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THE FACILITATION OF FUNDAMENTAL MOTOR SKILL LEARNING IN YOUNG CHILDREN

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ABSTRACT

THE FACILITATION OF FUNDAMENTAL MOTOR SKILLS IN YOUNG CHILDREN

By

Susan Elizabeth Miller

The purpose of this investigation was to determine the effectiveness of various programs of motor skill instruction for three and four year old children. Seventy-nine children from the Greater Lansing area were volunteered by their parents to serve as subjects for the study. Each was assigned to one of three treatment groups. Two such groups received identical programs of instruction in gross motor skills. One group, labeled Traditional, was taught in the conventional manner of providing a predetermined number of teachers for a specific number of students. The other instructional group, labeled Parent, was provided with the same teacher-student ratio (1:6) but additionally required a parent of each child to participate in the program. Instructions relevant to skill improvement were directed to the parents who, in turn, were responsible for disseminating the information to their children. A third group, entitled Free Play, was not exposed to any formal program of instruction. The children of this group were permitted to use all available equipment for self-initiated activities.

Although two instructors were present to assist the group they refrained from teaching or correcting errors except in cases of potential danger. A fourth group, composed primarily of children attending two local nursery schools, was included in the study to control for the effects of maturation.

Each of the instructional groups and the free play group met at the same campus facility for one hour activity periods twice a week. The program was in operation for a total of twenty-seven weeks. The traditional and parent groups were taught by the same instructor who also supervised each free play section. An assistant was available to provide additional help in each group. The curriculum used for the two instructional groups emphasized the development of fundamental motor skills.

All subjects were pre-and post-tested on nine fundamental motor skills: throwing, catching, kicking, punting, striking, running, hopping, skipping and jumping. Stages of development of the fundamental skills, as described by Seefeldt and Haubenstricker, were determined by a team of trained observers.

The data were transformed to an expanded scale, then subjected to Finn's Multivariate Analysis of Covariance procedure. Age and pre-test scores were used as covariates and tests for significance were performed for the following ordered contrasts:

Control Group versus the Free Play, Traditional and Parent Groups

Free Play Group versus the Traditional and Parent Groups

Traditional Group versus the Parent Group

No significant group effects were evident for the first contrast, that of the Control Group versus the combined treatment groups. However, when the Free Play Group was contrasted with the combined Traditional and Parent Groups significant differences were found. These results signified that the Free Play and Control Groups were not different from each other. Children who participated in a program of free play within a specialized environment did not experience greater increases in skill development than children who played at home and/or nursery school. The inclusion of the Free Play Group in the first analysis masked the differences between the control Group and the combined treatment groups. When the Free Play Group was singularly tested against the combined Traditional and Parent Groups the effects of instruction became evident. The combined groups performed significantly better, indicating that programs of directed practice and instruction are more effective than programs of free play in increasing the fundamental skill level of young children. The third contrast failed to show significant differences between the Traditional and Free Play Groups. These results indicated that these two methods of instruction are equally effective in promoting the development of fundamental motor skills.

DEDICATION

To Richard, Kristi and Brad

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CHAPTER I

THE PROBLEM

Current interest in early childhood education has generated a great deal of research on the cognitive functioning of young children, but parallel investigations into the motor domain are conspicuously lacking. Although most educators of young children are aware of the importance of motor skill development they lack a research-based body of knowledge from which to draw inferences about program planning. Those who include specific motor experiences in the curriculum for young children most often select content and methods on an empirical basis or in a manner to coincide with available space and equipment, personal preference or past experience. Many teachers of young children, however, favor a laissez-faire approach to motor skill development and make no attempt to provide instruction for the children in their care. They assume that when children are ready, they will acquire the fundamental motor

skills through their natural play activities. The only function of the teacher in this process is to provide a time and place for the children to engage in gross motor activity.

Although many basic movements seem to have a genetic foundation, there is no assurance that a child will become proficient in these skills simply through maturation and incidental exposure to them. The number of adults who operate at immature levels of performance is testimony to the fact that many people never learn to move their bodies in an efficient and effective manner. The inability to move efficiently can have drastic consequences for a child. Games requiring the execution of gross motor skills are so central to the lives of children that the individual who cannot run, jump, throw, catch and strike with ease is likely to become socially, as well as motorically, handicapped. Some kind of intervention program, then, seems necessary to assure that all children develop an extensive repertoire of fundamental motor skills at an early age.

Need for the Study

There is a paucity of research on motor skill programs for young children. The few attempts made to provide instruction in fundamental motor skills have produced conflicting results. Some programs have produced significant effects while others demonstrated no benefits beyond those expected to occur through maturation. Most of the programs reported were of short duration and involved only a limited number of skills. Few reports are available on the effectiveness of parent participation in programs of motor skill instruction. Therefore, research first is needed to determine if young children can profit from a program of instruction in basic motor skills. If positive changes accrue from instruction, additional study is required to determine the types of programs that most effectively serve the needs of young children.

Purpose

The purpose of this investigation was to study the facilitation of motor skill learning in preschool children. The investigation was structured to provide answers to two basic questions:

1. Is it possible to facilitate the learning of fundamental motor skills by young children, or are these skills genetically determined to such an extent that attempts at initiation or modification during the early years are not profitable?

2. If fundamental motor skill learning can be enhanced, what types of learning situations are most conducive to effecting positive change?

Hypotheses

It was hypothesized that:

1. Children who participate in programs of free play or motor skill instruction within a

specialized environment (Combined Free Play, Traditional and Parent Groups) will become more proficient in fundamental skills than children who do not play in the described specialized environment (Control Group).

2. Children who participate in programs of instruction designed to enhance motor skill learning (Combined Traditional and Parent Groups) will become more proficient in fundamental motor skills than children who engage in a program of free play in a specialized environment (Free Play Group).

3. Children who participate in an instructional motor skill program with their parents (Parent Group) will become more proficient in fundamental motor skills than children who engage in the same program without their parents attending (Traditional Group).

