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NUMBER CONCEPT DEVELOPMENT IN YOUNG CHILDREN

by

Karen Lee Clark

A thesis report submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Child Development

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Karen Lee Clark

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ABSTRACT

Number Concept Development in Young Children

by

Karen Lee Clark, Master of Science

Utah State University, 1973

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Department: Family and Child Development

The effect of tutorial instruction was studied as it influences number concept development in preschool children. The research was conducted in the Logan and Providence areas of Cache County, Utah, with 24 non-preschool four-year-old children. Twelve of the children were given tutorial experience through the use of children's flannel board stories written by the author. The stories were developed to teach the number concepts of not first or last, second, third, pair, and medium-sized.

It was found that the 12 children who received tutorial experiences significantly increased in score on the Boehm Test of Basic Concepts from the pre-test to the first post-test, and further, that there was a slight but insignificant loss of knowledge after a six-week waiting period on the number concepts taught. The control group, which received no tutorial experience, made no significant gain in score on any of the tests.

The findings also indicated that there was no significant difference between boys and girls on their ability to learn and retain number

concepts. The control group boys made a slight gain in score from the pre-test to the second post-test that was unrelated to any tutorial experience.

(96 pages)

INTRODUCTION

Programs for the education of preschool children are numerous. It is now believed that preschool children are not only quite capable of learning, but it is felt that if children do not have a great variety of experiences and are not stimulated intellectually early in their lives, this lack will have a significant effect on their future ability to learn. Preschool programs such as those of Maria Montessori, Bereiter and Engelmann, The Institute of Developmental Studies, Dr. Susan Gray, and Dr. David Weikart, just to name a few, have been established to educate the preschool child (Pines, 1966). These programs emphasize cognitive development, social and emotional growth, and every other aspect of the young child's development.

One area of emphasis in the cognitive realm is in the area of number-concept development. Children express an early interest in numbers. Words relating to numbers are part of a child's speech soon after he starts to speak, but what a child actually understands and when he can use it in a meaningful way are difficult to determine. Research indicates that preschool children have difficulty with number concepts, although they are familiar with the vocabulary of numbers. Donaldson and Balfour found that although children were familiar with the words "less" and "more" they used them interchangeably and did not seem to know the difference (1968, p. 470). Piaget emphasizes that the child's understanding of numbers is related to a developmental process;

there are stages through which each child passes on his way to acquiring real number knowledge. The child's ability on arithmetic achievement tests is not a true indicator of his readiness to learn concepts such as space, measurement, and time (Flavell, 1963).

However, some research indicates that there are number concepts that preschool children are able to use. Children can use the ordinal number concepts of first, second, third, etc., under conditions with which they are familiar, such as when playing games and taking turns (Stone and Church, 1968). Several studies have indicated that the kindergarten entrant comes to school with an extensive acquaintance with numbers, such as the ability to rote count, the ability to identify the sizes of comparable objects, knowledge of the function of a clock, money, and a ruler, and many other learnings (Brace and Nelson, 1965; Williams, 1965; Rea and Reys, 1971). Teachers must be ready to accept the child's abilities and integrate his knowledge into a curriculum.

It is apparent that children learn number concepts when they are involved with them. What is the best method of involvement? Do children learn number concepts by listening to stories about them? The present study is concerned with answering these questions.

Statement of the Purpose

The purpose of this study is to determine the degree to which a sample of four-year-old children is familiar with the number concepts of not first or last, second, third, pair, and medium-sized, specifically, and other number concepts as demonstrated by performance on the quantity section of the Boehm Test of Basic Concepts, and further, is to

find out if these children can be taught these concepts through stories, and if the children will maintain these learnings.

Objectives

1. To determine if tutorial experiences with children's stories can teach certain number concepts.

2. To determine if knowledge of these number concepts can be maintained over a defined period of time.

3. To investigate the differences statistically of number concept learning which may be due to sex.

Hypotheses

The following null hypotheses will be statistically tested:

1. The experimental group, which will have tutorial experience, will make no significant improvement in test performance (Boehm Test of Basic Concepts) after the training as compared to the control group, which will receive no tutorial experience.

2. The experimental and control groups will have no significant difference in scores from the first post-test (following training) and the second post-test (following a waiting period).

3. There will be no significant differences between the scores of the boys and the scores of the girls on the tests.

REVIEW OF LITERATURE

Two main topics will be considered in this representative review of the literature, and under each of these headings will be several subheadings. These headings and subheadings are:

I. Number
   A. Development of the number concept
   B. Piabet's theory as it relates to number concept development
   C. Number concepts possessed by the preschool child
II. Instructional Methods for Number Concept Development in Young Children
   A. Concept and number concept teaching
   B. Specific methods of teaching number concepts

Number

A. Development of the number concept

Research in the area of number concept development has been done for many years in an effort to understand the child's thought processes and to discover best how to help the child gain facility in working with number and numerical concepts. Children become aware of words relating to number soon after they begin to sepak and use these words in their own speech, but this is merely "parrot speech," and what these words mean to the child is difficult to determine (Hurlock, 1972). The development of the number concept becomes a function of maturity and education. Ross (1970) emphasizes that it is important to distinguish

between the development of number concepts and rote memory. Number concepts do not suddenly become clear to the child, in an "all or none" fashion, but rather, they develop slowly, depending upon many opportunities to manipulate, explore, and experience (Ogletree, Rackauskas, and Buergin, 1970). Ross (1970) gives the example that,

> When a child can distinguish between one penny and two pennies in a specific game situation he has one bit of number knowledge about "two" but does not have a number concept of "two." When he can, upon command, give two jumps, select two people, write the numeral two, and accurately identify, choose, and use a number of other "twos," he has acquired this particular number concept. (p. 723)

Wohlwill (1960) indicates that the process of the development of number concepts is most adequately described in terms of three discrete phases: the initial phase is one in which the child responds to numbers wholly on a perceptual basis, without using symbolic representation. The intermediary phase is the one in which the mediating structures representing individual stimuli are developed, so that dependence on perceptual support is reduced; and the final phase is that phase in which numbers are dealt with in an abstract way, and the structures representing the number concept are elaborated, thereby leading to an understanding of such functional principles as the conservation of number and the coordination between ordinal and cardinal number.

Several studies have indicated that the most elementary of quantitative concepts is that of simple magnitude discriminations; that is, the concepts of "more" or "less" for discrete groups and "larger" and "smaller" for solid areas (Hollister and Gunderson, 1964; Ginsberg, 1969; Siegel, 1971). The child understands and uses many terms, such as "big," "many," and "more," before he has an idea of number values.

In fact, Donaldson and Balfour (1968) found that in response to a task devised to test children ages three and four on the terms "more" and "less," his subjects gave no indication that they differentiated "more" from "less" and thus used them interchangeably.

Following the child's recognition of simple magnitude differences Siegel (1971) indicates that the next quantitative concept to develop is that of the equivalence of sets. This occurs later in cognitive development since the concept of equivalence involves an understanding of correspondence. According to Potter and Levy (1968), in order to count a set of things, the child must pair a numeral with an object in proper sequence. Three skills underlie this ability: the first skill is that of knowing the numeral names in the correct order; children aged two or younger often grasp this ability. The second skill underlying counting is the understanding of one-to-one correspondence. This is the ability to take (or point to, or look at) each item in an array, one at a time, until all have been taken exactly once. The third skill is the ability to coordinate the first two skills, to bring the numerals in a one-to-one relation with the items in an array (Pottery and Levy, 1968; Ogletree, Rackaukas, and Buergin, 1970; D'Mello and Williamsen, 1969). Hargis (1971) lists the following as the four component steps of learning to count: (1) One-to-one correspondence; (2) Rote counting; (3) Assigning by one-to-one correspondence the number names learned in sequence to a set of objects; and (4) Rational counting, or enumeration, learning that each assigned number name tells "how many" have

occurred or are contained through that point. Hargis (1971) goes on to say that,

> At the same time a child is learning one-to-one correspondence (and very often before) he may be learning rote counting (saying the number names in sequence). When both of these skills are mastered the child is ready to assign one and only one number name to each of the objects he is counting. . . . When the child synthesizes these skills he is ready to learn that any assigned number tells "how many." He learns that numbers tell "how many" objects to which he has made this correspondence. (p. 171)

Conservation, the ability to recognize the identity of a set despite changes in relationships between elements of the set, develops later than the understanding of equivalence relationships (Wohlwill, 1960). According to Piaget (1965), a child can be expected to begin to understand more complicated quantitative concepts once he has mastered conservation. Among these are ordination, seriation, and addition. Ordination is the ability to respond to a particular ordinal position. Seriation involves both the ability to order a series of numbers and to respond to a particular position. Addition involves both the understanding of equivalence and of specific magnitude differences, and follows ordination and seriation in level of difficulty (Siegel, 1971).

After children enter school and are exposed to formal instruction in arithmetic, their number concepts develop rapidly. There is a gradual increase in understanding of indeterminate number concepts such as "few," "several," and "some." School textbooks place a great deal of emphasis on quantitative concepts, and children eventually develop definite and increasingly more accurate concepts of what numbers mean (Hurlock, 1972).

B. Piaget's theory as it relates to number concept development

Piaget's work and resultant theories of the cognitive development of the child have stimulated a great deal of research in the area of number concept development. The following is a representative overview of Piagetian theory and research in number concept development.

Piaget lists four stages through which the learner proceeds in the development of knowledge. These stages are based upon development in the learner of a well defined set of operations. An operation is a "set of action modifying the object, and enabling the knower to get at the structure of the transformation." (Piaget, 1964) In other words, the learner must be able to "reason" about the actions he is performing.

The first stage is the sensory-motor stage; it usually lasts from birth to age 2. All subsequent knowledge is based on the learnings gained during this period. The child learns, for example, that objects have permanence, and also he learns that physical motions have a cause, and the child's action can produce events (Flavell, 1963; Picard, 1969). The pre-operational is the second stage, usually lasting from ages 2 to 7. It is characterized by the development of language and the use of symbols. The child still has not satisfied the criteria for operations, however. He does not conserve, nor does he comprehend reversibility. The third stage is the concrete operational stage, usually lasting from age 7 to age 11. The child carries out true operations at this stage; he classifies and orders, but these are carried out in terms of concrete physical objects (Flavell, 1963; Picard, 1969). The final stage is the stage of formal operations. It occurs from ages 12 to 15. The learner

now successfully carries out his operations abstractly. He is able to construct new knowledge by reorganizing pre-existing information.

Piaget stresses that the order of these stages is fixed but the ages at which each appears is subject to the capacities of the learner. Each succeeding stage is dependent upon the learnings gained from the preceding stage or stages (Deal and Maness, 1968; Picard, 1969).

There are four factors which contribute to the development of knowledge: nervous maturation, encounters with experience, social transmission, and equilibration. The learner is mentally passive with respect to the fourth. The learner attempts to assimilate and accommodate information from the first three factors into his existing knowledge (Picard, 1969).

As it relates to the development of number concepts, Piagetian theory postulates that rational behavior, and in particular the production of rational (operational) solutions to problems involving number, develops from a primitive form of thinking which does not operate with categories and relations which are well defined, and also does not apply to rules which are independent of the "viewpoint" of the operator (Bodwell, 1960). At about age 6, when children display an interest in numbers and have learned to count, Piaget claims they have only a vague idea of what "number" is. Piaget theorizes that the learner is in the first stage of quantitative concept development, called the stage of "global comparison." The child makes global and overall comparisons of groups of objects based on his perception. The child's understanding is based solely on what he sees. He may have some conception of more or less, but he cannot verbalize it or choose correctly (except by

chance) if asked "Which is more?" The value of the quantity to him will be the significant factor (Zimiles, 1963; Deal and Maness, 1968; Pufall and Shaw, 1973).

The second stage is called the "intuitive stage," in which the child starts to realize that judgments of quantity and number cannot be made simply in terms of perceived attributes. In this stage the child can make comparisons of groups of discrete objects by matching units and ordering. The child's comprehension of amount or quantity is dependent on how it looks to him. He is able to realize that training that he can match things to see if there are more, less, or the same, but he is still very much affected by how he sees the groups. When correspondence is destroyed the child judges that the numeric equality of two rows has been destroyed as well. In the final stage, the stage of "concrete operations," judgment becomes completely "operational;" it is no longer bound to perceived patterns. The child develops the concept of lasting equivalence, or number conservation; he attains the ability to conserve the attribute of numerousness whatever may be the change in perceptual arrangement (Flavell, 1963; Gruen, 1965; Ogletree, Rackauskas, and Buergin, 1970).

The operations necessary to the understanding of number are, Piaget contends, the ability to deal with the equivalence of cardinal classes in terms of one-to-one correspondence, and the ability to deal with transitive relations, such as "greater than" and "less than." The child must be able to order and to seriate. The second and third stages occur usually in the seventh and eighth years for most children (Dodwell, 1960).

