation and the F value of .375 in Table 9 reveals that there was no significant interaction between Bohem Test of Basic Concept scores and the combined independent variables of treatment group variation, preschool children's sex, and preschool children's age. The null hypothesis of no significant interaction in Bohem Test of Basic Concepts scores between preschool children who had participated in an intense program of spatial and temporal concepts and preschool children who had participated in a similar program without the concept emphasis when classified by treatment group variation, by sex, and by age was accepted.
Summary

Seven null hypotheses, each dealing with whether there were significant differences between and among groups of preschool children in their gain scores derived from the pretests and posttests of the Stanford-Binet Test of Mental Maturity were tested by a 2 x 2 x 2 analysis of variance. These seven null hypotheses were also tested by a 2 x 2 x 2 analysis of variance on the posttest Stanford-Binet Test of Mental Maturity with pretest Stanford-Binet scores used as a covariable.

Seven additional null hypotheses, each of these dealing with whether there were significant differences between and among groups of preschool children in their gain scores derived from the pretests and posttests of the Bohem Test of Basic Concepts were also tested by a 2 x 2 x 2 analysis of variance. Significant differences between and among preschool in concept development was also tested by a 2 x 2 x 2 analysis of variance of posttest Bohem Test of Basic Concepts scores with pretest Bohem scores used as a covariable. The results of the testing were presented in this chapter, and a brief summary of the findings is made below.

In the first place, the independent variable of treatment, taken alone, combined with sex, combined with age, or combined with sex and age did not result in any
significant differences in intelligence quotient scores between or among student groups.

The independent variable of sex when taken alone did not result in significant differences in intelligence quotient scores.

The independent variable of preschool children's age, taken alone, resulted in significantly different intelligency quotient scores between the 3½ - 4½-year-old preschool children and the 4½ - 5½-year-old preschool children. Inspection of the mean intelligence quotient gain scores revealed that the younger children, the 3½ - 4½-year-old group, had attained higher intelligence quotient gain scores than the 4½ - 5½-year-old preschool children. Furthermore, the combined independent variables of preschool children's sex and preschool children's age resulted in significantly different intelligence quotient scores among the 3½ - 4½-year-old preschool boys, the 4½ - 5½-year-old preschool boys, the 3½ - 4½-year-old preschool girls, and the 4½ - 5½-year-old preschool girls.

The examination of the mean intelligence quotient gain scores showed that the 3½ - 4½-year-old preschool girls attained higher gain scores than the 4½ - 5½-year-old preschool girls, the 3½ - 4½-year-old preschool boys and the 4½ - 5½-year-old preschool boys.
The findings concerning the hypotheses about the dependent variable of Bohem Test of Basic Concepts will be summarized below.

The independent variable of treatment variation did result in significant difference in Bohem Test of Basic Concepts scores between the 14 Group A preschool children and the 15 Group B preschool children. Study of the mean gain scores revealed that Treatment Group A, the experimental group, achieved the higher gain scores.

The independent variable of treatment, however, combined with sex, combined with age, or combined with sex and age, did not result in any significant difference between or among the groups of preschool children.

Inspection of the independent variable of sex, taken alone or combined with age, showed that no significant differences resulted in Bohem Test of Basic Concepts gain scores.

Finally, the data revealed that the dependent variable of age, taken alone, did not result in significant differences in Bohem Test of Basic Concepts scores.
CHAPTER V

SUMMARY AND CONCLUSIONS

The Purpose and Procedures of the Study

The purpose of this study was to determine the effect of an intensive program of teaching spatial and temporal concepts on the intellectual development of preschool children. The major interest was the effect of the program on children's measured intelligence. It was also of interest to determine the program's effect on concept development.

Twenty-nine (29) children participated in the study from a population of one hundred and sixty (160) preschool children involved in Title I preschool programs in Springfield, Ohio, during the 1971-1972 school year. The sample children were randomly assigned to an experimental group (Treatment Group A) and a control group (Treatment Group B).

An intensive program of spatial and temporal concepts was conducted with the experimental group, while a program without the concept emphasis was conducted with the control group. Direct teaching, play or dramatic play activities,
and art or craft activities were employed in both the experimental and the control groups.

The staff consisted of two teachers and three aides. The teachers were randomly selected and assigned. The aides equally divided their time between the treatment groups.

An individually administered Stanford-Binet Test of Mental Maturity was used as a pretest and as a posttest in each of the 1 Group A 3½ - 4½-year-old preschool boys, the 8 Group A 4½ - 5½-year-old preschool boys, the 2 Group A 3½ - 4½-year-old preschool girls, the 3 Group A 4½ - 5½-year-old preschool girls, the 3 Group B 3½ - 4½-year-old preschool boys, the 1 Group B 3½ - 4½-year-old preschool girls, and the 4 Group B 4½ - 5½-year-old preschool girls. Two qualified psychologists conducted the testing; one conducted the pretest, the other the posttest. The pretest and the posttest were independent of each other. A 2 x 2 x 2 analysis of variance of I.Q. gain scores with the independent variables of treatment group variation, sex, and age and a 2 x 2 x 2 analysis of variance of posttest I.Q. with pretest I.Q. as a covariable were used to determine whether there were significant differences between and among the groups.