Limitations of the Study

The results of this investigation were subject to the following limitations:

1. The children who participated in the study were volunteered by their parents. Therefore, the sample cannot be considered random and generalizations derived from the results may be limited to similar populations of children.

2. During testing periods individual performances may have been influenced by environmental factors such as temperature, humidity, test order, time of day and the presence of spectators and judges.

3. The free play setting may not have differed markedly from that of the instructed groups. Although a structured learning environment was not provided, it was difficult for the supervisors not to reinforce good performances when they occurred spontaneously.

Smiles and verbal praise then, may have induced greater learning in this group than would be found without the presence of supervising adults.

4. Approximately half of the children in the control group attended a nursery school where gross motor development was stressed to a greater extent than in most other schools. The proficiency of these children in fundamental motor skills might be expected to exceed that of the general population of three and four year old children.

5. Although regular attendance was constantly encouraged, illness, family vacations and other circumstances prevented some children from receiving the full course of instruction or opportunity for play.

Definition of Terms

1. Fundamental Motor Skills: Skills which involve two or more body segments and result in the transfer or reception of the body or some external object (Seefeldt, 1972). Running, jumping, catching and striking are representative of fundamental motor skills. These skills and others serve as the basis for more advanced games and sports.

2. Developmental Stage: The specific level of development of a fundamental skill ranging from its most rudimentary form to its most mature form of expression. The level is defined by the relationship of various body segments to each other during performance of the skill. For example, in Stage One of hopping the nonsupport leg is held in front of the body and the arms are at the sides or in a high guard position (Seefeldt, 1972).

3. Phylogenetic Activities: Those skills which must be acquired by all members of the human

race in order to function effectively. Walking, running, throwing and jumping are examples of phylogenetic activities.

4. Ontogenetic Activities: Those skills which are determined by the life history of an individual as a participant in a particular culture. Baseball batting, ice skating, swimming and bicycle riding are examples of ontogenetic skills.

CHAPTER II

SURVEY OF RELATED LITERATURE

Human development is influenced by genetic endowment and environmental conditions. It is the interaction of these two factors that produces the unique features of each individual. The extent of influence exerted by each cannot be ascertained accurately, but it is generally held that genetics sets the bounds of development while the environment dictates the amount of potential an individual achieves within those genetically determined limits.

The following survey of literature will review some of the most significant investigations dealing with the influence of genetic and environmental factors on the development of fundamental motor skills in young children. Emphasis will be placed on studies that examine attempts to modify the environment for the enhancement of motor skill learning.

Genetic Influence

Evidence in support of the genetic determination of motor skills comes from: 1) the orderly sequence of reflexes that develop in pre- and post-natal life, 2) the sequential developmental movement patterns observed in virtually all young children, and 3) the sudden emergence of new skills without the benefit of instruction or the opportunity for practice.

Reflexive Actions

Several investigators studying movement in the fetal period have identified various reflexes and spontaneous actions that occur as development progresses. Hottinger (1973) found that the human fetus becomes capable of responding to tactile stimulation as early as the eighth week of prenatal life. The neural connections between receptors and effectors are apparent and functioning at that time. Early fetal movement is primarily myogenic in nature, but after the thirteenth week, activation can be conducted through innervation of the spinal cord (Minkowski, 1921) or by stimulation

of the skin with a hair (Hooker, 1952). From this time until birth the central nervous system exerts increasing dominance over the behavior of the fetus. Specific rather than generalized body responses can be elicited, and intersegmental spinal conduction becomes well established.

Carmicheal (1954) found that respiratory movements begin to appear near the end of the fifth month and function well as early as the seventh month. By the eighth month of fetal life most of the neonatal reflexes can be elicited. Therefore, at the time of birth the infant possesses a large repertoire of reflexive motor actions.

Many early reflexes are related to neonatal survival functions, while others seem to be precursors of voluntary movements that appear between the ninth and fifteenth months after birth. Reflexive walking, swimming, crawling and climbing movements were noticed by Shirley (1931), McGraw (1935), and Ames (1937). Although these reflexes were extinguished long before their voluntary counterparts occurred, their presence indicated how deeply locomotor activities are rooted

within the nervous system of the human being (Cratty, 1970). Hooker's (1952) investigations lend support to the influence of genetics on motor behavior. He determined that the postnatal voluntary movements develop in the same sequence in which they can be elicited as reflexes during fetal life.

Since some infant reflexes are voluntarily suppressed within the first year after birth, their presence in later life is often interpreted as a sign of neurological dysfunction. Fukuda (1961), however, demonstrated that the tonic neck and labyrithine reflexes function latently in normal adults. He found the tonic neck reflex to be operational in the act of catching a ball that was projected to the right or left side of the receiver. Although catching behavior is voluntary, Fukuda suggests that portions of the act are directed involuntarily by the tonic neck reflex in order to maintain the body's equilibrium and perform the correct catching action.

In addition to reflexes, man also inherits a number of basic movement patterns. Knott and Voss (1968) identified four diagonal patterns of human motion in both

the upper and lower extremities. These patterns are based upon three components of motion occurring at the proximal joints, the shoulders and the hips. The elements of flexion or extension, adduction or abduction, and external or internal rotation are combined to form the four diagonal patterns which are used in both developmental and sport skill activities. Shambes and Campbell (1973) identified the diagonal patterns contained within the reflex actions of infants learning hand-to-mouth and rolling patterns. Their work extended to an analysis of several basic sport skills in addition to the sequential stages leading to the development of upright locomotion. In each case the utilization of inherent basic movement patterns was demonstrated.

Sequential Skill Development

In this section studies related to sequential skill development within the periods of infancy and early childhood will be discussed. Emphasis will be placed upon the early childhood years, focusing first on descriptive and normative accounts of motor behavior.

Investigations employing the use of the developmental stage concept then will be presented reflecting the thrust of current research.

Infancy

The fact that motor skill development proceeds in an orderly, sequential manner has been well established. Research on this phase of development dates back to the 1930's and 1940's when a wealth of information was obtained from the observations of child psychologists. Many of the early studies were very thorough and consequently, have withstood the test of time. Beyond the stage of purely reflexive action (approximately six to eight weeks) the two motor skills that have received greatest emphasis in the literature are prehension and upright locomotion. Halverson (1937), White, Castle and Held (1964), Shirley (1931), Bayley (1935) and Gesell (1940) have studied these skills in great detail and agree that development progresses in an orderly sequence that is essentially the same for each individual.