Many research studies have been conducted to verify or to refute Piaget's conclusions. Elkind (1961) agrees with Piaget's distinguishing the three types of perceived quantity by which things can be compared without actual measurement. These three types are: (1) gross quantity--single perceived relations between objects (longer than, larger than); (2) intensive quantities--perceived quantity relations taken two by two (longer and wider, taller and thicker); (2) extensive quantity--unit relations between objects (X is half of Y, X is twice Y). Extensive quantities are logical constructs which must be attained by abstraction (Elkind, 1961).

Baker and Sullivan (1970) found that conservation is more likely in kindergarten children when children work with high interest materials, and when working with smaller aggregate sizes. Also, it was found that middle-class kindergarteners displayed conservation more often than lower-class kindergarteners. Conservation did not seem to be related to the sex of the child.

In their work with kindergarten-age children, Rothenberg and Orost (1969) concluded that their results imply that conservation of number can be taught to kindergarten children, and that this training is effective, lasts for as long as three months, and significantly increases understanding of the related problem of conservation of quantity. The sequence of concepts and the style of teaching used seemed to present a reasonable and workable series for the teaching of number conservation.

In an attempt to understand conservation, Gelman (1972) felt that the conservation task is, at a minimum, a test for logical capacity, the control of attention, correct semantics, and estimation skills, and

that "the ability to conserve represents a sophisticated level of cognitive development in which many separate abilities are coordinated." (p. 89)

Mehler and Bever (1967) conducted a famous research study from which it was discovered that children under age 3 years 2 months exhibited a form of quantity conservation, and that children lose this ability as they get older and do not exhibit it again until they are about 4 years 6 months. Their results indicated that the inability to conserve quantity is a temporary phase in the child. In response to this contraction to Piaget's conclusions, several researchers conducted similar studies. Beilin (1968) found that children between age 3 and 4-7 correctly responded to the addition of objects in an array, to the numerical equality of arrays and to their relative numbers, but they were not able to conceptualize equality or inequality when objects were misaligned or spatially transformed; the results were that Mehler and Bever's assertion, Piaget (1968) predicts that the performance of the very young and older children should be similar on specific number judgment tasks. However, in contrast to Mehler and Bever, his theory predicts that the youngest children should not be successful on all number judgment tasks.

In conclusions, Picard (1969) lists some implications for the teaching of mathematics in light of Piagetian theory. These are: (1) Learning does not result from talking to the child. The child must be actively involved in creating the mathematics he is to learn. (2) It is important for the child to compare his answers with other children.

(3) There should be many opportunities when the child is presented with collections of mathematical data, in order to draw his own generalizations. (4) After determining the child's mathematical strengths and weaknesses, it is necessary to determine his stage of development as defined by Piaget so educational experience appropriate can be prescribed. (5) New material should be based on experience with physical objects (Picard, 1969).

C. Number concepts possessed by the preschool child and kindergarten entrant

Several research studies have dealt with the problem of discovering what it is that children know about numbers before they arrive at school. The following is a summary of this research.

Brace and Nelson (1965) are thorough in testing and reporting about numerical knowledge. An outline of the findings reveal that: (1) The preschool child's ability to count is not a reliable indicator of the child's actual number concept development. (2) Preschool children have a very limited knowledge of the nature of cardinal number. Holmes (1963) also reports that for the middle-class kindergarten children involved in that study rational counting abilities are superior to abilities in locating ordinal number, and that concepts of cardinal correspondence are more adequate than concepts of ordinal correspondence. From a study with 30 preschool children, Josephina (1965) found that 100 percent of the subjects knew the ordinal concept "first," 86 percent understood "middle," 66 percent knew "fourth," and 90 percent knew "last."

At least 50 percent displayed a knowledge of "second" and "fourth" (Bjonerud, 1960). Both of Rea and Reys studies (1970, 1971) concur with these findings. (3) The concepts of ordinal number and cardinal number do not develop concurrently as is generally believed. It appears that a thorough understanding of cardinal number is necessary before the child has real facility with ordinal number and before he appreciates the significance of the counting process (Brace and Nelson, 1965). (4) A complete understanding of ordinal, cardinal, and rational counting must exist before facility with the concept of place value and operations involving symbols are possible (Brace and Nelson, 1965). (5) The sex of the child does not seem to be a factor in the early development of the number concept (Dodwell, 1961; Brace and Nelson, 1965; Wiliams, 1965; Heard, 1970). Iversen (1970) reports that in a study of recognition of letter and number names of kindergarteners, boys seem to be slightly ahead in recognizing numbers but are far behind girls in recognizing letters. (6) Environmental factors are important in the child's development of the concept of number. Children of lower socioeconomic class membership have an inferior performance as compared to middle and higher socioeconomic classes (Brace and Nelson, 1965; Williams, 1965; Rea nd Reys, 1970). (7) Children in the age group of six years and over were highly superior in performance on number tests to those below six years, supporting Piaget's stage theory. However, there was notable gaps in number knowledge in the older age group (Brace and Nelson, 1965). (8) It cannot be assumed that beginning school children have developed all aspects of the basic ideas underlying the concept of number (Brace and Nelson, 1965).

Other research indicates that there are specific areas of number knowledge. Bjonerud (1960) found that 80 percent of a kindergarten sample responded accurately to situations requiring an understanding of largest, smallest, tallest, longest, most, inside, beside, closest, and farthest. Fifty percent of the sample recognized situations describing the terms shortest, few, underneath, and some (Hollister and Gunderson, 1964). Rea and Reys (1970) found that the word "pair" was apparently not generally understood, as only 21 percent of the kindergarten children responded correctly. Josephina (1965) and Rea and Reys (1970) found that almost 50 percent of the kindergarten children they studied could rote count to or beyond 20.

Preschool and kindergarten children have some knowledge of time concepts. Stephens and Dutton (1969), and Bjonerud (1960) found that kindergarten children knew the clock's function, and reported that children could learn the time concept if it was studied systematically.

Geometry concepts, such as the names of common geometric shapes, and measurement concepts (function of a ruler, use of scales, etc.) were understood with some facility by kindergarteners (Bjonerud, 1971; Rea and Reys, 1971). Most kindergarteners knew the names of coins such as a penny and a nickel, but were unable to name larger coins and bills; the children were aware of money's function, however (Rea and Reys, 1971).

Preschool children appear to have a wide variety of knowledge in number concepts before they experience any formal schooling. It seems essential that educators utilize the knowledge possessed by young children to plan curricula for mathematical concept learning.

Instructional Methods for Number Concept Development in Young Children

A. Concept and number concept teaching

Researchers and educators have been studying the area of mathematics instruction for a long time, and knowledge in this area is vast. But research intended specifically for expanding the knowledge of preschool mathematics does not exist in an abundance. Teaching methods which enhance the preschool child's number knowledge are mainly concerned with providing the child with a wide variety of experiences. Deal and Maness (1968) concluded from their research in this area that nursery school and kindergarten teachers have been providing children with rich, broad experiences but have not communicated to others exactly what they were teaching. They felt that it is very important that the teacher be aware of children's needs and that she be able to communicate to others the broad, general experiences that are provided for children (Deal and Maness, 1968).

Silverman (1972) comments on the current state of education when he says that "Although budgets have been cut, the nature of the primary school child and his mode of learning have not changed. The child must develop concepts for himself; to do this he needs a variety of experiences with a multitude of materials" (p. 431). Silverman goes on to say that the primary school child can usually think about number only when it is embodied in materials that are in his presence. The preschooler's learning style is physical; it is the teacher's task to

provide the appropriate learning experiences. The teacher must carefully select materials that will give the child opportunities to observe and experiment with relationships (Silverman, 1972).

In summarizing their work in educating young children, Suppes and Ginsberg (1962) found that: (1) Learning is more efficient if the child who makes an error is required to make the correct response; (2) Incidental learning does not appear to be an effective method of acquisition for young children; (3) A condition which focuses the child's attention upon the stimuli to be learned, enhances learning; and (4) A young child's learning tends to be very specific. Prior training on one concept did not improve learning on a related concept. Relative to Suppes and Ginsberg's work, Ginsberg (1969) later found that young children, aged 4-1/2 to 5-1/2, could learn tasks which would otherwise be too difficult for them if they were given pre-training on a simpler, but related task; the simpler the stimuli used in the preliminary training, the faster the children learned the initial task. However, Ginsberg related this finding to the fact that the experimenters took extra care in teaching the children. The teaching situation was highly individualized and concentrated, an "ideal situation," said Ginsberg (p. 12).

Greenfield (1968) in working with three-year-olds reported that evidence was accumulating to suggest that pure discovery is the least successful method of teaching specific concepts and that it does not improve the transferability of a concept. Discovery methods seem to be useful when the aim is to teach techniques of discovery, per se, but if the task is so difficult that the learner does not succeed in discovering the concept, then the discovery technique will not be reinforced either (Greenfield, 1968).

In teaching mathematics concepts, the most effective method appears to be a step-by-step approach, structuring goals and programs to proceed logically from simple to complex (Beard, 1962; Armstrong and Schmidt, 1972; Silverman, 1972). Beard (1962) set up the following objectives, around which was built a mathematics program for kindergarteners: (1) To develop a mathematics vocabulary; (2) To develop one-to-one correspondence; (3) To develop number meanings of the numerals one to ten; (4) To develop number quantity meanings of one to ten; (5) To develop appreciation of the use of mathematics in daily experience; and (6) To develop desirable attitudes toward and appreciation of mathematics.

Broman and Shipley (1973) candidly suggest that ". . . with just a little practice you'll learn to spot and make use of opportunities to tie math with kids' regular activities" (p. 170) if these guidelines are kept in mind: (1) "Think math"--analyze activities, structure situations, and study new equipment and materials for ways to use them to introduce new math concept; (2) Always use proper terminology when discussing an activity or project even though the words may be new to children. Hearing new words in their proper contexts will give them meaning and children will begin to incorporate them into their own vocabularies; (3) Once a concept is introduced, ask leading questions that will help children think through the concept; and (4) Check children's mastery of concepts by posing problems which require physical as well as verbal responses (Broman and Shipley, 1973).

B. Specific means of teaching number concepts

Several studies have been based around the use of games as an instructional method for teaching number concepts. Heard (1969) felt that,

> . . . there is a tremendous amount of mathematics a young child can learn and review through game-like procedures. If the child finds the experience enjoyable, his attitude toward the study of mathematics will be more favorable; and if he can feel success in his number work, he will have a more positive concept of himself. Nothing succeeds like success. An informal approach to the study of mathematics through games can alleviate much fear for the subject and a sense of failure in the subject that many adults experienced as children. (p. 150)

Heard has used finger puppets, listening games, and spinner games and found these are "teaching methods" which encourage young children to learn number and mathematical concepts more easily than by rote and review (Heard, 1969).

Armstrong and Schmidt (1972) found that the criteria for game materials in mathematics are: (1) The materials must be manipulative in characters; (2) They must be specifically designed to teach a numeral-quantity-association concept. Games such as table games, search games, card games, and guessing games were used by Ross (1970) who found that in using games a group of five-year-old children were beginning to develop quantitative thinking ability, where little or none had been apparent previously.

Finger plays, games, songs, and poems can help to reinforce the idea of cardinal number, Heard (1969) and Silverman (1972) report. For example, the constant repetition of "three" and the many opportunities for one-to-one correspondence between the sets of three objects in

"The Three Bears" make it a worthwhile story to dramatize (Silverman, 1972). McIntyre (1969) cites in an annotated bibliography many of the children's books which give number concepts to children. Literature is an important part of the preschool and kindergarten curriculum. It promotes an interest in books and reading and gives many language and cognitive experiences to children (Beard, 1962; Fowler, 1965; Read, 1968). Cappa (1958) found that once a story is read to them, kindergarteners were eager to look at the book themselves, hear it again, and utilize its teachings in their play.

Ogletree, Rackauskas, and Buergin (1970) indicate that at the preschool stage learning mathematics is similar to learning nursery rhymes. Like children's poetry, the spoken number sequence appeals to the child's inherent sense for rhythm, and the number sequence can be experienced. Poetry, Ogletree, Rackauskas, and Buergin (1970) felt, was an extremely effective way to teach "number sense" to young children.

In conclusion, teaching mathematics and number concepts to young children is an area for further research. It presents a challenge to all educators interested in providing effective and lasting number concept development in young children.

METHODS AND PROCEDURES

The administration of the Boehm test for all sessions, pre-test and the two post-tests for both groups, experimental and control, and also the teaching sessions for the experimental group, were conducted by the author of this study.