An individually administered Bohem Test of Basic Concepts also was used as a pretest and as a posttest. Two trained para-professionals conducted the testing; one con-
ducted the pretesting, the other the posttesting. Once again, the pretest and the posttest were kept independent of each other. A $2 \times 2 \times 2$ analysis of variance on Bohem gain scores and a $2 \times 2 \times 2$ analysis of variance on the posttest Bohem scores with pretest Bohem scores used as a covariable were conducted to determine whether there were significant differences in Bohem Test of Basic Concepts gain scores between and among the groups.

**Summary of Findings**

The independent variables in this study were the treatment effect on an intensive program of spatial and temporal concepts, preschool children's sex, and preschool children's ages. The dependent variables were measured intelligence quotient and measured concept development.

Although the data gathered on measured intelligence indicate that the Group A preschool children made higher mean intelligence quotient gain scores than the Group B preschool children, the values of $F$ for both the analysis of variance and the analysis of covariance were not significant at the decided alpha level of .05. Hence, the null hypotheses of no significant treatment effect were accepted.

No significant difference in measured intelligence quotient was found between the preschool boys and the preschool girls.
Both the analysis of variance and the analysis of covariance found significant difference in intelligence quotient (p. $\leq .01$) between the $3\frac{1}{2} - 4\frac{1}{2}$-year-old preschool children and the $4\frac{1}{2} - 5\frac{1}{2}$-year-old preschool children. An inspection of the mean intelligence quotient gain scores in Table 5 revealed that the $3\frac{1}{2} - 4\frac{1}{2}$-year-old preschool children had achieved the higher scores.

The data on measured intelligence revealed a sex x age interaction. Significant difference in measured intelligence quotient was found among the $3\frac{1}{2} - 4\frac{1}{2}$-year-old boys, the $4\frac{1}{2} - 5\frac{1}{2}$-year-old boys, the $3\frac{1}{2} - 4\frac{1}{2}$-year-old girls, and the $4\frac{1}{2} - 5\frac{1}{2}$-year-old girls. The mean intelligence quotient gain scores in Table 5 revealed that the $3\frac{1}{2} - 4\frac{1}{2}$-year-old girls achieved higher gain scores than any other sex x age classification. The difference was significant under the analysis of variance and the analysis of covariance (p. $\leq .01$).

At the .05 level, the null hypotheses concerning treatment x sex, treatment x age, and treatment x sex x age were accepted. The data revealed no significant difference in mean intelligence quotient among these respective groups of preschool children.

In general, the data on measured intelligence only allowed rejection of the null hypotheses concerning preschool children classified according to age and sex x age.
The data on measured concept development from both the analysis of variance and the analysis of covariance revealed significant difference between the Group A preschool children and the Group B preschool children. An examination of the mean gain scores demonstrated that the Group A preschool children achieved higher gain scores than did the Group B preschool children. In both the analysis of variance and the analysis of covariance, the difference would occur by chance less than one time in a hundred (p < .01).

No significant difference in measured concept development was found between preschool children classified according to sex or between preschool children classified according to age.

The data on measured concept development further revealed no significant treatment x sex, treatment x age, sex x age, or treatment x sex x age interaction.

In short, the data on measured concept development only allowed the rejection of the null hypothesis concerning the treatment effect; namely, the intensive program of spatial and temporal concepts.

Implications Related to Measured Intelligence

This study represents an attempt to observe the effect of one aspect of preschool curriculum on measured I.Q.,
concept development. A specific type of concept was identified and an intensive program was developed using preschool teaching techniques.

Since the intensive program did not demonstrate significant measured I.Q. difference for the experimental group over the control group, the concept development program used in the study cannot be considered as a successful means of changing intelligence quotient. Furthermore, since both experimental and control groups used teaching techniques common to many preschool programs, this research does not support spatial and temporal concepts as important preschool curriculum subject matter for changing measured intelligence quotient.

A "match" between the learner and his environment may be evident if the age variation finding is recalled. Significant differences were found between the $3\frac{1}{2} - 4\frac{1}{2}$-year-old children and the $4\frac{1}{2} - 5\frac{1}{2}$-year-old children. The data in Table 5 revealed that the younger preschool children had demonstrated larger gains in measured I.Q. than had the older preschool children. The difference was significant ($p < .01$). This is not an unfamiliar finding in the field of early childhood education. Some research has suggested that certain programs may benefit children age three. Palmer (1968) states that age three may still be young enough to alleviate some of the effects of poverty. Since
the young children in the experimental and the control groups both made gains in measured I.Q., the teaching techniques employed may have been the cause of the gains. A conclusion that might be drawn from this is that teaching techniques may be more important for the children 3½ - 4½ years old than precisely what is taught. It could also be that the organization, the "structure" of the program, accounted for the younger children's gains.

Educational and psychological theory are far behind testing and measurement. I.Q. tests are extremely reliable but I.Q. is difficult to adequately define. Intellectual growth research implies a need for much further research on cognitive development.

Implications Related to Concept Development

The experimental program did teach the spatial and temporal concepts. The experimental group was significantly superior to the control group under both the analysis of variance of Bohem Test of Basic Concepts gain scores and the analysis of covariance of posttest Bohem scores with pretest Bohem scores used as a covariable.