Halverson (1937) provided the most definitive work on the sequence of voluntary grasping behavior.

Through a film analysis of infants ranging from sixteen to fifty-two weeks of age, he detected three distinct developmental forms of approach toward a cube. He also studied the relative involvement of the parts of the body used for reaching and grasping. Again, a developmental sequence was observed both for the major body parts employed as well as in the use of finger-thumb opposition. Halverson's work was extended to a study of infants by White, Castle and Held (1964). They described a normative sequence of prehensive behavior very similar to Halverson's and also found object-oriented arm movements occurring at approximately two months of age.

In an extensive two-year study Shirley (1931) followed the growth and motor behavior of twenty-five infants from the time of birth. The infants were observed daily during the first week of life, then once each week for the rest of the first year. From her numerous accounts of behavior Shirley was able to describe a sequential, developmental pattern of activities leading to the acquisition of upright posture and bipedal locomotion. An intensive study of the several skills that contributed to progress in creeping led Shirley to

conclude that ". . . each separate stage was a fundamental step in development and that every baby advanced from stage to stage in the same order. This sequence was called the 'pattern'." (Shirley, 1931, p. 98.) Similar pattern-like sequences of development were found to exist for progression toward upright posture and walking alone, although individual differences were expressed by differential rates of development.

Bayley (1935) conducted a research program similar to that of Shirley's. From her observations Bayley was able to describe a developmental series of locomotor activities progressing from reflexive crawling movements to the ability to walk downstairs using an alternate foot pattern. A cumulative scale of motor development was devised as a diagnostic tool to determine a child's developmental status in the early years of life. This scale included all the intermediate skills or stages through which an infant progresses to achieve the final behavior listed. Both inter- and intra-skill sequences can be determined from inspection of the scale, and average ages for performance competency were given. Cross comparisons with the data of Shirley's study revealed that

California children generally progressed through the developmental sequence at a faster rate than did the children of Minnesota (Bayley, 1935).

Gesell (1940) approached the subject of early locomotion from a postural standpoint. He explained that since all movement requires adjustments of the individual as a whole to the environment, all forms of motor behavior are actually postural activities. Gesell stated, "In this sense any form of locomotion or prehension is essentially a closely knit series of sequential postural adjustments." (Gesell, 1940, p. 65.)

Early Childhood

In the period of early childhood (approximately two to six years) motor behavior is characterized by the development of specific skills and abilities useful in the games and sports of later life. Various forms of locomotion have been studied as well as the skills necessary for effective object projection and reception. Early studies generally focused on normative accounts of motor behavior. Investigators of the 1960's also were concerned with age-related norms and a number of

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new achievement scales appeared during that decade. Later, the developmental stage concept gained attention, providing a more effective avenue for the study of sequential motor skill development. The major studies of each period will be discussed, focusing upon their contributions to the body of knowledge about sequential development.

Descriptive and Normative Accounts of Motor Behavior

Investigations by Wellman (1937), McCaskill and Wellman (1938), Gutteridge (1939) and Gesell (1940); all support the concept of sequential development through their findings of increased ability with age. Wellman (1937) reported two studies of the motor achievements of ninety-eight preschool children from twenty-six to seventy-four months of age. The children were tested on several skills: ascending and descending steps and ladders; hopping, skipping, jumping; walking a path and a circle; and ball bouncing, catching and throwing. Each skill was subdivided according to the methods the children used to accomplish it. A corresponding "motor age" was then determined for each method. This was

defined as the age in months at which exactly fifty percent of the children used that method or a superior one. Computation of the motor age permitted direct comparison of the stages of development within a skill sequence as well as the comparative difficulty of various interskill sequences. A score of one was assigned to the lowest stage of performance and each successive stage received an additional point. In this manner total scores were computed on each child's performance. Motor quotients were also determined by dividing a child's motor age by his chronological age. Although proficiency in some of the skills was measured in terms of quantity rather than quality, inspection of the motor ages assigned to each developmental level shows a definitive increase in ability with advancing age.

In addition to assessing the motor achievements of young children, McCaskill and Wellman (1938) studied the interrelationships of various groups of skills with age. The correlations were reported to be high, ranging from .40 to .84. Age level comparisons on ball activities and locomotor skills revealed significant gains in ability with increasing age, except between five and six years.

The majority of children at these ages had reached the maximum level of ability in the tasks studied with the exception of ball skills, in which they continued to improve. Motor age assignments were made for each stage of each skill and presented in ascending order from twenty-four to seventy-one months. Comparison of these results with comparable items from Bayley's study (1935) generally revealed slightly higher age assignments for Bayley's children. However, there was close agreement on the relative placement of items, which strongly supports the concept of sequential progression.

In additional studies of locomotor and ball skills Gutteridge (1939) and Gesell (1940) also found increased proficiency with advancing age. Gutteridge observed children two to seven years of age while they were engaged in their usual play activities. Each child's motor ability in ten different activities was analyzed, and comparisons by age level revealed increasing skill with age. Gesell (1940) examined the patterns of development for walking, running, throwing and other related motor skills. Cinemagraphic analysis provided descriptive accounts of the typical patterns found at

various age levels from birth to five years. In accordance with the previous studies cited, Gesell also found increasing facility with age. He attributed this progressive increase to the development of dynamic equilibrium. The ability to make appropriate bodily adustments in response to visual and proprioceptive cues was found to parallel the level of skill achieved in the activities studied.

For a period of almost twenty years, there was little reported research in the area of motor development. The early studies were considered adequate in both scope and depth, so few attempts were made to confirm or refute their results. In the 1960's, however, a renewed concern for the young child stimulated interest in further study of motor development. Several scales appeared that showed a relationship between age and motor performance, and the analysis of fundamental skills through the use of developmental stages was extended.