Sample

The twenty-four experimental and control group children were drawn from the population in the Logan and Providence areas of Cache County, Utah. The children were selected on the basis of their participation in the "Primary" period of religious instruction in the Latter-Day-Saint Church. This instruction is conducted by the Latter-Day-Saint Church once a week for one hour for children ages 3-11 years. Each class is grouped by age with one teacher for each group. The classes range in number from two to ten or fifteen children. It was determined that the sample would be drawn from a non-preschool sample; i.e., children who have not participated in the preschool program at Utah State University, in order to minimize the chances of the children's being involved in school instruction about the concepts being taught.

To enable the author to draw a large group of children of ages 4 years to 5-5 years, selecting Primary groups best accomplished this purpose. As a result, a random sample was not drawn. The investigator first contacted the persons involved in the LDS church who are in charge of the Primary program. These persons led the author to the Primary

presidents, women who supervise the Primaries and keep track of the class roles. The author contacted several Primary presidents and selected those Primaries whose regular attendance in the four-year-old class was between eight and fifteen children. Ultimately, two Primary groups served as the experimental group, and two Primary groups served as the control group. In the experimental group, one Primary class contained ten children, five of whom were used in the sample. In the other Primary class of the experimental group, there were twelve children, seven of whom were used for this sample. The non-selected children were disqualified due to participation in the Utah State University Child Development Preschool Program, or because of more than one absence during the five-week teaching session period. A child was used in the sample if he was in attendance for four out of the five teaching sessions. In the control group, one Primary class contained sixteen children, nine of whom were used in this study. The other Primary class contained eleven children, three of whom were selected for this sample. Again, participation was allowed on the basis of no preschool experience and attendance for the testing sessions.

The children used in this sample ranged in age from 4-6 to 5-4 years at the time of the pre-test. All of the children had not yet attended kindergarten in the public schools, but would attend the following school year. The parents of the children were generally employed in the Logan City and Cache County area, although some of the parents were students at Utah State University. On the basis of this, it was determined by the investigator that the sample was drawn from a middle-class population.

Procedure

Testing sessions

All of the children participating in this study, both the control and the experimental group children, were tested three times: one pre-test prior to the experimental group teaching sessions, one post-test following the fifth teaching session, and finally, one post-test after a six-week waiting period following the first post-test. There were four locations for the testing, one location for each of the groups participating in this study. The same testing room was used for all three testing sessions. All of these testing rooms were similar in that they were located at a close distance from the child's classroom, and each lacked an abundance of visual and auditory stimuli. After having been introduced to the children in the classroom by the teacher, each child was asked individually to come with the administrator, to "play a picture game." This testing was done during the regular class period. As each child was returned by the administrator to the classroom, another was asked to come. While walking to the test room the child was engaged in coversation with the administrator in order to acquaint the child with her and to reassure the child about his participation in the "picture game."

For the testing sessions, Form A of the Boehm test was used for the pre-test and Form B was used for the two post-tests. A complete introduction of the quantity section of the Boehm test, Form A, was given to each child for the pre-test. After sitting at the table in the testing room, the administrator wrote the child's name on the data sheet and then said, "I'd like you to play this picture game with me. Listen

carefully while I tell you what to point at." After completing the three introductory examples, the administrator praised the child on his performance and then assured him that he would do well on the rest of the "game." After completion of the test, the child was again praised on his performance, thanked for "helping play the game" with the administrator and then was escorted back to his classroom. The same procedure used in the pre-test was repeated for the two post-tests; however, since the children and administrator were already acquainted, preliminary discussion centered on a reminder of what was to be done. When the child was seated in the testing room, the administrator said, "Do you remember when we played this game before?" When the child responded, the introduction and the body of the test were given. Standard testing procedure was maintained throughout all three testing periods.

A pre-test was given to both groups, the experimental and the control, for the purpose of determining if the two groups were comparable prior to any training, and also to establish a base to show any change following the teaching sessions. It was found from the pre-test that the groups had no statistically significant difference in scores, and thus it was concluded that the groups were comparable prior to training.

Teaching sessions

Two groups of children were involved in the teaching (story telling) sessions. One group was the four-year-old class of the Primary at the LDS Church in Providence, Utah. The other group was the four-year-old class of an LDS Church in Logan, Utah. Following a brief general

session for all children in the Primary, the large group of children and teachers divides into classes and proceeds from a group meeting area to the various classrooms, for a forty-minute class period. The story telling sessions of the study were conducted in the children's classrooms during this class period. During the five-week course of this portion of the study, a time period of 8-12 minutes was used to tell the story and have a brief questioning and discussion period following the story. During this time, the teacher sat at the back or side of the room, usually listening as the story sessions were conducted, but never participating in the story telling, discussion following, or in the direction giving prior to or following the teaching session. The author maintained control of the group of children from the time she arrived until she finished and turned the control back to the classroom teacher.

The classrooms were located in the two church buildings; each classroom was located in a group of classrooms in a section of the building. Other classes were being conducted while the teaching sessions were being conducted, and although there were a variety of noises heard, none were distracting to the participating children. Each classroom contained a table and a number of chairs for the classroom teacher and the children. During the teaching session, the author also brought into the classroom a 2 foot by 3 foot black flannel board, a small cassette tape recorder (used for standardization purposes), the flannel board story and characters contained in a folder, and a small role book and pen. All five teaching sessions were conducted in the same manner: the children were asked to sit on the floor in a semi-circle around the

flannel board, so that each child had a clear view of the flannel board and the author. The tape recorder was hidden behind the flannel board, although the tape recorder microphones were visible from behind the flannel board. The author sat on the floor on the right side of the flannel board; the flannel board story characters in their proper order were stacked in a pile in front of her. The typed copy of the story also lay in front of her. After having called the children's attention to herself, she then proceeded to introduce the story, and following this, told the story. Short responses and comments during the story were encouraged from the children. Following the story, there was a short discussion period about the story. These questions were intended to clarify the concepts being taught and to assure the author that the children had understood the story. The children were allowed to manipulate the characters in response to questioning and direction from the author. Group and individual responding was encouraged; responses pertinent to the story and its concepts were allowed. Irrelevant comments were accepted but not encouraged. At the completion of the discussion period, the control of the group was given to the classroom teacher. The story materials were then gathered and removed from the classroom by the author.

Instruments

Description and administration of the test. The Boehm Test of Basic Concepts was used in this study to determine the children's facility with some basic quantity concepts expected of young children. The Boehm test was developed and published by Ann E. Boehm in 1969; it was designed to

measure young children's mastery of concepts considered necessary for achievement in the first years of school. Its use in this study was first to discover to what degree each child was familiar with the quantity concepts on the test (pre-test); secondly, it was used to determine how much was learned from the teaching materials developed by the author (first post-test); and finally, it was used to determine the degree of retention of concepts about which each child had indicated knowledge on the first post-test (second post-test). Both Forms A and B were used in this study; Form A was used for the pre-test, and Form B was used for the two post-tests. The original Boehm test was designed to determine familiarity in four areas: space, quantity and number, time, and miscellaneous. For the purpose of this study, only the quantity section of the test was used. The concepts included in the quantity section are: some, not many, few, widest, most, whole, second, several, almost, half, as many, not first or last, medium-sized, zero, every, pair, equal, third, and least. The test booklet was modified to include only the quantity questions in order to facilitate administration of the test. An example of this modified form is found in Appendix A, page 64. A standard data collection sheet accompanied the Boehm test; it was also modified in that the spaces provided for the questions for the space, time, and miscellaneous concepts were blocked out. A sample of this data sheet is also in Appendix B, page 72.

Administration of the test was as follows: each child was individually tested in a room especially set up for the testing. Each room contained a child-sized table with two chairs. The child and the administrator sat side-by-side at the table. On the table were the test

booklet, placed directly in front of the child, and a sheet of paper to cover the test booklet. In front of the administrator lay the data sheets and a pen. After seating the child, the administrator said, "I'd like to play a picture game with you. Listen carefully and I will tell you what to point at." The first page of the test booklet has three practice questions. The administrator gave the direction for each, covering the succeeding pictures (questions) with the sheet of paper as she proceeded. After each response from the child, the administrator acknowledged the response and praised the child. After the three introductory questions, the author said, "You are doing just fine. You'll do very well on the rest of the game." She then turned the page, covered all but the top question with the sheet of paper, and said to the child, for example, "Look at the paper and stars. Point to the paper with the star at the top." If the child responded correctly, a mark was made on the data sheet next to the appropriate answer. If the response was incorrect, the administrator went on to the next question, pulling the sheet of paper down to uncover the next set of pictures. This continued throughout the test. Marking the data sheet was done smoothly and unnoticeably, in a way to prevent distracting the child's attention from the test questions. The administrator gave no positive or negative responses to the child during the test. Each question was repeated if it seemed necessary, with a maximum of two repetitions. If the child indicated confusion or did not know the correct response, the administrator would say, "Let's go to the next one," and would phrase the next question. After the test was completed, the child was thanked for playing the game and praised for his participation, and then was escorted to his classroom.

Instrument for teaching sessions--flannel board stories. Five stories were written by the author for the purpose of teaching five basic concepts selected from a total of eighteen concepts from the quantity section of the Boehm test. The five concepts selected from the eighteen quantity concepts were: not first or last, second, third, pair, and medium-sized. These concepts were selected by the author on the basis of the children's demonstration of a lack of mastery of these concepts. It was determined that these concepts were generally unfamiliar to children of the age involved in this study, and also because these concepts lent themselves to instruction through the use of flannel board stories. Only five concepts were taught as it was beyond the scope of the present study to teach all of the quantity concepts on the Boehm test.

There was no particular order given to the sequence of presentation of the concepts. It was determined that the concepts first, second, third, and last would be grouped together and taught in two separate stories; the concepts of pair and medium-sized were taught in two stories, one session for each concept; and in the final story, all of the concepts were presented and developed within the story. In each teaching session, only one story was told and discussed; thus a total of five stories for five teaching sessions were presented to the experimental group children. The five teaching stories are found in Appendix C, beginning on page 74.

Pilot study

A pilot study was conducted by the author on February 9, 1973, in order to determine the most appropriate method of presenting the stories for the teaching sessions, to discover the approximate length of a teaching session, and to practice giving a sample story to the children. Eight children, four boys and four girls, were selected from the Afternoon Child Development Laboratory at Utah State University and were taken to an unoccupied classroom. The children were seated around a flannel board on a large rug. The author sat to the right of the flannel board with the flannel board characters placed in a pile in front of her. A tape recorder was placed behind the flannel board out of the view of the children. After re-introducing herself to the children and acquainting them with the classroom and herself, the investigator then told the story, Six Foolish Fishermen, by Benjamin Elkin (1957). The story was illustrated in flannel board characters taken from figures in the book. The story contains emphasis on the terms first, second, third, fourth, fifth, and sixth. The author modified the story to emphasize only the terms first, second, third, and last. The story was told about four brothers, rather than six. After telling the story, questions and discussion followed. At the completion of the story, the author escorted the children back to their classroom.

It was the intention of the author to use this story as the first story in the series of five teaching stories, and locate four other stories from already published stories which could be adapted for the purposes of this study, such as those found in McIntyre's article (1969). As a result of the pilot study, however, it appeared to be

essential to use stories which were intended exclusively for this study. The story Six Foolish Fishermen did not lend itself to the teaching of the concepts as adequately as the investigator had intended for it to do. Also, the response of the children indicated that the story seemed too long and the plot was too involved and difficult for the four-year-old children used in the pilot study.

On the basis of the findings in the pilot study, the author decided that it would be more functional to the purposes of the study to write the stories for the teaching sessions and illustrate them by herself in order to adequately and effectively facilitate this study.

After the stories had been written and illustrated by the author, a practice session was again conducted on March 15, 1973, with the children from the Morning Child Development Lab. Six children, three boys and three girls, were selected and taken to an unoccupied classroom. The same procedures as the first practice session were repeated, this time using the story Animals Walking in a Line written by the author. The purposes of the original pilot study, to determine the most appropriate method, to discover the approximate length of a session, and to practice telling the story, were fulfilled in this practice session.

FINDINGS

Presentation of Findings

Two groups, the experimental and the control, were tested three times each. The pre-test was given to each group prior to any tutorial experience. The results of this testing indicated that there was no significant difference between the two groups. After a period of five weeks, meeting once each week with the experimental group for a tutorial experience, and not meeting at all with the control group, both groups were retested by the researcher. The results of this testing are reported under hypothesis I. Finally, after a six-week waiting period during which time no tutorial work was done with either group, the two groups were again tested. The results of this testing are cited under hypothesis II. The results reported under hypothesis III provide information gained from all of the testing periods.

The statistical test used in this section of the study was a t-test of significance. Tables 1 and 3 were analyzed for significance using a t statistic for two-sample independent populations, and Tables 2, 4, 5, and 6 were analyzed using a t statistic for two-sample correlated or dependent populations.