This is an important finding since the spatial and temporal concepts used in the study may be related to later school achievement. (Bohem, 1967) It is also important since other learnings could possibly be successfully taught with the same teaching strategies and program organization.
The findings of no significant differences in measured concept development among the children when analyzed according to the variables of age, sex, treatment x age, treatment x sex, sex x age, or treatment x sex x age, are also important since it seems that children of the different sex and age combinations sampled in this study can be taught spatial and temporal concepts, and possibly other preschool subject matter, by using the program described in this study.

The data do not reveal whether one or a combination of teaching techniques employed in this study was responsible for the gains in measured concept development of the preschool children in Treatment Group A. The direct teaching aspect of the program would have Bereiter-Englemann (1966) as theoretical supporters. They would seem to concur with a "down to business" or a "let's get the job done" attitude. Indeed, it seems that certain learnings can be quickly and efficiently taught to young children.

The play or game aspect of the program consisted of adult-prescribed activities rather than free spontaneous play. It will be recalled that the schedule for both the experimental and the control group contained equal time allotments for free play. It is possible that adult-prescribed play is a potent teaching technique and a balance between adult-prescribed play activities and free or spontaneous play activities is called for.
The art or craft activities in the program may also have contributed to the gains in measured concept development. Modeling activities where an adult illustrated procedures or activities where an adult specified directions were more prominent in the program than free painting, drawing, or clay work activities. However, such activities were often chosen in the free play portion of the schedule.

Both experimental and control programs contained similar typical preschool experiences. It would seem that both programs encompassed somewhat equally stimulating environments. The experimental program yielded gains in concept development which cannot be accounted for by maturation or by immersion in a stimulating environment. This is also an important, although easily overlooked, finding because immersion in a stimulating environment and free or spontaneous activity have long been bastions of preschool curricula. These activities should not be devalued, but the field of early childhood education should systematically consider the respective merits of structured and unstructured activities.

The data constitute proof that certain learnings can be taught. If such learnings prove to be valuable educational objectives, then improved methods of teaching toward these desirable objectives would seem to be of central concern of the field of early childhood education.
Further Implications

In both the areas of measured concept development and the area of measured intelligence, the issue for early childhood educators seems to center upon the nature versus nurture dilemma. Can nature be trusted? Or should educators intervene? The argument for intervention seems to be that one cannot take for granted that without formal planning the maximum benefits of environment can be attained. The argument for nature holds that minimal stimulation is all that is required for development of intellectual capacities. However, it is possible that valuable human resources are definitely contingent upon identifiable preschool skills or learnings. In such instances, it would seem that educators should be encouraged to participate. The problems are: Can such skills or learnings be identified? How can they best be assimilated? This study implies that such questions belong in the early childhood educator's realm, for it seems that young children can profit from formal planning and improved methods of instruction.

In general, educators and psychologists are attempting to break various classifications of learning into components. The nature of a "rich" and "stimulating" environment is also in question. Educators must try to analyze their potential impact on the development of young
children to determine the precise components of valuable learnings. However, in search for the precise influences on a dependent variable such as concept development or measured intelligence, it may not always be easy to isolate for empirical analysis a curriculum area or a teaching strategy since underlying correlates may exist between areas and strategies. For example, growth in intelligence for the young children in this program may reflect an increase in ability to follow directions. Although the intention was for the groups to use different content, direction-following was unavoidably part of the content for the young children in both groups. Furthermore, it is also possible that some beneficial experiences cannot be constantly varied and repeated and build cumulative value. Going to the park for a picnic every day would not constitute a good academic preschool program. Similarly, teaching a spatial or temporal concept daily may have been too limiting for maximum intellectual growth.

Recommendations

The findings of this study suggest a need for much further investigation of the effects of concept development and other aspects of preschool programs on the intellectual development of preschool children. The study also suggests a need for further investigation of the effect
the intensive program described in this study has on achievement. Some recommendations for further research are given below:

1. Further research on the preschool program in the present study using different concepts would be useful in order to determine if similar results are obtained.

2. Further research on the preschool program described in the present study with groups classified by other variables might be useful in order to determine the dimensions or properties of the children who can profit most from such an educational experience.

3. Research is needed to determine if one or a combination of the teaching techniques described and used in this study is responsible for the demonstrated gains in measured intelligence.

4. Research is needed to determine if one or a combination of the teaching techniques described and used in this study is responsible for the demonstrated gains in concept development.

5. Research is needed to determine if the intellectual gains and the gains in concept development produced by the program described in the present study are maintained.

6. In general, further investigation into the nature of cognition in early childhood is needed in order to improve understanding and effectiveness of instruction.
7. Research is needed to determine the merits of teaching techniques used in early childhood education.

8. Investigation is needed to determine the proper "matches" between developmental levels and instructional techniques.

9. Investigation is needed to determine what learnings are essential for optimal development of preschool children's intellect.

10. Investigation is needed to determine what learnings are essential to enhance school achievement.

11. Research is needed especially to determine the areas in which formal planning of preschool activities is valuable and to determine possible areas where formal training or planning is not beneficial.