A number of studies have demonstrated increased ability in fundamental skills with advancing age (Johnson, 1962; Cratty and Martin, 1969; Williams, 1973; Frankenburg and Dodds, 1967; and Sinclair, 1971). Using a large sample

of boys and girls in grades one through six, Johnson (1962) found that mean scores showed an upward trend except between fifth and sixth grade. Norms were presented in percentile ranks according to sex and grade for the skills of throwing, catching, kicking, batting, jumping and running. Cratty and Martin (1969) discussed the movement attributes of young children and gave age-related sequences for body image, manipulation, throwing, catching, jumping and hopping. They determined alternate hopping to be highly dependent upon dynamic balance, a finding supported by Espenschade (1947). The ability to transfer a movement pattern from one side of the body to the other, to coordinate both sides of the body and to perceive a rhythmical pattern also were deemed important attributes for gross motor efficiency. Norms were reported for 365 children, four through twelve years, on tests of ball interception, locomotor skills and selected perceptual motor skills. All norms revealed increased ability with age. Williams (1973) compiled information on the motor behavior of children aged three to six, a span of years described as a period of accelerated growth in the acquisition of motor skills. She provided a summary

description of the movement characteristics of each age level for a number of fundamental skills. Although some descriptions are definitive, others are so vague that they lack meaning. The inaccurate use of the terms hopping, leaping, and jumping also confused the discussion, but in general, more advanced movement patterns were found with increasing age.

A useful device for evaluating the development of infants and children appeared in the late 1960's. The Denver Developmental Screening Test (Frankenburg and Dodds, 1967) was devised to detect evidence of retarded development so that effective therapy could be undertaken at an early age. Both gross motor and fine motor-adaptive skills are included and scaled according to their developmental order of appearance. Although the Denver scale has been criticized for underscreening, it offers the distinct advantage of indicating the ages at which twenty-five, fifty, seventy-five and ninety percent of the population, respectively, pass each item. A chart listing benchmarks of behavior neatly demonstrates the overlapping, yet sequentially developing, skills of infancy and early childhood.

Another study emphasizing the developmental aspects of movement patterns was reported by Sinclair (1971). This extensive investigation, which was mixed longitudinal in nature, studied the capabilities of forty-four children from two to six years of age. At the onset of the experiment twenty-five motor tasks were analyzed into their component, developmental parts. Standards for both successful completion of the tasks and mature movement patterns were defined. The children then were filmed in their performance of these basic motor skills. The films were analyzed and a score was assigned to each performance according to the number and quality of elements observed in the child's movement pattern. Positive correlations between age and mean motor score were found at each half-year interval. In addition, progresive development and maturation of movement patterns was observed between age levels, lending support to the basic assumption that movement is a developing process during the early years of childhood. Typical trends and characteristics were reported for each group. Variations in movement patterns occurred at all age levels and equal numbers of boys and girls were found at the

extreme ends of the continuum. Children who were poorly skilled in one task tended to be low in all tasks, but deficiencies in balance, eye-hand coordination, rhythmic locomotion and the total body assembly for power were particularly evident.

Applications of the Developmental Stage Concept

Although normative accounts of motor behavior are useful, they generally do not provide information about the qualitative changes that occur as a child progresses toward mature form. Early investigators were limited to visual observations of performance, but once the techniques of cinematography were applied to the study of human movement precise descriptions of behavior became possible.

Wild (1938), Hellebrandt and others (1961), Seefeldt, Reuschlein and Vogel (1972), Seefeldt (1972a, 1972b), Seefeldt and Haubenstricker (1974-76) and Roberton (1977) all used film analysis to define the intraskill sequences for various fundamental skills. In an investigation of throwing behavior Wild (1938) studied how

children from two to seven years use their bodies in the execution of a forceful overhand throw. Motion picture analysis revealed four distinct, age-related stages of throwing. The outstanding developmental trend was a change from movements in the anterior-posterior plane to movements in the horizontal plane and from a stationary base to a moving base of support. The development of the pattern was attributed to maturational factors.

Both Wickstrom (1970) and Seefeldt, Reuschlein and Vogel (1972) concurred with Wild's description of throwing, and additionally presented analyses of other fundamental skills. Wickstrom reported the sequential progressions of form in running, jumping, throwing, catching, kicking and striking. Basic mechanical principles which apply to each pattern were also discussed. An interesting aspect of Wickstrom's work was found in the differentiation between developmental stages and developmental trends. He proposed that the gradual changes in form that a child undergoes in progressing toward a mature pattern can be interpreted either as distinct patterns (stages) that are present at different levels of skill development, or as broad developmental trends which

are more continuous than step-like. Trends are usually characterized by changes in a particular part of the movement pattern over an extended period of time. They can be described in terms of a number of mechanical and kinesiological aspects; timing, range of motion, changes in joint angles, segmental interrelationships, segmental velocities and angular velocities. Wickstrom emphasized that stages and trends are not mutually exclusive; both can be used satisfactorily to interpret the observed improvement in developmental motor patterns.

Seefeldt, Reuschlein and Vogel described their version of intra-skill sequences for throwing, catching, running and jumping. Their description of jumping concurred with that of Hellebrandt and coworkers (1961). Films taken on approximately 150 children ranging in age from eighteen months to eight years were used for the identification of developmental sequences. The commonality of segmental relationships between children engaged in a specific skill served as the primary criterion for the determination of stages. It was recognized that additional segments could have been identified, but the authors wished to define the stages so they would be

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readily discernable by visual inspection to the elementary school physical education teacher.

In two additional papers, Seefeldt (1972a, 1972b) elaborated upon the processes of catching, walking and running. In contrast to Wickstrom he did not find a fear reaction in young children (eighteen months to three years) engaged in catching behavior. He did, however, notice a small number of children of ages four, five and six who expressed fear of an approaching ball. He suggested that this fear was a conditioned behavior caused by the children previously having been struck in the face or frstrated by objects which they could not catch. Success in catching was found to be attainable as early as two years of age, and the generalization that large balls are easier to catch than small balls was corroborated. Seefeldt's analysis of walking was divided into the swing phase and the support phase. Differences between walking and running were discussed and age characteristics for these skills were presented from a developmental, rather than a stage point of view. Later study provided stage descriptions for the skills of hopping, skipping, kicking and punting (Seefeldt and Haubenstricker, 1975-1977).