In every case, there are two scores reported for every subject: the score obtained on the Boehm Test of Basic Concepts for the entire quantity section, with a possible score of 18, and the score which represents the five selected concepts taught specifically in the

teaching sessions, which are not first or last, second, third, pair, and medium-sized. It was determined that both scores should be reported to clarify the fact that only five concepts were actually emphasized. These five concepts, not first or last, second, third, pair, and medium-sized, were five of the possible eighteen concepts in the quantity section of the Boehm test.

Hypothesis I

The experimental group, which will have tutorial experience will make no significant improvement in test performance (Boehm Test of Basic Concepts) after the training as compared to the control group, which will receive no tutorial experience.

After five training periods the experimental group was tested, using the Boehm Test of Basic Concepts, Form B, Quantity Section only. The control group was also tested, but this group had received no training. This is called the first post-test for the purposes of this study. Table 1 indicates that the total score on the quantity section for the experimental group for the pre-test is 120, and for the first post-test the total score is 159; this is a statistically significant difference at the .001 level of significance. Also, the pre-test score for the experimental group on the five selected concepts is 21, and the total score for the first post-test is 46. This is also a significant difference at the .01 level of significance.

The total score for the control group for the pre-test is 128, and the total score for the first post-test is 130; the pre-test score for the five selected concepts is 24, and the first post-test score is 27.

Table 1. Comparisons of Boehm test pre-test and first post-test scores, quantity section and five selected concepts, for experimental and control groups

Experimental group							Control group						
			Quantity		Five					Quantity		Five	
Subject	Age	Sex	Pre-test	First	Pre-test	First	Subject	Age	Sex	Pre-test	First	Pre-test	First
A	4-9	F	9	13	0	5	M	4-5	F	9	9	2	0
B	5-2	F	9	14	1	4	N	5-4	F	11	11	2	4
C	4-6	F	15	16	4	5	O	4-8	F	10	8	2	0
D	4-11	F	7	12	0	5	P	5-2	F	10	11	2	3
E	5-4	F	9	13	1	3	Q	4-9	F	13	11	3	2
F	4-8	F	11	13	3	3	R	5-1	F	13	11	2	2
G	4-10	F	8	10	1	1	S	5-4	F	9	12	1	2
H	4-9	F	11	15	2	5	T	5-1	F	12	12	4	3
I	5-0	M	12	16	4	5	U	5-4	M	13	13	2	4
J	4-6	M	6	9	1	1	V	5-3	M	9	13	1	3
K	5-3	M	11	15	2	5	W	4-5	M	10	9	2	2
L	4-7	M	12	13	2	4	X	4-7	M	9	10	1	2
Total			120	159	21	46	Total			128	130	24	27
Mean score			10	13.25	1.75	3.83	Mean score			10.66	10.83	2	2.25
Subjects		12					Subjects		12				

t score

Quantity section 7.9191
Significant at .001 level
Five selected concepts 4.0451
Significant at .01 level

t score

Quantity section .0309
Not significant
Five selected concepts .5832
Not significant

Neither of these scores are significantly different for the control group.

Referring to Table 2, the total score for the experimental group on the first post-test was 159; the total score for the control group was 130. This is a significant difference at the .01 level of significance. The total experimental group score for the five selected concepts is 46 on the first post-test; the total control group score is 27 on the first post-test. This is also significant at the .01 level of significance. These findings suggest that the training given to the experimental group did in fact have an effect on the performance on the first post-test, whereas the scores for the control group indicate that there was no significant change in the scores from the pre-test to the first post-test. Therefore, hypothesis I was not validated.

Hypothesis II

The experimental and control groups will have no significant difference in scores between the first post-test (following training) and the second post-test (following the waiting period).

After giving the first post-test to both the experimental and the control groups, a six-week waiting period elapsed before giving the final test, called the second post-test. Again, the Boehm test, Form B, Quantity section only, was given to both groups. It was speculated by the author that there might be a significant reduction in score by the experimental group from the first post-test to the second post-test, thereby demonstrating a loss of the learnings gained from the training sessions. However, this did not prove to be the case. Referring to Table 3, the total score for the experimental group on the first

Table 2. Comparison of Boehm test first post-test scores for experimental and control groups, total quantity section and five selected concepts

Experimental group					Control group				
Subject	Age	Sex	Quantity	Five	Subject	Age	Sex	Quantity	Five
A	4-9	F	13	5	M	4-5	F	9	0
B	5-2	F	14	4	N	5-4	F	11	4
C	4-6	F	16	5	O	4-8	F	8	0
D	4-11	F	12	5	P	5-2	F	11	3
E	5-4	F	13	3	Q	4-9	F	11	2
F	4-8	F	13	3	R	5-1	F	11	2
G	4-10	F	10	1	S	5-4	F	12	2
H	4-9	F	15	5	T	5-1	F	12	3
I	5-0	M	16	5	U	5-4	M	13	4
J	4-6	M	9	1	V	5-3	M	13	3
K	5-3	M	15	5	W	4-5	M	9	2
L	4-7	M	13	4	X	4-7	M	10	2
Total			159	46	Total			130	27
Mean score			13.25	3.43	Mean score			10.83	2.25

Subjects 24

t score

Quantity section 4.3203--significant at .01 level

Five selected concepts 3.2795--significant at .01 level

Table 3. Comparisons of Boehm test first post-test and second post-test scores, quantity section and five selected concepts, for experimental and control groups

Experimental group					Control group				
	Quantity		Five			Quantity		Five	
Subject	First	Second	First	Second	Subject	First	Second	First	Second
A	13	11	5	3	M	9	11	0	1
B	14	14	4	4	N	11	12	4	2
C	16	15	5	5	O	8	7	0	0
D	12	11	5	4	P	11	13	3	3
E	13	14	3	4	Q	11	9	2	2
F	13	13	3	3	R	11	13	2	3
G	10	10	1	0	S	12	9	2	1
H	15	13	5	4	T	12	16	3	5
I	16	16	5	5	U	13	15	4	3
J	9	9	1	2	V	13	10	3	3
K	15	16	5	5	W	9	13	2	2
L	13	15	4	5	X	10	10	2	2
Total	159	157	46	44		130	138	27	27
Mean score	13.25	13.08	3.83	3.66		10.83	11.5	2.25	2.25
Subjects	12				Subjects	12			
t score					t score				
Quantity section .4937					Quantity section .9428				
Five selected concepts .6284					Five selected concepts 0				

post-test was 159; the total score for the second post-test was 157. This is not a significant difference in the scores. Also, the score for the first post-test of the five selected concepts is 46 for the experimental group, and the second post-test score is 47. This, too, is not a significant difference in scores. The total score for the first post-test for the control group is 130; the total score on the second post-test is 138, representing a slight, although not significant, gain. On the five selected concepts the first post-test score for the control group is 27, and the score on the second post-test is 27, representing no improvements or loss on these concepts. The results of this comparison indicate that the number concepts learned by the experimental group as demonstrated by the performance on the tests were maintained over the six-week waiting period, whereas these concepts were not gained by the control group. As a result, in the cases of both the experimental and control groups, hypothesis II was validated.

Hypothesis III

There will be no significant difference between the scores of the boys and girls on the pre-test, first post-test, and second post-test.

In comparing the scores of the female sample, Table 4 indicates that for the experimental group the pre-test score was 79, the first post-test score was 106, and the second post-test score was 101 for the quantity section. This represents a significant difference from the pre-test to the first post-test at the .01 level. For the comparison

Table 4. Comparisons of Boehm test on pre-test, first post-test, and second post-test for female sample

	Experimental group						Control group					
	Quantity section			Five selected concepts				Quantity section			Five selected concepts	
Subject	Pre-test	First	Second	Pre-test	First	Second	Subject	Pre-test	First	Second	Pre-test	First	Second
A	9	13	11	0	5	3	M	9	9	11	2	0	1
B	9	14	14	1	4	4	N	11	11	12	2	4	2
C	15	16	15	4	5	5	O	10	8	7	2	0	0
D	7	12	11	0	5	4	P	10	11	13	2	3	3
E	9	13	14	1	3	4	Q	13	11	9	3	2	2
F	11	13	13	3	3	3	R	13	11	13	2	2	3
G	8	10	10	1	1	0	S	9	12	9	1	2	1
H	11	15	13	2	5	4	T	12	12	16	4	3	5
Total	79	106	101	12	31	27	Total	87	85	90	18	16	17
Mean score	9.88	13.25	12.63	1.5	3.88	3.38	Mean score	10.88	10.63	11.25	2.25	2	2.13
Subjects	8						Subjects	8					

t scores

Quantity section: Pre-test to first post-test 6.3388--Significant .001.
First post-test to second post-test 1.6666--Significant at .20

Five selected concepts: pre-test to first post-test 3.3662--Significant at .02
First post-test to second post-test 1.5275--Significant at .20

t scores

No significant difference on any score

of the first and second post-test, there is a significant difference at the .20 level, indicating a slight decrease in score. For the five selected concepts the scores on the pre-test, first post-test and second post-test are 12, 31, and 27 respectively. This also represents a significant difference from the pre-test to first post-test at the .02 level. Again, there was a slight decrease from the first post-test to the second post-test at the .20 level.

For the control group the scores for the quantity section were 87, 85, and 90 respectively. The scores for the five selected concepts were 18, 16, and 17. None of these comparisons represents a significant difference in score.

The results for the female sample fail to validate hypothesis III for the experimental group; for the control group hypothesis III is validated.

For the male sample, Table 5 reveals that the scores on the quantity section of the Boehm test for the experimental group are 41, 53, and 56 respectively, on the pre-test, first post-test, and second post-test. A significant difference at the .05 level is indicated for the pre-test-first post-test comparison, whereas there is no significant difference for the first post-test-second post-test comparison. For the five selected concepts, the scores are 8, 15, and 17 for the three tests. This is a significant difference at the .10 level for the pre-test-first post-test comparison, but there is no significant difference in the first post-test-second post-test comparison.

For the control group, the quantity section scores are 41, 45, and 48 respectively, for the three tests. There is no significant difference

Table 5. Comparisons of Boehm test on pre-test, first post-test, and second post-test for male sample

Experimental group							Control group						
	Quantity section			Five selected concepts				Quantity section			Five selected concepts		
Subject	Pre-test	First	Second	Pre-test	First	Second	Subject	Pre-test	First	Second	Pre-test	First	Second
I	12	16	16	4	5	5	U	13	13	15	2	4	3
J	6	9	9	1	1	2	V	9	13	10	1	3	3
K	11	15	16	2	5	5	W	10	9	13	2	2	2
L	12	13	15	2	4	5	X	9	10	10	1	2	2
Total	41	53	56	9	15	17	Total	41	45	48	6	11	10
Mean score	10.25	13.25	14	2.25	3.75	4.25	Mean score	10.25	11.25	12	1.5	2.75	2.5
Subjects	4						Subjects	4					

t score

Quantity section: pre-test to first post-test 4.2426--Significant at .05
First post-test to second post-test--no significant difference

Five selected concepts: pre-test to first post-test 3.4857--Significant at .10
First post-test to second post-test--no difference

t score

Quantity section: No significant difference on any test

Five selected concepts: pre-test to first post-test 3.1334--Significant at .10
First post-test to second post-test--no significant difference

in any of the scores. For the five selected concepts, the scores are 6, 11, and 10, indicating a significant difference at the .10 level for the pre-test to first post-test comparison. This suggests a gain in score for the control group, male sample, for reasons other than any tutorial experience.

In conclusion, hypothesis III is not valided for either the experimental group on the pre-test to first post-test comparison, and this hypothesis is valided for the first post-test-second post-test comparison for both groups.

Related Findings

In studying the gain or loss of the five selected concepts, Table 6 gives the total number of children responding correctly under each concept specifically taught.

Table 6. Comparisons of experimental and control groups on five selected concepts for the pre-test, first post-test and second post-test

Test--groups	Not first or last	Second	Third	Pair	Medium-sized
Pretest					
Experimental	7	6	3	3	2
Control	7	10	3	3	3
First post-test					
Experimental	10	8	8	10	10
Control	8	9	3	1	6
Second post-test					
Experimental	11	11	5	7	10
Control	7	9	4	1	6

On the pre-test, both groups are essentially comparable in demonstrated knowledge of the five concepts, except perhaps, for the concept second where the two groups vary by 4 points, and for medium-sized where there is a difference of 1 point. In both of these cases, the control group is the one demonstrating the greater knowledge. On the first post-test the greatest discrepancy is on the concepts of third, with a difference of 5, and pair with a difference of 9. The groups differ on medium-sized by 4 points, on not first or last by 2 points, and on second by 1 point. Second is the only concept where the control group still is greater, but the gap has narrowed from 4 points to 1 point. On the second post-test there is still a large difference on pair of 6 points; there is a difference of 4 points on medium-sized and not first or last, a difference of 2 on second, and 1 point's difference on third. For all concepts on the second post-test the experimental group demonstrates greater knowledge.