Conclusion

Early childhood education may still be fighting for its credibility even though many vital services can be offered to the young child. Research has only begun to assess the merits of working instructionally with young children and it certainly has not prescribed teaching formulas for the young. But this should be the unique knowledge of the field of education. Professionalism requires the pursuit not only of knowledge about cognition, but also
about how desirable development may be enhanced. The young child deserves the attention of educators who are searching to maximize human powers.
APPENDIX A

Introductory Letter

Federal Assistance Programs
Title I. E.S.E.A.
Springfield Public Schools
Springfield, Ohio 45501

June 1, 1972

Dear Parent,

There will be a summer program at the location of Emerson Title I Pre-kindergarten (Good Shepherd Church on Selma Road) for those children who have attended a Title I pre-kindergarten this year.

The program will operate from 8:30 to 11:15 in the mornings from June 19 to July 28. Transportation to and from the school must be provided for the child.

Along with enrollment we request your permission for some psychological testing of your child. This testing is mainly for evaluation of the program.

Approximately 60 children can be accepted into this program. If the number wishing to participate is larger than that, not everyone will be accepted.

Please return this form to the pre-kindergarten teacher on or before June 8.

CHILD'S NAME ____________________________

BIRTH DATE ______________________________

PARENT'S NAME ___________________________

ADDRESS ________________________________

PHONE NUMBER ___________________________

I authorize the release of information derived from the psychological testing to those involved in the program.

PARENT'S SIGNATURE ______________________
APPENDIX B
Experimental Program

CONCEPT: ABOVE

Direct Teaching:
Pictures of plants were shown to illustrate the spatial relationships of the concept. The roots were under the ground while stems and buds were "above" the ground. Teacher talked about objects which could be "above" the children's heads, e.g., the roof of the school. The concept was illustrated on a magnetic board and the children were given a chance to demonstrate the concept.

Game or Play Activities:
The children attempted to keep an inflated balloon "above" their heads by batting it with their hands. The children had a race passing a ball from one child to another, keeping the ball "above" their heads.

Art or Craft Activities:
A drawing of a tree trunk was given to each child. Using paints and brushes, the children could add the ground and the leaves, making sure that the tree branches and leaves were
"above" the ground. A cutting and pasting activity involving airplanes, sky and clouds was used. The children cut out clouds and planes and pasted them on blue construction paper. The airplanes were pasted as though they were flying "above" the clouds.

CONCEPT: ACROSS

Direct Teaching:
Using a chalk board, the teacher explained the concept by drawing lines "across" the board to connect chalk marks. She discussed with the children what things were "across" the room, "across" the street, etc. She asked the children to walk "across" the room and "across" the hall.

Game or Play Activities:
Music for creative movement was played. The children pretended to be elephants stomping "across" the plains, alligators swimming "across" a river, snakes crawling "across" a road. The children bounced large rubber balls "across" a wide hall to children on the other side. They tried to make it "across" to the other child on one bounce or on two bounces.
Art or Craft Activities:
The thin paint was placed on the left of fingerpaint paper. The children were given straws and told to blow the paint back and forth "across" the paper. The children were given a paper with three large spots on each side. The children were asked to connect top, center, and bottom spots by means of single straight lines "across" the paper.

CONCEPT: AFTER

Direct Teaching:
The teacher presented the concept by mentioning several common actions that normally followed "after" other actions, such as brushing teeth after eating. Next she lined up two animals one chasing the other on a felt board and talked about which animal was chasing "after" the other. The teacher also illustrated the concept by asking what number comes "after" a given low number, e.g. two.

Game or Play Activities:
The children ran a relay race and "after" they all had run they sat down. Next some of the children pretended they were rabbits and some
pretended they were hunters. The rabbits
were chased "after" by the hunters. Later the
children pretended they went to the store to
buy groceries. "After" they picked up their
imaginary food, they paid for it, and "after"
that, they got their change back.

Art or Craft Activities:
The children painted pictures on stiff paper.
"After" that, they were asked to weave yarn in
and out of pre-punched holes. Next, the
children made flags. They pasted the stripes
on, one "after" another. "After" that was done,
they pasted on a blue field, and then glued
stars on.

CONCEPT: ALMOST

Direct Teaching:
Teacher showed a glass "almost" full of water
and another "almost" empty, attempting to
explain the concept almost. Synonyms were
suggested such as nearly or practically. Teacher
asked children what it would mean to be "almost"
at the top of a tree or "almost" at the top of
the ladder or stairs. Children demonstrated by
climbing ladder "almost" to the top.
Games and Play Activities:
Some children played at the water table filling containers "almost," but not completely, full. Some children practiced batting, learning they had to swing the bat when the ball was "almost" there. Then, the children tried to catch the beam of a flashlight on a wall. The teacher moved the light in rhythm or in a pattern. Success in catching the beam could be obtained by waiting until the light was "almost" upon them and grabbing the wall ahead of it. Children played a chase game in which one child was to stand still until another child was "almost" up to him, then first child could take off running.

Art or Craft Activities:
Children tore green and brown construction paper to make a picture of a large tree. "Almost" at the very top of the tree, small blue birds were pasted on. "Almost" at the bottom of the tree, a squirrel was pasted on.

CONCEPT: ALWAYS

Direct Teaching:
Teacher explained that "always" means every time. Then she used the word "always" in several
different sentences to help them understand the meaning of the word. Next, the teacher questioned the children about what they "always" did in the morning, what they "always" did at school etc.

**Game or Play Activities:**
Children squatted down in a circle. Teacher read a statement. If it were "always" true, children were to jump up. If it weren't, children were to stay down. Children pretended they were bumble bees. It was explained bees "always" have six legs and extra legs were attached to the children.