The reliability of the developmental stages for eight fundamental motor skills was evaluated by Lerner (1975) using the test-retest method. Thirty-four subjects chosen at random from a large sample were retested within a two week period after the initial test was completed. Individual consistency was found to range from sixty-three to ninety-six percent. Over half of the subjects showed consistent performance in eighty percent or more of the skills. Item consistency calculated across skills ranged from fifty-six to eighty-two percent with most individuals showing no change in stage. The greatest number of changes occurred on the skills of kicking, catching an eight and one-half inch ball and hopping on the right foot. Stage level increases were found twice as often as stage level decreases during the retest. These changes were attributed to inconsistent performances, differential learning, greater motivation or less inhibition. The possibility of inconsistent interpretation of the stages also was provided as an explanation for the changes.

Using the stage descriptions of Seefeldt and Haubenstricker, Lerner (1975) compiled age-related norms

based on the performances of 123 males and 85 females. The percentage of children performing at each stage was calculated for males and females at six-month intervals, ranging from thirty-six to sixty-five months of age. Standards were provided for nine skills, which, in general, showed greater proficiency with increased age.

Roberton (1977) expanded the stage theory to an analysis of the separate components of movement. Rather than assigning a stage classification to the total body configuration displayed by a performer, she proposed making independent assessments of the arm, leg, trunk or other actions. Using this method it is conceivable that at any given time, an individual would display different performance levels for each of the components of any one skill. Although all children progress through the same stages of development, Roberton's method recognizes differential rates of development in each component. This type of analysis has some promising implications for research, but would be too cumbersome to apply in the daily teaching situation.

The foregoing review of studies dealing with motor development clearly demonstrates the existence of

sequentially developing patterns of behavior. Perhaps Barsch provided the best concluding statement when he wrote, "Development proceeds in orderly sequential progressions. The documentation to substantiate such a statement has now become so voluminous that a state of common agreement exists." (Barsch, page 53.)

Environmental Influence

Motor development can be influenced by a lack of environmental stimulation or by specific attempts to enrich the environment for the enhancement of learning. Studies focusing on the effects of environmental deprivation will be discussed in this section. These will be followed by a review of investigations concerned with enrichment programs for the development of motor skills.

Deprivation

Because of the inherent moral issues embodied in studies of deprivation involving human subjects,

researchers have not been able to effectively manipulate this variable to study the consequences. What is presently known about human motor deprivation has come from the observation of natural populations in which the movement of children has been restricted for the purposes of convenience, cultural custom or other reasons.

Dennis (1960), Dennis and Najarian (1957) and Yarrow (1961) all studied the motor development of institutionalized children and found varying degrees of retardation due to restricted activity. Dennis (1960) found that institutionalized children in two Iranian hospitals were extremely retarded in motor behavior. They could not sit alone until the age of two and were not able to walk until after four years of age. These children were placed on their backs in cribs almost all the time. They were handled only when necessary for feeding and changing. Because of their lack of experience in the prone position they never learned to creep. Instead, these children moved by scooting across the floor on their buttocks. In other institutions where children were handled, placed in the prone position and allowed to play with toys, motor skills developed in a pattern comparable to that

of children reared in private homes. Dennis concluded that the motor retardation of institutionalized children was due to restriction of activity rather than nutritional status or the prevailing emotional climate of the institution.

In a later study Dennis and Najarian (1957) compared institutionalized infants who received only essential physical care to children raised in a home environment with their mothers. They tested infants under one year of age and children between four and one-half and six years on four scales of cognitive and motor development. Institutionalized infants receiving limited sensory stimulation developed normally up to the second month of age. However, they were greatly retarded from three to twelve months. These infants performed poorly on the Cattell Scale because of their lack of opportunity to explore the environment and receive sensory input. Additional deprivation in the form of restricted use of the sitting position also hampered the younger institutionally raised children. Most of the children in the older age range performed at almost normal levels on the four tests. This was primarily due

to the fact that the test items were selected to minimize the effects of an institutional environment. From the results obtained Dennis and Najarian concluded that the effects of early environmental deprivation are not irreversible but that they are subject to modification at later periods in time.

In reviewing other studies of deprivation, Yarrow (1961) found motor development to be one of the four areas of retardation in institutionalized children. Hyperactivity was commonly observed during initial stages of institutionalization, but after a prolonged period the lack of stimulation contributed to a condition of hypoactivity. Reports of motor disturbances in the form of bizarre stereotyped motor patterns also were described. Although these forms of behavior are suggestive of neurological damage, Yarrow stated they are due to psychogenic factors rather than dysfunction of the central nervous system. He did not draw any conclusions ragarding the reversibility of the effects of deprivation but did specify four conditions which have an effect upon the degree of retardation: 1) the amount of individualized stimulation, 2) the age at which the child was

institutionalized, 3) constitutional factors or the vulnerability to deprivation and 4) the duration of the institutional period. The younger the child and the longer the interval of institutionalization, the greater the degree of retardation expected.

Studies of cultures that impose physical restrictions on their infants were reported by Danzinger and Frankl (1934), Dennis (1940), and Dennis and Dennis (1940). Danzinger and Frankl (as reported in Espenschade and Eckert, 1967) observed Albanian children who were bound to small wooden cradles during their first year of life. Infant tests detected some retardation in motor development among these children, although social development progressed normally. Delayed motor development was particularly evident during the third year.

Dennis (1940) studied the influence of cradle binding on motor development as practiced by the Hopi Indians. Comparisons with the norms for American infants showed no significant differences in motor development. This finding was believed to be the result of increasing amounts of freedom being allowed as the Hopi Indian child advances in age. Infants are generally

bound to the board during their first three months but after that time are given longer and more frequent periods of unrestricted movement. In a comparison of Hopi children raised with complete freedom and others reared with the traditional cradle boards, Dennis and Dennis found little difference in the age of onset of walking. Although the data were based on the recall of parents, the results seemed to indicate that the physical restrictions placed upon Hopi infants were not detrimental to normal motor development. In contrast, the Albanian practice of cradle binding and the deprivation experienced by institutionalization both tended to retard normal progress in the motor realm.