Summary of Findings

Hypothesis I was not supported. There was a significant increase in score by the experimental group from the pre-test to the first post-test, suggesting to a significant degree that the training was effective in teaching the five selected number concepts to the four-year-old children involved in this study. The control group made no significant increase in score during the same period of time as was involved in the teaching sessions, without having tutorial experience.

Hypothesis II was validated. There was no significant difference in score from the first to the second post-test between which there was

a six week waiting period when no training was done. The experimental group maintained its improved score on the first post-test to the second post-test; the control group also maintained its unimproved score, indicating that there was no significant learning of the number concepts taught in this study.

Hypothesis III was not supported. From the findings there appears to be no difference between the boys and the girls in the ability to learn number concepts through a story telling method. There was a slight increase in score by the control group boys that was unrelated to the tutorial experience.

DISCUSSION

Discussion of Findings

The null hypotheses made in this study were supported in two cases and not supported in one case. On the pre-test both the experimental and control groups were very similar in performance. None of the children in either group received the total score of 18 for the quantity section and 5 for the five selected concepts. Following the teaching sessions, both the experimental and control groups were given the first post-test. The range in score on this test for the experimental group was 9 to 16, and the mean was 13.25 for the quantity section; for the five selected concepts the range was 1 to 5 with a mean of 3.83. This was significant difference in score from the pre-test. All of the children gained in score on the quantity section; two children gained 5 points, four children gained 4 points, one child gained 3 points, and two children gained 1 point. On the five selected concepts two children gained 5 points, three gained 3 points, two gained 2 points, two children gained 1 point, and three did not increase their five selected concept score. The three children who did not gain on the five selected concepts did have a gain on the quantity section, however. This could be due to familiarity with the administrator of the test, with the testing booklet and procedure, or perhaps because of involvement with number-related concepts and discussion from the teaching sessions, although facility with the particular concepts being taught was not evident.

In the control group the range in score on the first post-test for the quantity section was 8 to 13, with a mean score of 10.83, and for the five selected concepts the range is 0 to 4 with a mean of 2.25. In both cases there was a gain in mean score: for the quantity section 10.66 to 10.83, and for the five selected concepts 2 to 2.25, but the gain is small. In the quantity section one child gained 4 points, one child gained 3 points, and two children gained 1 point, whereas one child decreased 2 points, and three children showed no gain or loss from the pre-test to the first post-test. This gain of points could be due to familiarity with the administrator and the testing situation, or perhaps also to some learning attained somewhere other than in a tutorial situation. The losses might be attributed to a child's "guessing" on some of the questions on the pre-test and then guessing incorrectly on the post-tests. In the control group in both cases, the quantity section and the five selected concepts, there was no statistically significant difference in score from the pre-test to the first post-test.

After the waiting period of six weeks from the first post-test, the second post-test was given to both groups. In the experimental group the range for the quantity section on the second post-test was 9 to 16 with a mean score of 13.08. This represented a very slight decrease from a mean of 13.25 on the first post-test. Five children did not change in score from the first to second post-test, with two children gaining 1 point and two gaining 2 points; two children decreased 1 point, and one child decreased 2 points. For the five selected concepts the range on the second post-test was 0 to 5. Five children maintained

their first post-test score, three gained 1 point, three lost 1 point, and one lost 2 points. When a decrease in score occurred, the concepts lost were generally one or two of the five concepts taught in the teaching sessions. Further, when a gain was made from the first to second post-test, again the points gained were generally one or two of the five concepts taught specifically in the teaching sessions. This could possibly be due to an increased awareness of the specific concepts taught, which did not manifest itself on the test immediately following the teaching sessions but became evident after a longer period of time.

It must be noted that where a decrease occurred, only one child's score decreased back to her pre-test score; this child pre-tested with a very high score of 15 out of a possible 18 for the quantity section, then gained 1 point on the first post-test for a score of 16, and then decreased 1 point to a score of 15 for the second post-test. But the scores for the five selected concepts for this subject on the pre-test, first post-test, and second post-test were 4, 5, and 5, respectively, indicating that the decrease in score was not on any of the concepts taught in the teaching sessions.

For the control group the range of score for the quantity section was 7 to 16 with a mean score of 11.5; this is a small increase from 10.83 from the first post-test. Only one child's score remained constant from the first post-test to the second post-test; one child gained 1 point, four children gained 2 points, and two children gained 4 points. Conversely, one child lost 1 point, one lost 2 points, and two lost 3 points. On the five selected concepts there was no change in mean score from the first post-test to second post-test; it remained 2.25, with a

range of 0 to 5. On these five concepts, six children remained constant, two children gained 1 point, and one child gained 2 points. Two children decreased in score 1 point and one decreased 2 points. The fluctuation in score from the first post-test to the second post-test in the control group is not related to the five concepts as it was for the experimental group. Apparently, either from learning gained from other sources and experiences, or from guessing on the tests, the scores varied haphazardly from one test to another. None of the differences in total score represent a statistically significant difference for the control group.

In comparing the scores of the experimental group, female sample, the same trend as for the entire sample is indicated. On the pre-test the total for the quantity section is 79 with a mean of 9.88; the total on the first post-test is 106 with a mean of 13.25, making a statistically very different score at the .001 level. The second post-test score is 101 with a mean of 12.63, representing a small decrease in score. For the five selected concepts the score is 12 for the pre-test with a mean score of 1.5; on the first post-test the score is 31 with a mean of 3.88, which is a statistically significant difference. The second post-test score is 27 with a mean of 3.38, again representing a small decrease in score. For the control group, the scores for the quantity section are 87, 85, and 90, with means of 10.88, 10.63, and 11.25 respectively. The scores for the five selected concepts are 18, 16, and 17 with means of 2.25, 2, and 2.13. These represent no statistically significant difference for any comparison. For the female

sample, the differences are comparable to the difference for the entire sample, with the experimental group gain in score after the teaching sessions being a large one.

For the experimental group, male sample, on the quantity section the scores are 41, 53, and 56, with means of 10.25, 13.25, and 14 respectively, representing a significant difference at the .05 level after the teaching sessions. On the five selected concepts the scores are 9, 15, and 17 with mean scores of 2.25, 3.75, and 4.25 respectively. This also is a significant gain in these concepts.

For the control group, male sample, an interesting phenomenon occurred. The scores for the quantity section on the pre-test, and first and second post-tests are 41, 45, and 48, with means of 10.25, 11.25, and 12. This is a slow but not statistically difference gain from the pre-test to first post-test, and from the first post-test to the second post-test. For the five selected concepts however, the gains become very apparent. The scores are 6, 11, and 10 with means of 1.5, 2.75, and 2.5 respectively. This represents a significant difference at the .10 level from the pre-test to first post-test. The boys in the control group gained almost as significantly as did the experimental group boys from the pre-test to the first post-test. An explanation for this could be that the boys felt much more confident about the testing situation and with the administrator; or familiarity with the five concepts could have been gained from normal day-to-day activity. However, since the male sample in either case is so small, few conclusions can justifiably be drawn from this group.

Discussion of Related Findings

Children of the age studied here displayed more familiarity with the concepts of not first or last and second than on third, pair, or medium-sized. On the pre-test, at least half of the experimental group of 12 children demonstrated facility with not first or last and second; the control group's scores on these two concepts were 7 and 10 respectively. On the first post-test the experimental group score raises from 7 to 10 on not first or last, and from 6 to 8 on second. The control group's score on not first or last decreased from 10 to 8, and increased from 8 to 9 on second. On the second post-test the experimental group score again raised from 10 to 11 on not first or last and from 8 to 11 on second. A total of 11 out of 12 children in the experimental group had gained these two concepts by the time of the second post-test. The control group decreases again on not first or last from 8 to 7, and on second the total score of 9 remains unchanged.

On the concept third the scores for the experimental group for the three tests are 3, 8, and 5. This demonstrates an increase after the teaching session, and then a decrease after the six-week waiting period. Apparnetly the ordinal concept of third is not as secure as the other ordinal concepts of first, second, and last. For the control group the scores are 3, 3, and 4 representing a very slight gain on the second post-test.

On the concept pair the increase is a significant one for the experimental group from the pre-test (3 points) to the first post-test (10 points). There is again a decrease to 7 on the second post-test.

The children enjoyed learning about this concept and participated eagerly in the story telling discussion during which the children pointed to "pairs" of things on their bodies, such as their eyes, ears, and hands. The Boehm test, Form B, tests for this question by having pictures of dolls. Perhaps the decrease in score could be related to the unusualness of locating a "pair of dolls." The control group scores are 3, 1, and 1; it seems as if this is a concept that, once learned, is a useful one to the children and one that is readily learned. If the concept is not pointed out specifically to children of four years of age, however, it does not appear to be one that is picked up from their environment.

The most dramatic learning and retention of a concept is on medium-sized. The experimental group score raised from 2 to 10 after the teaching sessions, and is maintained as 10 on the second post-test. It seemed as if this was a concept that the children needed, and once it was learned it was permanently acquired. In labeling the comparison of different-sized objects, the children already seemed to know "smaller" and "larger" but did not have a label for the size in-between. After the teaching sessions, there was no hesitation on the test at this concept's question; the children immediately knew which was the medium-sized picture. The control group's scores were 3, 6, and 6, representing an increase from the pre-test to the first post-test and no improvement on the second post-test. Again, the improvement is possibly due to learning obtained in other than a tutorial situation.

Discussion of Procedure

The two groups, the experimental and the control, were comparable in enthusiasm and cooperation; both groups of children were somewhat apprehensive about leaving their classroom to accompany the researcher, but since all of the children were introduced to the researcher by the teacher in their classroom before being asked to leave, the children were not reluctant to participate. Only one child in all of the Primary groups was eliminated due to refusal to be tested. This child agreed to be tested for the pre-test after some coaxing, but then refused to be tested on the first post-test, and thus was disqualified. This child was very shy; the researcher was unable to understand him when he spoke because he mumbled and spoke into his hands. No child was forced to come, and after one or two of the children had been tested, all of the children seemed eager to participate- After the pre-testing session, the children did not hesitate to leave. Their enthusiasm for the testing sessions made this part of the study easy and enjoyable.

During the teaching sessions with the experimental group, the interest level seemed very high. Before the first teaching session the researcher had informed the children what was to be done, i.e., that sories were going to be told to them and that they would be able to "play" with the flannel board characters. For the first teaching session the children were interested in the flannel board, the flannel board characters and the tape recorder. The function of the tape recorder, that the researcher wanted to remember how she told the story and listen to what the children said, was explained to the children,

and they were very interested in it. However, after it was put out of sight behind the flannel board and the story telling began, the children seemed to forget about it. After the first teaching session, the tape recorder was not discussed although the children sometimes displayed recognition of its presence.

The children, once one teaching session had occurred, seemed to know what to expect from the story telling session and were very cooperative and uninhibited. The researcher asked the children to sit on the floor around the flannel board, thus moving from sitting in chairs to sitting on the floor. Before preparation for the story telling was completed, the children usually had assumed the story telling position on the floor. During the discussion prior to the story telling, the children were anxious to tell the author what they remembered about the previous teaching session, or to discuss the flannel board characters. A short review was conducted, followed by that week's story. The interest level was high. Very few disciplinary measures were necessary during the course of the five sessions. Children occasionally had to be reminded to listen to the researcher and that they would have a chance to talke after the story. Some discussion pertinent to the concepts in the story during the telling was allowed and encouraged, however. For the discussion that followed every story, the children were asked questions and involved in discussion about the story and its concepts. Response to the questions was spontaneous and stimulating. Manipulation of the flannel board characters by the children in response to discussion was encouraged. The children were often called on by name to respond.

The participation was with interest and enthusiasm. After the discussion the control of the children was turned back to the teacher, and the story telling materials were removed. The total time for the entire session was between 8 and 12 minutes. The class teachers were cooperative and supportive, and they mentioned to the author that they enjoyed the stories. Neither of the two teachers expressed annoyance or indicated that the story telling was disrupting to them.

The teaching sessions were intended to be exciting and stimulating for the children. The author took care to be enthused herself, and to make the teaching sessions enjoyable as well as educational. The fact that children's stories are usually used for entertainment was of prime consideration, and the techniques for effective story telling were employed, such as facial and voice expression and careful manipulation of the flannel board characters. It is felt by the author that the warm atmosphere and rapport established between the teacher and the children is as important as the story and the flannel board characters in teaching concepts through the story telling technique.

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to instruct 12 four-year-old non-preschool children through the use of children's stories in a tutorial situation in five sessions to develop certain number concepts and display this knowledge on a test. The stories were centered around the concepts not first or last, second, third, pair, and medium-sized.