**Art or Craft Activities:**
Children made bees from construction paper and pasted six legs on. It was emphasized that bees "always" have six legs. Children made paper traffic lights and reviewed rules about "always" stopping on red and going on green.

**CONCEPT: AWAY FROM**

**Direct Teaching:**
The teacher directed a child to walk away from her, emphasizing the words "away from". Next the teacher showed a series of pictures illustrating a squirrel running away from a tree. Then the teacher put animals in a group on the felt
board. She moved one animal "away from" the group. Then she had various children come up to the felt board to move other animals "away from" the group.

**Game or Play Activities:**
The children played a game called "partners". In this game one of the movements was to move "away from" their partners. Next the children pretended they were worms trying to get "away from" hungry birds. Groups of three children played "keep away". In this game two children try to keep the ball "away from" the third one. Using puppets the children dramatized the Three Little Pigs, emphasizing the pigs trying to get "away from" the wolf.

**Art or Craft Activities:**
The children colored a picture of a squirrel running "away from" a tree. Then the children put glue and sand on the outline of a car. Their pictures were taken and put in the driver's seat. The children then pretended they were driving "away from" school. Then the children cut out construction paper worms and glued them on to magnets. They also glued bird stickers on magnets. Then the children played with the
magnets having the birds chase the worms. Sometimes the worms would move "away from" the birds and sometimes they would be attracted depending on which end of the bar magnet was used.

CONCEPT: BEGINNING

Direct Teaching:
The teacher explained that "beginning" was what came first in a sequence. Teacher told the story of "The Three Bears," then asked the children what happened at the "beginning" of the story. Teacher questioned the children about what was done at the "beginning" of each day and at the "beginning" of each session.

Game or Play Activities:
Children pretended they were seeds just "beginning" to grow. Beginning all curled up, they gradually grew until they were straight and tall or fully grown plants. The children were divided into three groups to dramatize the "beginning," middle and ending of the story "The Three Bears." Sequence cards were put in their proper order.

Art or Craft Activities:
The children were given a series of pictures to color showing seed "beginning" to grow into a
plant. The children made flowers "beginning" by cutting out a small circle, then adding a larger circle and ending by adding an even larger circle. All circles were different colors.

**CONCEPT:** BEHIND

**Direct Teaching:**
The teacher placed cloth animals on a felt board and showed babies following "behind" their mother. Then the children took turns putting the babies "behind" their mothers. The teacher directed individual children to stand "behind" specific objects in the room. Several children were directed to form a line by standing "behind" a leader. The teacher then asked direct questions as to which child was standing "behind" whom.

**Game or Play Activities:**
The children formed a circle and played "Drop the Handkerchief: in which the handkerchief is dropped "behind" a child. The children also played "Brownies and Fairies" in which the object of the game was to sneak up "behind" a player without getting caught. Then the children formed two lines for a relay race in which a ball was passed from one child to the child
"behind" him.

**Art or Craft Activities:**
The children colored, cut out, and pasted train cars behind its engine. The children made murals by pasting cut-out animals "behind" trees, rocks and grass.

**CONCEPT: CENTER**

**Direct Teaching:**
Teacher drew several circles on the chalk board. She put a point in the "center" of the first circle. Then a volunteer put a point at the "center" of the next circle. Teacher showed a dart board, explaining the bull's eye was the "center." Teacher showed pictures of daisies. She asked the children to point out the "center" of each.

**Game or Play Activities:**
Children threw bean bags at a bull's eye which was drawn on the floor. The closest to the "center" was the winner. Children played "Farmer in the Dell" with the farmer standing in the "center" of the circle. Children played "Jump the Shot" with the teacher standing in the "center" of the circle twirling a rope around which the children were to jump over.
Art or Craft Activities:
Children pasted blue "centers" on pre-cut tissue flowers. They then pasted the flowers on a piece of construction paper and added stems and green grass. Children put hands on paper plate clocks. They had to put a brass fastener through the precut hands and then through the "center" of the paper plate. Children also made clown faces from paper plates, glueing small pieces of sponges in the "center" for noses, then adding eyes and a smile.

CONCEPT: CORNER

Direct Teaching:
Teacher explained the word "corner," showing the children the "corner" of the table, the "corners" of a square, the "corners" of the chalkboard, etc. The teacher demonstrated that the proper way to turn pages in a story book was to use the "corners" of the pages. Teacher directed the children to find various "corners" in the room.

Game or Play Activities:
Children sang the song "My Hat Has Three Corners." They also put actions with the song using their arms and hands to form "corners." The children played a chase game in which each "corner" of
the room was a safe area. The children took
turns pretending they were policemen, helping
children to cross from one "corner" to another.

Art or Craft Activities:
Children made paper hats that had three "corners."
They made envelopes from a square piece of paper,
folding each "corner" toward the middle of the
paper and pasting the points together. Then, the
children made a picture for a house with doors,
windows and a pointed roof. Children explained
where the "corners" of the windows, doors, etc.,
were as they put the picture on the envelope
they had made to take home.