In a rather atypical experiment Dennis (1935, 1938) raised twin girls from the age of one month to fourteen months under very restrictive nursery conditions. The infants were kept in cribs apart from the mainstream of family life and were given no social stimulation even when being fed or bathed. Comparison of their developmental progress with that of standard norms showed no significant differences in social behavior, although the appearance of certain motoric

achievements was appreciably delayed. Social development may have progressed normally because the twins could relate to each other. Their lack of progress in the motor realm, however, concurs with the findings reported above and confirms the fact that children need freedom of movement in order to learn the skills normally present in early childhood.

Modification of the Environment

Investigations dealing with modification of the environment usually involve the provision of special training in one or more skills. Early studies examined the differences between trained and untrained twins, while later investigations studied the effects of special programs provided for groups of children. The results of these studies will be discussed below. Two investigations concerned with the influence of parents on the motor behavior of their children also will be presented. Since parents act as role models for their children and control the home learning environment, the extent of their influence over motor development can be considerable.

Twin Studies

Attempts at environmental modification for the purpose of enhancing motor skill development began with the studies of identical twins conducted by Gesell and Thompson (1929), McGraw (1935) and Minerva (1935). Gesell and Thompson (1929) gave an experimental twin daily ten-minute periods of practice and encouragement in stair climbing and cube manipulation. The training continued for six weeks during which time the identical control twin was deprived of experiences with stairs and cubes. At the end of the training period the timed performance of the experimental twin was superior to that of the control. However, after only two weeks of training begun at fifty-two weeks of age the control twin was able to climb stairs as fast as the "trained" twin. Gesell and Thompson concluded that training can not transcend maturation but maturation can alter or supplant the effects of training. The period of life during which training is introduced also may have some effect on the child's style of movement and approach to activity. Although the twins completion times for stair climbing were

similar at the end of the experiment, Gesell and Thompson observed that the trained twin was more skillful in climbing and maintained this position of superiority six weeks later. Further observations at sixty-eight and ninety-four weeks of age found the trained twin more agile, more mobile and less afraid of falling than the control twin. Although learning was more efficient once a higher level of maturity was reached, early training in stair climbing and cube manipulation seemed to have had a very positive effect on general mobility and agility.

McGraw's (1939) follow-up study of twins Johnny and Jimmy also showed long range effects in relation to one's "feeling" for motor activities. The trained twin, Johnny, demonstrated superior coordination and assurance in his movements into adult life. As a child he was given special training in activities from the age of twenty-one days to twenty-two months, while Jimmy was kept comparatively restricted. New activities such as climbing, striking, swimming and roller skating were introduced to Johnny when he appeared to be capable of performing them. Jimmy fell within the normal range of motor behavior when compared to a control group that was

observed in the same activities. Johnny, however, was advanced in the skills in which he had received special training (McGraw, 1935). McGraw concluded that there are critical periods in the life span when repeated training and practice can most efficiently alter the development of specific motor skills. Those skills which appear to be most modifiable through training are ontogenetic in nature. The phylogenetic skills are primarily influenced by maturation.

Minerva (1935) also found beneficial effects of training on complex motor tasks. She initially tested four sets of identical twins and three sets of fraternal twins (all four and one-half years old) on throwing accuracy, ball rolling accuracy and jumping over a cord. The performance of the identical twin pairs was very similar for the jumping and throwing tasks, but the rolling activity, considered more complex, did not show the influence of an inherited characteristic. Following the initial test one twin from each pair was provided with a six-month training program in the tested skills as well as in a variety of other skills. It was found that training was beneficial in improving the

relatively complex throwing skills but had little effect on the skill of jumping. Like McGraw, Minerva concluded that the complex tasks (which are usually more ontogenetic in origin) are modifiable through training, whereas the more basic locomotor skills are dependent upon maturation for their development.

Other Studies

Although the variables of practice or training were not the primary focus of studies by Wild (1938) and Gutteridge (1939), the effects of these factors were observed. In Wild's study of the overhand throw, comparison of the sexes revealed similarity in the development of the basic movement pattern. However, differences attributed to learning favored the boys, particularly after six years. Gutteridge (1939) found that although proficiency in fundamental motor skills increased with age, the median curve of achievement slowed down after three years. This was believed to be due to a lack of environmental stimulation rather than the attainment of mature performance.

More recent attempts to study the effects of training in young children have met with varying degrees of success. Dusenberry (1952) and Masche (1970) realized positive effects from training while Miller (1957) and Halverson and others (1977) found no significant differences between trained and untrained groups of children. Dusenberry (1952) provided an experimental group of twenty-eight children three to seven years of age with a three week program of practice and instruction in overhand ball throwing. A total of six instructional periods consisting of five practice throws and five recorded throws constituted the experimental treatment. An equated control group received no instruction or practice, but did participate in pre- and post-testing sessions. Using t-tests to compare the gains of the two groups, Dusenberry found significant differences (alpha=.07) in the trained group. In addition to studying the distance attained in throwing, Dusenberry used an observational checklist to note the pattern of movement employed by the children. Sex differences in movement content were very apparent. The boys made better use of their bodies and showed more advanced arm and hand movements during the execution of their

throws. Overall, there was a shift from the ipsilateral to the contralateral pattern, automatically causing greater body rotation and, therefore, longer distances.

Dusenberry also found that the older children (five to six years) profited from instruction more than did the younger children (three to four years). This would be expected because of their greater capacity for understanding and assimilating verbal instructions. In addition, a period of three weeks usually is insufficient to allow a young child to become comfortable at one stage of development before moving on to the next. It is through improvement in the stage (or maturity level) of the throw that children are able to increase their throwing distance.