Twelve non-preschool four-year-old children served as a control group, and were tested the same number of times as the experimental group but received no tutorial experience. The groups were then compared to determine if there was a significant difference between the two groups as indicated from the tests.

These null hypotheses were formed:

1. The experimental group, which will have tutorial experience, will make no significant improvement in test performance (Boehm Test of Basic Concepts) after the training as compared to the control group, which will receive no tutorial experience.

2. The experimental and control groups will have no significant difference in scores from the first post-test (following training) and the second post-test (following a waiting period).

3. There will be no significant difference between the scores of the boys and the scores of the girls on the pre-test, first post-test, and second post-test.

The sample of 24 four-year-old children were gathered from Latter-Day-Saint Church Primaries in the Logan and Providence areas of Cache County, Utah. Two Primaries served as the control group and two Primaries served as the experimental group. There were 12 children, eight girls and four boys, in each group. All of the children were given a pre-test to determine their level of knowledge of number concepts on the Boehm Test of Basic Concepts. After the pre-test the experimental group participated in five teaching sessions, one session per week. At the conclusion of the teaching sessions both groups were retested (first post-test) to evaluate each group's performance on the Boehm Test after the experimental group's tutorial experience. Finally, after a six-week waiting period had elapsed, during which time no group received any tutorial experience, both groups were given the second post-test, to again determine the level of knowledge of number concepts; particularly, it was given to see if there had been any loss of the concept learning from the first post-test.

The findings revealed no significant difference between the experimental and control groups on the pre-test; there was a significant difference in score after the teaching sessions, however. The experimental group significantly increased its score from the pre-test to the first post-test and this was also significantly different from the control group's first post-test score, whose performance on the first post-test was not significantly different from its pretest score. There was no significant change in score for either group from the first to the second post-test for the entire sample, both the experimental and the control groups; however, in comparing the boys' pre-test,

first post-test, and second post-test scores there was a small, significant increase for the control group from the pre-test to the first post-test that was not related to any tutorial experience. Further, it was found that the four-year-olds in this study gained most on the concepts of medium-sized and pair, and since they had demonstrated greater familiarity with the concepts of not first or last and second, gained less on these concepts. The concept of third was less familiar to the children and it was not learned as adequately as the other concepts.

Conclusions

The findings of this study appear to support the conclusion that concepts related to number can be taught effectively to young children through the use of tutorial training experiences, utilizing stories designed to emphasize such concepts. Specifically, these conclusions are made relevant to this sample:

The four-year-old non-preschool sample involved in this study appear to learn number concepts from hearing and participating in flannel board stories about these concepts.

The use of children's blannel board stories seems to be an effective method of teaching number concepts to this group of children.

Knowledge gained from the use of children's flannel board stories is maintained over a period of time.

The sex of the child does not appear to be a significant factor in determining a child's ability to learn number concepts by hearing stories about them.

The ordinal concepts of first, second, and last are more familiar to this sample than are pair and medium-sized but these last two concepts can be taught effectively through children's flannel board stories.

Recommendations for Future Studies

From the results of this study, the following are recommendations for future studies:

A similar study, done with a preschool sample, could possibly determine the degree that preschool education has on number concept development.

A similar study, with younger subjects of three years old, might clarify the age differences in number concept development.

Stories developed around concepts of time, space, or other basic concepts could be tested to see if children's flannel board stories are effective in teaching concepts other than number.

A similar study, using only story telling and not flannel board characters and not allowing the children to participate verbally or physically, might determine whether auditory stimulation only can teach concepts.

A similar study, with a longer waiting period than six weeks could possibly determine if and when knowledge of the concepts after a tutorial experience may be lost.

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APPENDIXES

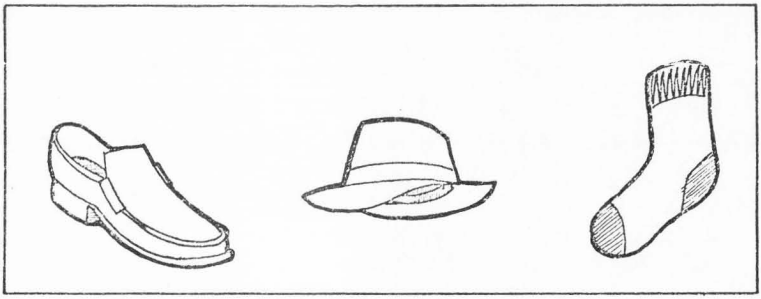
Appendix A

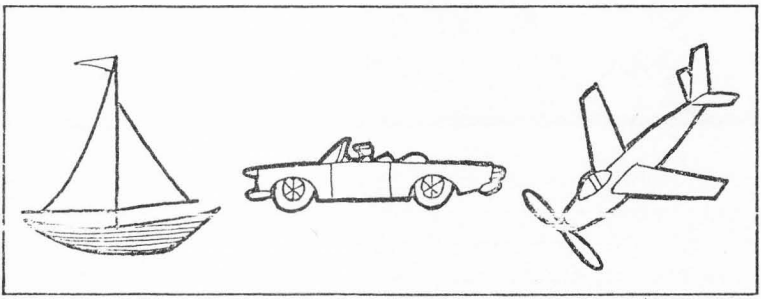
Boehm Test of Basic Concepts

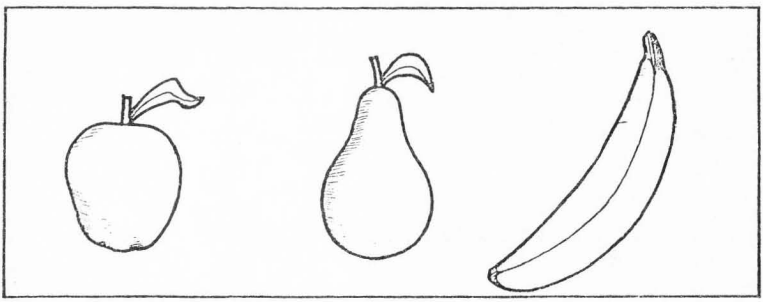
Quantity Section

NAME _____ 65

Form B
Booklet 1







BOEHM TEST of basic concepts

Ann E. Boehm

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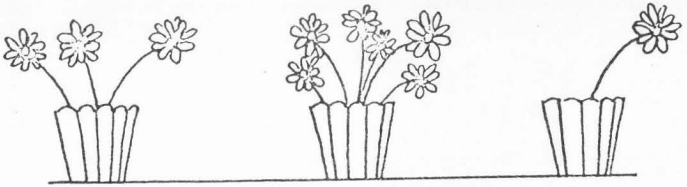

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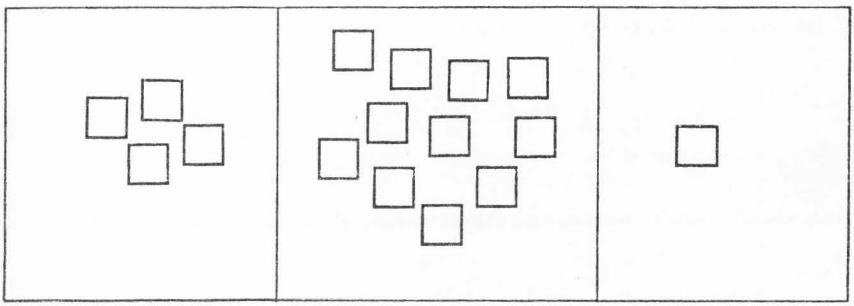

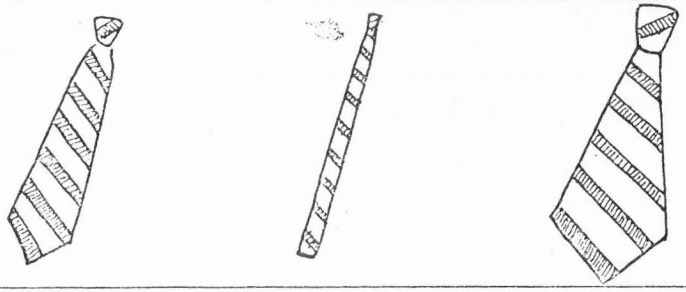

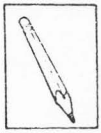

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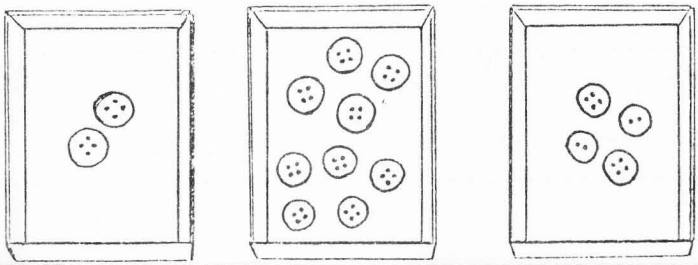

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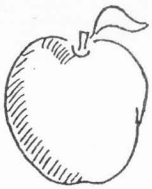

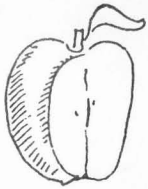

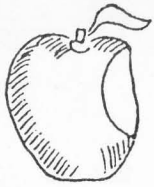

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apple that is whole

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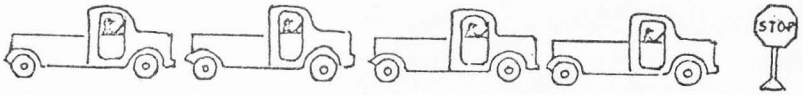

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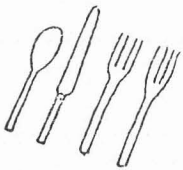

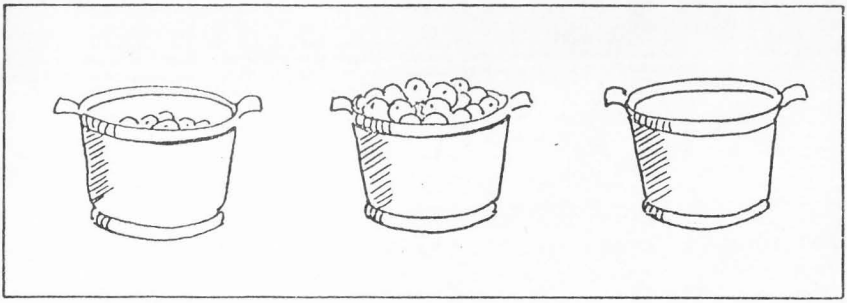

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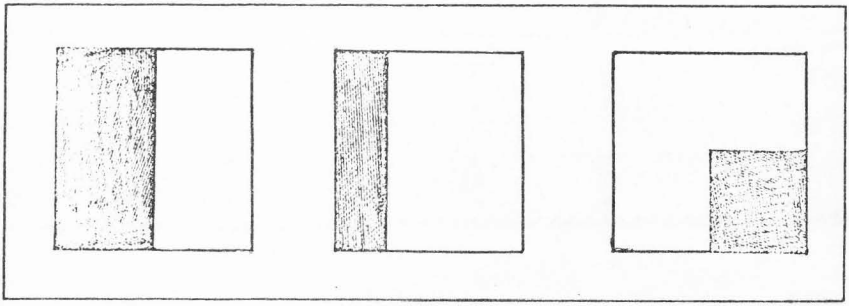

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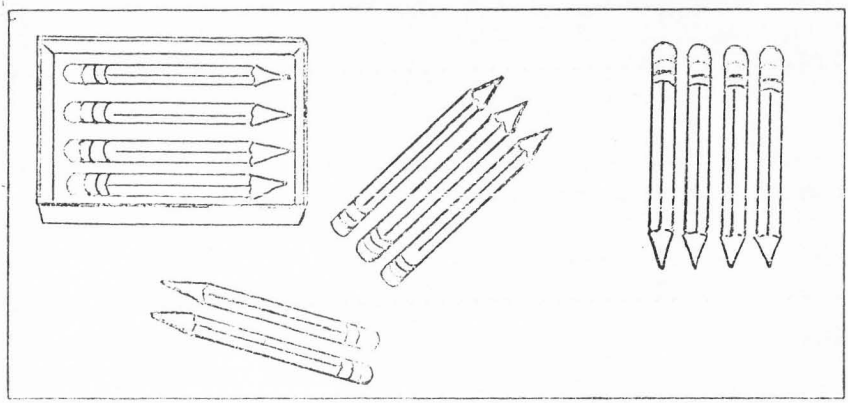