CONCEPT: DIFFERENT

Direct Teaching:
The teacher put three triangles and one circle
in a row on a magnetic board. The children
selected the one object that was "different."
This was repeated using other objects. The
children were each given a bag of assorted
objects. The children were directed to find one
which was "different" from the one held by the
teacher.
**Game or Play Activities:**

An obstacle course was made so that the children would need to move in many "different" ways to manipulate the course. The teacher and aides helped the children to recognize the "different" ways they could move. A circle game was played in which a leader was designated and the remaining children imitated the leader's actions. New leaders in this game were directed to do something "different," or to use "different" body parts than the former leaders.

**Art or Craft Activities:**

Necklaces were made by stringing macaroni and beads. The children were instructed to put many "different" types and colored objects on to their necklaces. Children were given dittos with one object different in each row. The children were to color the one that was "different" in each row.

**CONCEPT: FARTHEST**

**Direct Teaching:**

Teacher put circles in a cluster with one farther away. She pointed to the one "farthest" away and explained what was meant by "farthest." She, then, asked which of three objects in the
room was "farthest" away from the child. Teacher showed pictures which had three dimensional illustrations, asking what tree was the "farthest" away, which bird was "farthest" away, etc.

Game or Play Activities:
Children had a contest to see who could kick the "farthest," and who could throw the "farthest." Children had another contest to see who could blow a balloon the "farthest" in one minute without touching the balloon.

Art or Craft Activities:
The children were given a picture with three boats different distances from the shore. They were asked to circle the boat "farthest" from shore. Then, they were to color the picture. The children made paper airplanes, folding the two "farthest" corners toward the center. Then, help was given to complete the airplane. Each child then competed with the others to see whose airplane would fly the "farthest."

CONCEPT: FORWARD

Direct Teaching:
Teacher demonstrated forward by walking "forward" saying, what she was doing as she did so. She directed the children to walk "forward." She,
then, bent "forward" and directed the children to do so. The teacher directed the children to form a line. Teacher, then, moved the children forward in line until they reached a certain point.

**Game or Play Activities:**
The children marched "forward" in time to music. Children played "Mother May I?" in which the children could move "forward" as long as they asked, "Mother May I?" If they forgot, they had to start over again. Children played another game in which a spinner was used. The player spun the spinner and the number it stopped on was how many steps he could take "forward" toward a goal. The winner being the child who reached the goal first. Then, the children pretended they were caterpillars and crawled slowly "forward."

**Art or Craft Activities:**
Children made spinners with numbers on them so they could play the game we had played earlier at home with brothers and sisters. Children made caterpillars out of egg cartons and pipe cleaners. Children, then, played with the caterpillars, making them creep "forward."
CONCEPT: HALF

Direct Teaching:
The teacher demonstrated cutting a circle and a triangle in "half" on a chalkboard. The teacher demonstrated folding paper in "half." The teacher cut apples and potatoes in "half."

Game or Play Activities:
Pairs of children pretended to go to the store to buy candy bars. They divided actual candy bars in "half" to share with their partner. The children played at a water table filling containers full and "half" full of water. The children played a relay game in which the children were to run "half" way and walk "half" way to a designated point. The relay game was played a second time but the children skipped "half" way and hopped "half" way.

Art or Craft Activities:
Paper cups were torn in "half" and painted bright yellow. Then the children glued the cups on a "half" sheet of construction paper. Stem and leaves were added to complete the flower. Also, paper was folded in "half" and designs were cut along the folded border. The paper was then reopened.
CONCEPT: IN A ROW

Direct Teaching:
The teacher demonstrated the concept by placing objects "in a row" on a magnetic board. The teacher put several magnetic triangles in a straight row except for one and directed and helped the children locate and rearrange the object which was out of the row. The teacher demonstrated putting pegs in horizontal and vertical rows and instructed the children to repeat the task.

Game and Play Activities:
Music for marching was played and the children lined up "in rows" with instruments and marched as a band would march on parade. The children also lined up "in straight rows" for relay races.

Art or Craft Activities:
The children planted flower seeds in a row in individual cigar boxes. The children also colored and cut out flowers and put them in rows on construction paper to represent how flowers might look when they bloomed.

CONCEPT: IN BETWEEN

Direct Teaching:
The teacher directed the children to tell what numbers came "in between" 2 and 4, 1 and 3, etc.
The teacher formed a line of children by asking them to stand between specific children. The teacher placed objects on a magnetic board and children were asked to put specified objects "in between" the ones already on the board.

**Game or Play Activities:**
The children formed two lines and played "Red Rover," the object of the game being to break the hand clasps "in between" children. A race course was set up modeled after a giant slalom. The children, one at a time, pretended they were skiing down a giant hill, making sure they stayed "in between" the markers at all times.

**Art or Craft Activities:**
The children were asked to complete a picture of a bird in a cage by drawing lines "in between" the ones already on the paper. The children colored flowers and flower pots. Then they cut out stems and leaves and pasted them "in between" the flower and its pot.

**CONCEPT: IN ORDER**

**Direct Teaching:**
Teacher explained the concept "in order" by putting numbers "in order" on the chalk board. Then, she put circles "in order" of size. She lined up some of the children "in order" of height.
Game or Play Activities:
The children played a game in which they had to repeat items they were taking on a trip "in order." Each child added one more item. Children were divided into two teams. Each child was given a different geometric shape on a large card on a team. The teacher, then, showed three shapes in a certain order. The members of each team having these shapes were to run up and form a line in the same order as the teacher had shown the shapes. The team arriving "in the correct" order first was the winner.