In constrast to Dusenberry, Miller (1957) found no significant differences between first grade children given instruction in overhand throwing and those receiving an equal amount of time playing ball games. A total of twenty-six, twenty-minute periods of instruction or practice were provided over an eleven week time interval. Miller failed to state what type of instruction was given, but the task objective was to improve accuracy. However,

since a ten-inch playground ball was used it is not surprising that significant gains were not realized. Children should be given a ball which can be gripped in the hand if they are to be able to throw effectively.

Halverson and others (1977) also studied throwing in young children. Noting that previous programs of instruction affected the angle of release more than the velocity of the throw, they gave kindergarten children guided practice stressing the force component in throwing. Forty-five children were randomly assigned by sex to either a treatment group receiving a movement program including 120 minutes of guided practice in throwing or to a control group which received the same movement program without exposure to the throw. A second control group composed of twenty-four children received neither the movement program nor any formal exposure to the throw. Ball velocities were measured by a Roberts' velocimeter before and after the eight-week experimental period. Treatment by sex ANOVAs revealed no significant differences between groups at the start of the program or after the completion of the training period. Although it was concluded that 120 minutes of guided practice did not

significantly alter the ball velocities of kindergarten children, the authors suggested that velocity alone may not be the appropriate index of throwing development. The movement pattern itself could be undergoing change which might not be reflected immediately in the velocity score. A study of the filmed performances of the children was initiated to see if, in fact, developmental changes in movement did occur.

Masche (1970) found that a program of instruction in volleyball and basketball skills was of greater benefit than a curriculum of low organization games and movement education in producing increased skill in ball handling, jumping, throwing for distance and balance. She compared two groups of twenty-four second grade children who had received two half-hour periods of skill instruction a week for a total of ten weeks. The experimental group spent five weeks learning basketball skills and another five weeks on volleyball skills. Although the actual game skills were used, the equipment and the complexity of the game were modified to meet the needs of second grade children. The control group experienced approximately fifteen minutes of movement exploration and

another fifteen minutes of low organization games throughout the entire experimental period. The Magnusson test of motor ability in elementary school children was administered before and after instruction. Although the concept of a general motor ability is questionable, pre- and post-comparison of the individual test items would indicate whether positive changes occurred. No differences between the groups were found on the pretest. Over the ten week period the control group showed no significant improvement on any of the motor ability items, whereas the experimental group improved significantly in four of the five events: ball handling, broad jump, throw for distance and stork stand. Neither program produced significant changes in the obstacle race. It may be argued that the skills program gave direct instruction in at least three of the test items, thereby increasing the likelihood of finding significant differences between the groups. However, proponents of movement education believe that basic skills can be improved through an indirect, exploratory approach. Similarly, advocates of the games approach to physical education hold that basic skills can be improved through practice in game situations.

The results of this study indicate, however, that a structured program is more efficient in producing desired changes in basic motor skills. This finding lends support to the concept of specificity in motor skill learning. It would have been interesting to see whether changes in movement patterns occurred in conjunction with increased scores, and whether the same results could be obtained with younger children.

Parent Influence

Parents are the first teachers encountered by a child and probably exert more influence over early behavior than any other person or factor. The association between certain factors within the home or family environment and the motor proficiency of children was studied by Rarick (1949). A battery of tests evaluating seven areas of gross motor performance was administered to 172 third grade children. The five boys and five girls who scored the highest and the five boys and five girls who had the lowest composite score were selected for further study. Interviews with the parents and teachers of these children were conducted to elucidate variables that might be

related to extreme levels of motor performance. Parents of the superior group of children were very active in sports. Only a few parents of children in the inferior group engaged in any form of athletic endeavor. Children in the superior group also had greater opportunities and provisions for play from a very early age. A greater variety of gross motor play materials were available in their homes and yards and they frequented neighborhood playgrounds more often than the children who scored poorly on the tests. In addition, eighty percent of the parents of superior children participated in the play activities of their children whereas none of those in the inferior group did. Although a causal relationship cannot be established, the results of this study seem to indicate that parental interest and participation in children's play activities are important factors in the achievement of a high level of motor ability.

Schnabl-Dickey (1977) studied the relationship between child-rearing attitudes and the jumping and throwing performances of preschool children. Parental attitudes were assessed by the Maryland Parent Attitude Survey, administered individually to each parent. Jumping and throwing skills were

evaluated by using motor pattern maturity checklists. Two raters independently judged the performances of thirty-two males and twenty-six females, three to five years of age. Canonical correlations between the variables produced conflicting results. Permissive parents providing indulgent home environments (characterized by low disciplinarian, high indulgent and high protective child-rearing attitudes) had children with superior throwing skill. Proficiency in jumping, however, was associated with high maternal discipline. These results may indicate that jumping ability is more maturationally determined than throwing skill. It seems logical that a permissive environment would be conducive to the practice of motor skills, but a highly protective parental attitude would appear to be counter-productive. Although most of the results of this study are inconclusive, it was established that mothers played a much greater role than fathers in the motor development of their preschool children. Significant correlations between fathers' attitude scores and their children's motor scores were obtained only when the fathers' attitudes were considered together with those of the mother. Certainly, the whole area of parental

influence over motor behavior is in need of further study. The home atmosphere should be recognized as one of the most important variables associated with early skill learning.

Summary

The literature on early motor skill learning clearly supports the concept of sequential development arising from a genetic base. Environmental deprivation generally retards motor development but many deficits can be overcome when appropriate stimulation is provided. Attempts to accelerate or advance the development of motor skills through enrichment programs have met with varying degrees of success. It appears that ontogenetic skills are more amenable to modification through learning than are the phylogenetic skills. Additional research is needed to delineate the extent to which specific skills can be modified, as well as the conditions that best promote efficient skill learning in young children.

CHAPTER III

PROCEDURES

Sources of Data

Ninety-six boys and girls from the Greater Lansing area of Michigan were enrolled as subjects at the outset of the study. Five children failed to complete the program because increased family obligations prevented the parents from continuing to transport their children to the campus facility. In addition, data were not complete on twelve children who refused to perform one or more of the required tests. Therefore, data on seventy-nine children were available for statistical analysis.