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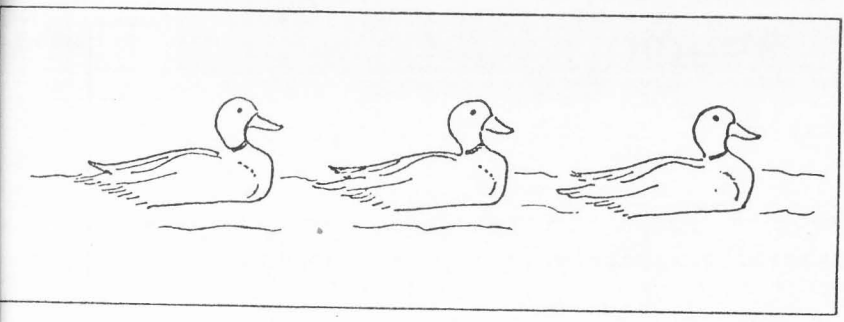
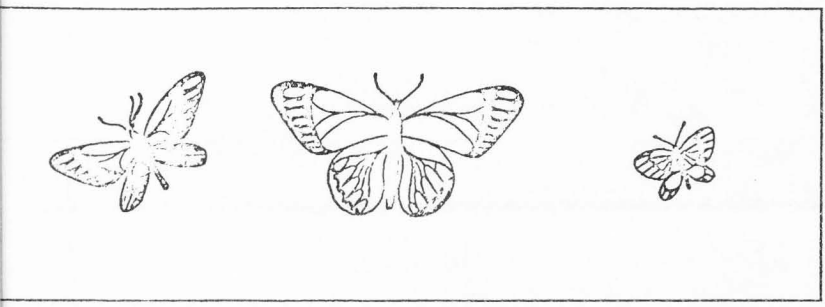


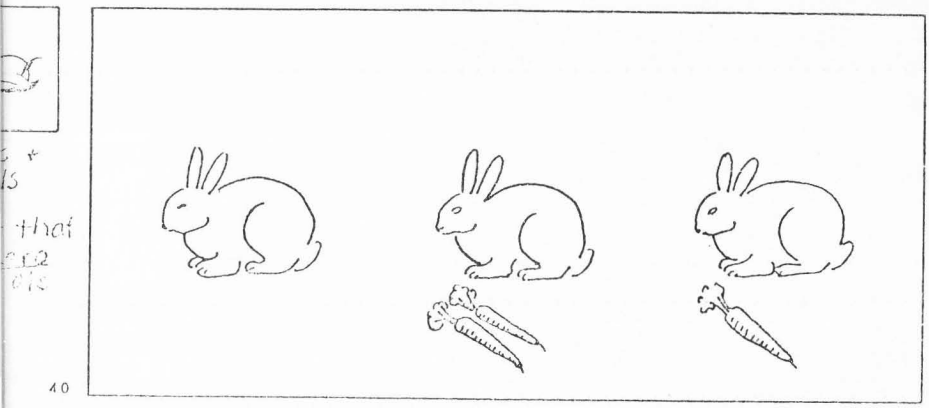
ducks 69

duck that is NOT the first or third one



butterflies

butterfly that is medium-sized



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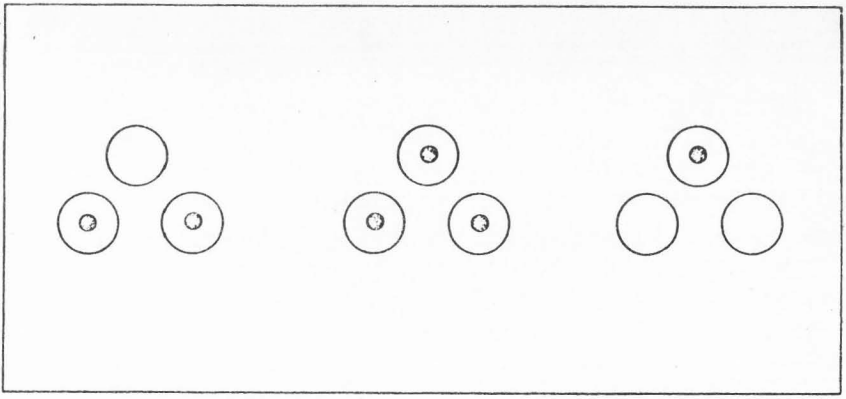

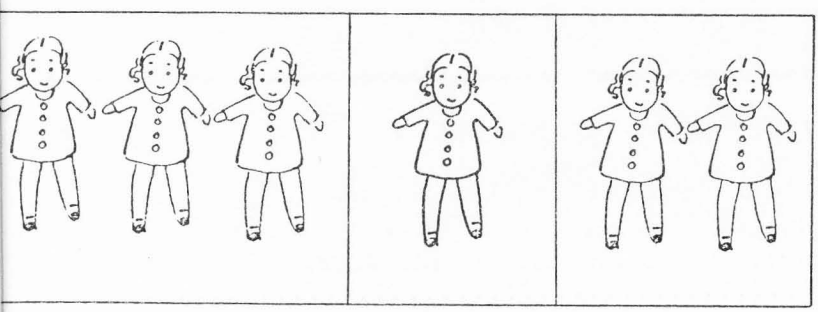

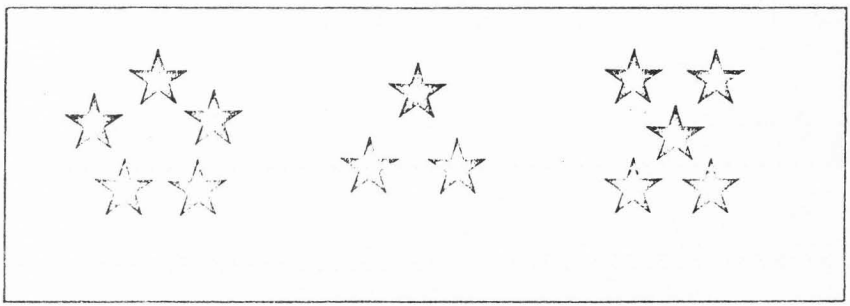

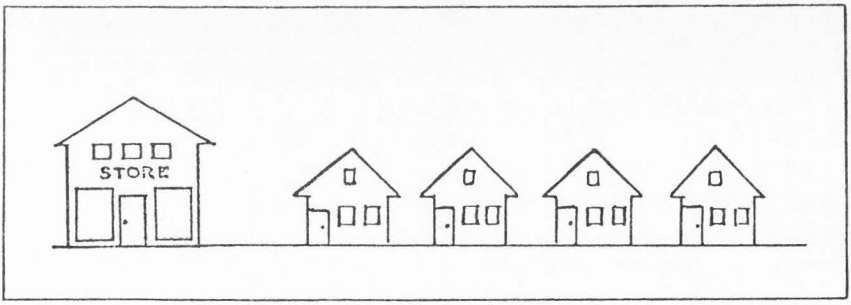

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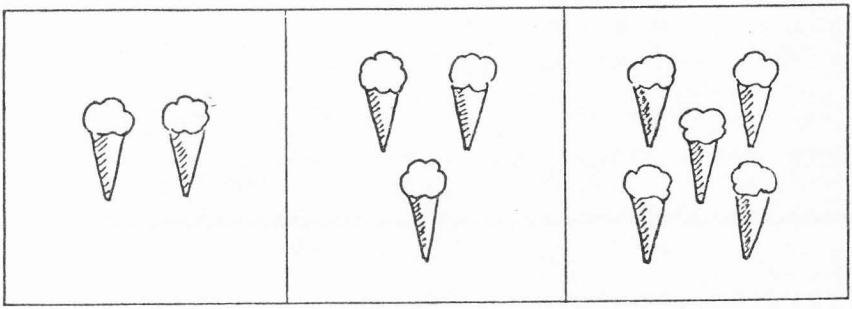

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Appendix B

Boehm Test of Basic Concepts

Sample Data Sheet

To compute the entries for the column marked PER CENT PASSING, for each item, divide the total number of children answering it correctly by the total number of children tested. (The Appendix can be used to determine PER CENT PASSING for classes of 11 to 40 children.) To compute the CLASS AVERAGE, divide the SUM by the total number of children tested. See the Manual for determining PERCENTILES. (For further scoring and recording directions, see reverse side of this form.)

CHILD'S NAME

CONTEXT CATEGORIES:
S = Space (location, direction, orientation, dimensions)
Q = Quantity (and number)
T = Time
M = Miscellaneous

CONCEPT	KEY	CONTEXT CATEGORY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	TOTAL NUMBER OF CHILDREN ANSWERING CORRECTLY	% = PER CENT PASSING Number answering correctly / Number [illegible]
OOKLET 1																																		
. Top		S																																
. Through		S																																
. Away from		S																																
. Next to		S																																
. Inside		S																																
. Some, not many		Q																																
. Middle		S																																
Few		Q																																
Farthest		S																																
Around		S																																
Over		S																																
Widest		Q																																

Appendix C

Teaching Instrument

Five Flannel Board Stories

Story 1--Animals Walking in a Line

In the story the concepts of first, second, and third were emphasized. In this story, the concept of first was mentioned approximately eight times, and the concepts second and third were mentioned approximately five times each. The story as it was told to the children is as follows:

Three animals were going to find some water to drink. They all were walking in a line. The first animal was a cow. The second animal was a horse. The third animal was a pig.

It was a hot day and the animals had been walking through the fields for a long time. The first animal, the cow, said, "I think there is some water in the barnyard." The second animal, the horse, said, "No, cow, the other animals drank it all and the farmer is gone and can't bring it to us. But I think there is some water in the stream down over the hill." The third animal, the pig, said, "But we have been walking for a long time and cannot find the stream. We are all very thirsty and need some water to drink. Where shall we find some water to drink?" All of the animals stopped to rest and think of a place to find some water.

The cow said, "When we find some water to drink, I shall be the first to have a drink of water because I have been leading us to find the water. I am the first in the line." But the horse said, "No, cow. I have been following you because I was second in the line. The dust from your feet has been kicking up into my face and has made me very thirsty. I shall be the first to drink." But then the third animal,

the pig, said, "Oh, no. I am the most thirsty. I was the third animal in the line and both of you have been kicking dust in my face and it has made me very thirsty. Even though I was the third animal in the line, I must be the first to have a drink." Well, the cow, and the horse, and the pig began to quarrel and argue about who would drink first, and they did not even notice that it began to thunder and lightning, and soon it began to rain. As soon as the animals felt the rain they stopped arguing. They were all so thirsty from their long walk and from arguing that they forgot to think about who was to be the first to drink. They lifted their heads up and opened their mouths and let the rain fall in. It tasted so good to have a drink of water from the rain! After the animals had gotten enough to drink, they turned around and let the cow lead the way back to the barnyard. The cow was first, the horse was second, and the pig was third.

The discussion questions that followed the first story were:

Why were the animals thirsty?

Why were the animals arguing?

Who was the first animal in the line? Who was the second animal? Who was the third animal?

Who wanted to drink first?

How did the animals get a drink of water?

Did the animals have to take turns?

Which animal was first to go back to the barnyard? Which animal was second? Which animal was third?

(After rearranging the characters, the administrator continued.) Now which is the first animal? Which is the second animal? Which is the third animal?

The line of animals goes first, second, third. How many animals are there altogether?

(Rearrangement of the characters) Which is first now? Which is second? Which is third?

What does it mean to be first? Do you have to wait on anyone when you are first?

There were four characters used for this story: a cow, a horse, a pig, and a cloud with rain. The characters each are proportional to the others, ranging in size from 8 inches by 7 inches for the largest, the horse, to 5 inches by 4 inches for the smallest, the pig. The cloud is illustrated as if it were up in the sky, in perspective to the animal characters. The cloud is gray with gray raindrops; the cow is black with white spots and pink udders; the horse is brown with black hoofs and a pink hat on its head; and the pig is totally pink.

Story 2--Going Down the Slide

In this story the concepts of first, second, third, and last are emphasized. The concept of first is mentioned approximately fifteen times, the concepts of second and third are mentioned approximately eight times, each, and the concept of last is mentioned approximately ten times.

The story, as it was told to the children, is:

Some children were walking to the playground. They were walking in a line. The first child was named John. The second child was named Lisa. The third child was named Kevin. The last child was named Jill. As they were walking they all said together, "First, second third, last."

Each child said his place in the line. John said, "First." Lisa said, "Second." Kevin said, "Third." And Jill said, "Last."

When they got to the playground, John, who was the first in line, said, "I speak to be first to go down the slide." And Lisa said, "I will be the second to go down the slide." And Kevin said, "I will be the third to go down the slide." But when it was Jill's turn to speak her place in line, she said, "But I will be last. I have been last in line as we were walking. I want to be first to go down the slide." Then the other children said that they wanted to be first to go down the slide. Who should be first to go down the slide? All of the children wanted to be first. They all thought and thought.

Then John said, "I know how each of us can be first in line. I will go down the slide. After I go down the slide and then go to the back of the line, then Lisa will be first in line. Kevin is the second. Jill is third. And now I am last.