Art or Craft Activities:
Children pasted cut out felt numbers "in order" on a sheet of construction paper. Children arranged green rectangular bars "in order" of size from largest to smallest, thus forming a picture of an evergreen tree. Brown trunks were added at the bottom.

CONCEPT: LEFT

Direct Teaching:
The teacher illustrated the concept of "left" by showing the children their names started at the "left" and that the first letter or number in their address was the farthest "left." The
teacher demonstrated beginning at the "left" and going to the right on the chalkboard. Then the children had the opportunity to practice beginning at the "left" of a sheet of paper and drawing a line to the right side of the paper.

**Game or Play Activities:**
A story was created for dramatic role play involving a bank robber named "Louie Lefty" and his arch rival, Sheriff Right Ralph Righty. Children marched to music beginning on the "left" foot and calling out left, right, left, etc. The children played "Simon Says" in which the teacher emphasized "left" body parts.

**Art or Craft Activities:**
Again working in pairs, the children drew around their "left" hands and feet. Children then glued cotton onto their prints. The right hand and foot prints were put with the "left" hand and foot prints to form a booklet to take home.

**CONCEPT: MIDDLE**

**Direct Teaching:**
Teacher drew three lines on the board and put a circle around the one "in the middle." Teacher put cut-outs on felt board and asked children
which was "in the middle." Teacher held up three picture cards and asked children which was "in the middle." She, then, put up five pictures and, again, asked which picture was "in the middle."

**Game or Play Activities:**
Children played "Brownies and Fairies" in which a "middle" area is a danger zone and the side areas are safe zones. A bowling lane was made using masking tape. Indian clubs were used for bowling pins. In order to knock down the pins, the children had to roll the ball down the "middle" of the lane.

**Art or Craft Activities:**
Children colored a picture with five balloons, everyone coloring the "middle" one red. Children made pictures by putting red or blue paint in the "middle" of their papers, blew the paint with a straw, and folded the paper "in the middle" to form two matched prints.

**CONCEPT:** NEXT TO

**Direct Teaching:**
Teacher put an object on the felt board and demonstrated putting another object "next to" it. Teacher put another object on the felt board and
had one of the children put same object "next to" it. Teacher then had a child come sit "next to" her. Then, the children had to tell who was sitting "next to" them.

**Game or Play Activities:**
Children formed two lines and a ball was given to the first child in each line. The first child passed the ball to the child "next to" him in line, and that child passed it to the child "next to" him, etc., until the ball reached the end of the line. Tiles were laid out on the floor. These were to represent stepping stones across a river. The children were to step from one stone to the "next" so they wouldn't fall in the river.

**Art or Craft Activities:**
Checker boards were measured off and squares of red and black paper were cut. Children pasted on a red square and, "next to" it, a black square, and "next to" it, a red square, etc. Then, the children made necklaces putting macaroni or straws "next to" each other as the teacher directed.
CONCEPT: OVER

Direct Teaching:
Teacher drew a line on the chalk board and put an "x" "over" the line. Teacher put her hand "over" each child's head, using the word "over" each time. Children were asked what other things were "over" their heads.

Game or Play Activities:
Children played "leap frog," jumping "over" one another. Children also played "high water, low water," a game in which the children jump "over" the jump rope, beginning with it very low and continuing until it is as high as the children can jump. The children also pretended a table was a bridge across a deep river. Each child crawled "over" the bridge, being very careful not to fall into the river.

Art or Craft Activities:
Children made crayon resists, in which they used several colors of crayons to form a pattern or a picture and then covered it "over" with thin black paint. The crayon resists the paint and this lets the color shine through. Then, the children painted "over" leaves and pressed them on paper, making prints.
CONCEPT: RIGHT

Direct Teaching:
The teacher discussed "right" and left body parts. The aide placed tape strips on the "right" hand and on the "right" foot of each child. The teacher directed the children to raise their "right" hand, to touch their "right" foot, to wink "right" eye, etc. The teacher instructed the children to place "right" hand over heart for "Pledge of Allegiance."

Game or Play Activities:
Highways were made from a long roll of art paper. A center strip was painted. Then the children identified the "right" side of the road on which their toy cars were to travel. The intersections were laid out so many "right" turns were possible. A circle game, "Loopy Lou," was played which required the children to identify their "right" hands and "right" feet.

Art or Craft Activities:
Working in pairs, the children drew around each others' "right" hands and "right" feet. Then they went around the outlines of their hands and feet with glue and sand. Mnemonic association between "right" and rough was utilized.
CONCEPT: SECOND

Direct Teaching:
The teacher demonstrated the concept using a felt board and a variety of felt teaching materials. The beginning numerals and beginning letters of the alphabet were aligned in rows on the felt board for the teacher to illustrate and the child to choose the "second" object. The relationship between the cardinal and ordinal numbers was explained. The teacher presented examples of the concept from the morning's activities and the children's personal world. Who was the "second" child to arrive this morning? Who was the "second" child in his place in the circle? Which is your "second" finger?

Game or play activities:
The children ran relay races. First and "second" place finishes were praised. A kickball game was played using a first and a "second" base. The children were paired for shadow movement. The first child became a leader while the "second" child played his shadow while keeping time to music.

Art or craft activities:
The children colored and cut out "second" animals in a row on a worksheet. The animals were then
CONCEPT: SEPARATED

Direct Teaching:
The teacher took the black beads off the shoe string saying she was "separating" the beads. Teacher "separating" the sections of plastic egg cartoon explaining what she was doing. Then, each of the children "separated" an egg carton into its section. The children were shown how to "separate" a string of different shaped beads into the egg carton sections.

Game or Play Activities:
Children pretended they were rain drops, falling from a cloud. All the drops had to keep "separated" from each other. Children pretended they were beads on a string, then the string broke and all the beads "separated," falling down. All the children had their feet tied together and they were to see how fast they could get them "separated."
Art or Craft Activities:
Children were given straws, paper and paint. They were to let drops of paint fall to the paper, trying to keep all the drops "separated" from each other. Then, the children colored pictures and cut them apart, "separating" the parts that were colored the same color.

CONCEPT: SEVERAL

Direct Teaching:
The teacher explained this concept as a way of expressing a number of objects more than two or three without counting. Counting blocks, small plastic counting bears, and groups of the children themselves were used as examples. A chalkboard was also used to recognize sets which contained "several" objects.

Game or Play Activities:
A bushel basket was used as a hoop, and the children played basketball by attempting to bounce a ball into the basket. Each child had several chances. A game of "Hide and Go Seek" was played with "several" children hiding in a large playroom at a time.
Art or Craft Activities:
Indian head-dresses were made for the children. Each child cut out "several" feathers for his head-dress.

CONCEPT: THIRD

Direct Teaching:
The teacher put groups of three objects on felt board. She pointed to each, saying which was first, second and "third." Children then were to repeat which was the "third" object. The teacher put three numbers on a number line. Children were to name the "third" number. The teacher directed some of the children to form a line. Then the remaining children were to point out which child was "third" in line.

Game or Play Activities:
The children dramatized the "Three Little Pigs," special emphasis being given to the "third" pig. Children had a contest to see who could jump the highest. They practiced jumping two times and, on the "third" jump, it was marked with chalk how high they had jumped.

Art or Craft Activities:
The children made red and white chains. Every "third" loop of the chain being white. Children
were given a picture to color in a specific order; first, the sky was colored blue; second, the grass colored green; "third," the dog was colored black.

**CONCEPT: THROUGH**

**Direct Teaching:**
Teacher explained the meaning of "through" by putting her hand "through" bracelets and open-end boxes. Teacher asked children what things they could see "through," walk "through," crawl "through," etc.

**Game or Play Activities:**
Children played crawling and sliding "through" a large cloth and wire tunnel. Children ran "through" an obstacle course that had been set up in the game room. Then, spooky music was played and the children pretended they were going "through" a haunted house.

**Art or Craft Activities:**
The children cut out from patterns the body and wings of a bird. A slit was cut on the body of the bird and then the children put the wings "through" the slit. They put a string "through" the punched hole on the bird's head. The
CONCEPT: **TOP**

**Direct Teaching:**
The teacher put objects on "top" of the table, explaining what she was doing. She then had the children put various objects on "top" of the table. The teacher showed pictures with seals on "top" of boxes with balls on "top" of their noses. Then the teacher asked the children to put their hands on "top" of their heads, then on "top" of their knees, etc.

**Game or Play Activities:**
Children were divided into two teams. Each child on a team had to walk up to a line with a book on "top" of his head. The first team done was the winner. Next the children tried to throw bean bags on "top" of the table. They each had three tries.

**Art or Craft Activities:**
Children iced cup cakes and put candles on "top" of each one. Then the children colored a picture of a seal, a ball, and a box. They cut them out...
and pasted them on a large piece of construction paper, putting the seal on "top" of the box, and the ball on "top" of the seal's nose.

**CONCEPT: UNDER**

**Direct Teaching:**
The teacher used felt board to illustrate spatial relationship of one object "under" another. Children's toys were placed "under" the room's furnishings in order to give the children an opportunity to locate the toy and use the concept to describe where it was.

**Game or Play Activities:**
"London Bridge is Falling Down" was sung and played. Emphasis was placed on going "under" the bridge. "Three Billy Goats Gruff" was dramatized using a walking board for the bridge. The troll was located "under" the bridge. Music was played for a "limbo" activity. Yardsticks were positioned at different heights. The children attempted to bend back and scoot "under" without touching the sticks.

**Art or Craft Activities:**
The children finger painted water and fish under the surface of the water. The teacher and aides helped the children make individual
CONCEPT: WIDE

Direct Teaching:
The teacher illustrated this concept by showing strips of ribbon and tape. She explained that the length could be the same and the "width" could vary. She showed the children a drawing of a river and asked them to find the "widest" part. The teacher and the children their mouths "wide" and spread their feet "wide" apart.

Game or play activities:
An imaginary river was made using long rope lengths and some water toys. The children could attempt to jump across the river where it was narrow or "wide." The children also moved to music pretending they were "wide" as an elephant, and pretending they were carrying a "wide" box.

Art or Craft Activities:
A selection of paint brushes was given to the children for painting and experimentation. The children were encouraged to try to find the brushes that made "wide" streaks. The children were also encouraged to try different painting methods to vary the "width" of the brush marks.
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