"Then when Lisa goes down the slide and then goes to the back of the line, Kevin will be first in line. Jill is second. I am third. And Lisa is last.

"Now, when Kevin goes down the slide and goes to the back of the line, then Jill will be first. I am second. Lisa is third. And Kevin is last. Now everyone has had a turn to be the first in line."

So all of the children took turns being first in line to go down the slide. Sometimes each child was first, sometimes he was second, sometimes he was third, and sometimes he was last. All of the children had fun sliding down the slide.

The discussion questions that followed the second story were:

Have you ever gone down a slippery slide?

Do you have to take turns when you go down the slide?

Did the children have to take turns going down the slide?

Show me who was first to go down the slide. Who was second? Who was third? Who was the last in line?

Did all of the children have a chance to be first in line?

(Rearrangement of children characters) Now who is first? Who is second? Who is third? Who is last?

What does it mean to be first? Do you have to wait when you are first?

When you go to the end of the line, do you have to wait?

Let's count how many children there are: 1, 2, 3, 4.

Let's say their places in line as I point to them: first, second, third, and last. When you are last there is no one after you.

In this story, the characters were manipulated by the author as she told the story in order to clarify the story and help the children visualize the idea of taking turns.

There were five characters for this story: four children characters and a slippery slide. The four children are 7 inches by 2 inches and the slide is 11 inches by 5 inches. The slide is silver with brown handles, designed so the ladder and slide portions are visible to the viewer. The children characters are designed as to be walking in a line, with two boy figures dressed in shirts and pants, and two girl figures, dressed in play-type dresses. One of the girl figures is negroid in complexion.

Story 3--Pairs

In this story the concept of pairs is emphasized. The word pair is mentioned approximately 22 times.

The story is as follows:

Bobby was a little boy who was always losing his shoes. Every time he needed to put on his shoes to go outside and play he would have to look all over the house to find his shoes. He could usually find one shoe, but he could never find the other shoe very quickly.

One day when he got up he looked out the window and saw that it had snowed the night before, and now the sun was shining and it looked like it would be a lot of fun to play in the snow. So Bobby hurried to get dressed and to eat his breakfast. But then when it was time to go outside, he could not find his shoes. He looked and looked and finally found one shoe under the bed, but he could not find the other shoe.

"Oh," said Bobby, "I need a pair of shoes to wear. That means I need two shoes that look alike. And I can't find my other shoe. I can never find a pair of anything!" Bobby was so sad that he almost began to cry. Bobby's mother had been helping him look for his shoes, too. She went over and said to him, "Bobby, you said you never can find a pair of anything. But you have pairs of things with you all the time. When you have a pair of something, it means you have two things that are alike. I'll bet if you think for a minute, you'll guess what they are." So Bobby thought. Suddenly his eyes lighted up and he said, "I know! I have two hands that are alike. That means I have a pair of hands. And I have two feet that are alike. So I have a pair of feet, too." Then Bobby looked in the mirror and said, "And I

also have a pair of eyes, because I have two eyes that look alike." Then Bobby looked around his room. He thought it was fun to look for pairs of things. "Here are two trucks. I have a pair of trucks. And here are two books. Two books make a pair of books." Then Bobby saw his coat, mittens, and boots. "Hey " he said. "I have a pair of boots. And here's a pair of mittens. I have two hands for two mittens. That means I have a pair of hands for a pair of mittens. And I have a pair of feet for a pair of boots. But I need to find my other shoe to have a pair of shoes to put on!" Suddenly he saw his other shoe where he had not looked before. It was in his closet! So Bobby put on the pair of shoes, his pair of boots, his coat, his pair of mittens, and his hat and then went out in the snow to play.

The discussion following the story was centered upon these questions:

What did Bobby lose?

How many shoes did Bobby need?

Two shoes means he has a pair of shoes. What else did he have a pair of? (Name several)

Do you have a pair of anything on your body?

(Rearrangement of characters, putting two dissimilar things alike) Are these two things a pair?

Show me how you make a pair. Use Bobby's things.

(Asking each child) Make a pair of things by matching the things Bobby has.

Is his hat a pair? Is his coat a pair? Are these two things a pair of things? Is a book and a truck a pair?

The characters used in Pairs were: a mother character, size 16 inches by 4 inches, dressed in a blue dress and a yellow apron, with short blond hair; a boy character, size 10 inches by 7 inches, illustrated with his arms outspread, dressed in a green sweater, tan pants, and blue stockings; and a variety of toys and clothes characters, mostly in pairs: a pair of yellow mittens, a pair of brown shoes, a pair of red boots, and red hat, and a blue and yellow coat. The toys were two red and blue trucks, and two green books.

Story 4--The Medium-Sized Boy

In this story the concept of medium-sized is emphasized, and is mentioned approximately twelve times.

The story:

Billy was a boy who had two brothers. One brother was younger than Billy. His name was Tony. The other brother was named Randy, and he was older than Billy. So there were three brothers, Tony, Billy, and Randy. Tony was the shortest brother, and Billy was the medium-sized brother, and Randy was the tallest brother. Billy was the medium-sized brother.

The three brothers had many things that were alike except that these things were different sizes. Billy could always tell which thing was his by its size. Tony's things were the smallest, Randy's things were the largest, and Billy's things were medium-sized. Each brother had a blue coat. Tony's coat was the smallest, Billy's coat was medium-sized, and Randy's coat was the largest. Each boy also had a red ball.

Tony's was the smalled red ball, Billy's was the medium-sized red ball, and Randy's was the largest red ball. Each boy had his own chair, too. Tony's was the smallest chair, Billy's was the medium-sized chair, and Randy's was the largest chair. Billy always knew which coat or ball or chair was his by its size.

One day in the summer it was Billy's birthday. For his present, Billy's mother and father said he could have a very special present--a puppy! Billy's mother took him to the pet store to choose his puppy. When Billy and his mother got to the store, there were all kinds of animals there. But in one corner of the room was a pen where the puppies were kept. There were three puppies. There was a black puppy, and a brown puppy, and a spotted puppy. Billy liked every one of them and could not decide which one he wanted. Billy played with all three of the puppies for a little while so he could decide which one he wanted. He looked at each puppy and he thought and thought. Then he thought of a way to choose his puppy. Billy said, "The black puppy is the smallest puppy, and the spotted puppy is the largest puppy. Since I am the medium-sized brother, I will take the medium-sized puppy. The brown puppy is medium-sized." So Billy took the brown puppy because it was medium-sized and because he was medium-sized. When Billy got home he let Randy and Tony play with the brown puppy, but Billy always knew it was his very own puppy.

The questions for discussion are:
Why did Billy choose the brown puppy? What size was the brown puppy? Which brother was the tallest brother? Which brother was the shortest? Which size was Billy?

How did Billy know which of the things were his? Did he have the largest things? Did he have the smallest things? What size were his things?

Match the ball, chair, coat with the brother that it goes with. Match the largest things with the largest brother. Match the smallest things with the smallest brother. Match the medium-sized things with Billy.

Show me which ball, chair, coat, puppy is medium-sized.

Since this story dealt with a size concept, all of the characters are grouped in three sizes. There are three boy figures, all of which are alike in facial features, all are dressed in shirts and pants of different colors, and all are facing the same direction and are of the same stance. These range in size from 11 inches by 5 inches for the largest to 8-1/2 inches by 4 inches for the smallest. The other characters are in proportion to these three characters. There are three dogs: a larger brown dog with black spots, a medium-sized brown dog, and a smaller black dog. These dogs are illustrated as different breeds, and are posed in three varying positions. There are three brown chairs appropriate to each boy character; there are also three red balls, and three blue and yellow coats.

Story 5--Money for the Movie

This story deals with all of the concepts: first, second, third, last, pair, and medium-sized. In the story first, second, third, and last are mentioned approximately five times each; pair is mentioned approximately eight times, and medium-sized is mentioned approximately six times.

The final story is as follows:

One day in the summer a movie came to the town where Steven lived. It was a funny movie about monkeys who rode on bicycles. Steven wanted to go to the movie very much. But Steven's parents said he had to earn his own money to pay for the movie, and he didn't have any money to pay his way. He thought and thought of a way to get some money. He just couldn't think of a way to earn some money. As he was playing with his toys in his bedroom, he thought to himself, "I'm tired of playing with these toys. I'll bet someone else would really like to play with these toys. I'd much rather go to the movie!" Then he got an idea! He would go see if someone else wanted to boy some of his toys, the toys he was tired of playing with, and when he sold his toys, then he would have some money to pay for the movie.

So Steven gathered up some of his toys to sell. He chose some toys that he had had for a long time and was tired of playing with. He picked up his pair of guns that he played cowboys and Indians with, and he picked up three green balls that were different sizes: smallest, medium-sized, and largest. He also looked in his drawer and saw his mitterns and thought, "It's summer and I don't need my mittens that I wear in the winter." He put his mittens with the other toys. He also took three cars that he played with in the sand pile. These were different sizes: smallest, medium-sized, and largest. He took all of the toys and mittens out to the driveway and put them in his wagon. He said, "I have other toys to play with. I hope someone will buy these toys so I can get some money for the movie." Then he pulled the wagon

down the sidewalk and up to the first house on his street. He knocked on the door and the lady who lived in the first house answered.

"Hello," said Steven. "I have some very nice things to sell. Would you please buy something so I can make enough money to go to the movie?"

The lady in the first house said, "Let me see what you have. I have a little boy who would like a pair of guns. I'll take the pair of guns." So she gave Steven some money and took the pair of guns.

Steven pulled the wagon along to the second house, and he knocked on the door. "Hello," said Steven when the lady in the second house opened the door. "Would you like to buy some nice things so I can earn some money to go to the movie?" The lady in the second house said, "I don't have any children to give the toys to, but I have a dog that would probably like to play with a ball. I'll take one of the green balls." The lady said, "My dog is not a small dog, and he isn't a large dog either, so I'll take the medium-sized green ball." So she gave Steven some money and he gave her the medium-sized ball.

Then Steven went to the third house and knocked on the door. "Hello," said Steven, "I have some very nice things to sell. I want to make enough money to go to the movie." The lady in the third house said, "Well, let me see what you have. You have a pair of mittens, two green balls, and three cars. I have three children, all of different sizes, who like to play with cars. I have a small boy, and a medium-sized girl, and a large boy. You have a small car, a medium-sized car, and a larger car. These cars will be just the right sizes for my children." So the lady in the third house gave Steven some money and took the cars.

Steven was really excited! If he could sell one more thing he would have enough money to go to the movie. So he pulled his wagon to the last house on the street. He knocked, and a man answered the door. "Hello," said Steven, "Would you like to buy some toys?" "Well," said the man in the last house, "I don't have any children to play with the balls, and the pair of mittens wouldn't fit my hands, because my hands are too large. I don't think I will buy anything."

So Steven pulled his wagon back home. When he got home he told his mother what he had been doing to get enough money to go to the movie. He said, "Now I can't go to the movie because nobody wants to buy my mittens and two green balls."

"But Steven," said his mother, "You forgot to ask the lady at one of the houses on this street if she wanted to buy something." And Steven said, "But I asked the lady at the first house, and the lady at the second house, and the lady at the third house, and the man at the last house. That's all the houses on this street."

"Oh, no, it isn't," said Steven's mother, "You forgot to ask me! We live on this street!"

"Oh," said Steven, "Mom, would you like to buy something?"

"Yes," she said, "I'd like to buy your pair of mittens. When it gets cold you will need them to keep your hands warm." So Steven's mother gave him some money for the pair of mittens. Now Steven had enough money to go to the movie! He went to the movie that afternoon and it was the best movie he had ever seen.

The discussion questions following the last story were:
What did Steven want to do?

How did he get money to go to the movie?

Did he want those toys anymore? He was tired of those toys, and he had some other toys.

Where did he go first? Where did he go second? Where did he go third? Where did he go last?

What did the lady at the first house buy? When you have two of something that look alike, what are they called?

What did the lady at the second house buy? What size was the thing she bought?

What did the lady at the third house buy? What sizes were the things she bought?

Why didn't the man in the last house buy anything?

What toys did Steven sell?

Show me a pair of something.

Show me something that is medium-sized.

Show me the first house. Tell me what house this is (pointing to the houses in turn, first, second, third, last.)

Tell me what house this is (pointing to the houses, out of order).

The characters in this story are: a young boy with blond hair with an orange shirt, blue pants, and brown shoes on, size 9 inches by 3 inches, illustrated as walking to be seen from a side view. There are four houses, all the same size, 7 inches by 7 inches, each having one door and one window, and illustrated for a front view of each. There is also a red and blue wagon with black wheels, and a variety of toys: three cars of varying sizes and colors, three green balls of varying sizes, a pair of silver and brown toy guns, and a pair of orange mittens.

VITA

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Master of Science

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Major Field: Child Development

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