All subjects were volunteered by their parents who were informed of the nature and purpose of the experiment through written materials. These materials were subsequently discussed with the parents at a meeting called for the purpose of answering any questions they might have concerning the experiment or their role in it. To qualify for inclusion in the study children

had to attain their third birthday by December 31, 1975 and could not have reached their fifth birthday before that date.

The subjects were obtained from three sources: 1) children enrolled in a longitudinal investigation of growth and motor performance at Michigan State University, 2) parental response to newspaper advertisements and flyers placed in local nursery schools and 3) children attending two local nursery schools.

All of the children from the cooperating nursery schools were placed in the Control Group. The other subjects were assigned to groups according to the method described below. Only one child (a member of the Traditional Group) had previously participated in an instructional program designed to improve fundamental skills. In general, the subjects were from families classified in the middle and upper-middle levels of socio-economic status. The parents of these subjects generally had college educations and many had post-baccalaureate degrees. They were interested in providing good educational experiences for their children.

Experimental Design

A two by four factorial design was used for the primary analysis of the study. The subjects were assigned to treatment groups on the basis of age, sex and initial skill level. Initial skill level was determined by pre-test scores on ten fundamental skills: throwing, catching, kicking, punting, striking, running, hopping (right and left feet), skipping and jumping. The stages of development of these skills were evaluated according to the procedures described under the heading of Measures, page 60. An attempt was made to equate the groups on the variables of age, sex and skill level, but individual family schedules precluded the complete matching of groups. The number of subjects in each category for whom complete data were obtained is listed in Table 3.1. A description of the conditions that existed for each of the four treatment groups follows Table 3.1.

Table 3.1

NUMBER OF SUBJECTS IN EACH CELL OF THE EXPERIMENTAL DESIGN

Control		Free Play		Traditional		Parent		Total	
F	M	F	M	F	M	F	M	F	M
12	11	7	11	8	13	9	8	36	43

Treatment Groups

Traditional

The treatment group designated as Traditional was instructed in the usual manner by assigning one teacher to a specified number of students. In this study the instructional unit consisted of two teachers for every nine to twelve children. Both instructors were responsible for introducing new activities, leading small practice groups and working with individuals who required special attention in order to learn specific skills. Although the program emphasized direct instruction in fundamental motor skills, the curriculum also included body management, rhythmic and creative movement activities. A complete description of the program's objectives and content is provided in Appendix A.

Parent

The Parent Group was similar to the Traditional Group in every respect except that parents were required

to participate in the program with their children. Thus, the adult-child ratio was at least 1:1; sometimes both parents participated thereby raising the adult-child ratio. During periods of individual skill work, instruction was directed to the parents, who then disseminated the information to their children. Whenever a new fundamental skill was introduced, the developmental stages of that skill were explained and demonstrated by the master teacher. The parents also were given suggestions on how to best elicit the desired movement and how to identify and correct common errors. Once the practice of a skill was underway, the teachers moved about the group to offer individual comments. Parents were encouraged to ask questions at this time and received additional help in working with their children. The parents were not asked to work with their children outside of class, although many of them did so on a voluntary basis.

Free Play

Rather than being exposed to a formal instructional program, the treatment group labeled Free Play

was allowed to use the room and equipment in any safe way desired. An attempt was made to duplicate the free play conditions typically found at neighborhood and nursery school playgrounds. Two instructors were available to assist children in their self-initiated activities, but they refrained from formal instruction and the correction of errors except in cases of potential danger. The equipment and materials used by the two instructed groups were made available during the free play period. The children selected activities at will and were given time or turn limitations only when a specific item of equipment was in high demand.

Control

The Control Group was established to compare the skill level achieved through organized instruction with that attained through maturation and incidental instruction by parents or peers. The children of this group participated in pre- and post-testing but did not partake in any special programs designed to improve their motor skills.

Operational Setting

Mixed groups of three and four year old children met twice each week for one-hour activity periods. The classes and instructors were scheduled as outlined in Table 3.2.

Table 3.2

SCHEDULE OF CLASS HOURS AND INSTRUCTORS

Group	Meeting Time		Instructors
Free Play I	Mon., Wed.	10:00	A, B
II	Tues., Thurs.	2:15	A, C
Traditional I	Tues., Thurs.	10:00	A, C
II	Wed. 5:00, Sat.	9:30	A, D
Parent I	Tues., Thurs.	1:00	A, C
II	Wed. 6:00, Sat.	10:45	A, D

The program was in operation for a total of twenty-seven weeks between October, 1975 and May, 1976. Each group, then, received fifty-four hours of instruction or free play. Winter and Spring vacations coincided with the Michigan State University schedule.

Instructional periods were planned by the experimenter who also served as the primary teacher for

each group. Another experienced teacher assisted with each class, providing a minimum student-teacher ratio of six to one. In the two Traditional classes one parent was assigned to assist children in tasks unrelated to the instructional program. Thus, the teachers were able to devote full attention to the instruction of the group at all times.

Classes met in a large room in Jenison Fieldhouse on the Michigan State University campus. Apparatus was provided to encourage balancing, climbing, jumping, tumbling and stair climbing. A large open space was reserved for the practice of locomotor and ball skills, rhythmic activities and simple games. For a complete listing of the equipment and apparatus used in the program see Appendix A.

Parents were responsible for transporting their children to and from class. They were allowed to observe the sessions whenever they desired, but few actually did once their children felt comfortable in the new setting. The last class period of the year was reserved for parent observation and participation. A free atmosphere prevailed so children could demonstrate to their parents

any skills or activities desired. After final measures were taken on the entire sample of children, parents were given the opportunity to confer individually with the author. The results of pre- and post-tests were discussed along with any concerns of the parent, child or experimenter. Approximately eighty percent of the parents attended private conferences.

Measures

Skill

Prior to the start of the instructional program each child was evaluated on the following skills:

Throwing	Hopping--left foot
Catching	Hopping--right foot
Kicking	Skipping
Punting	Standing long jump
Striking	Running

A group of examiners consisting of two faculty members and four graduate students (including the experimenter) from the Department of Health, Physical Education and Recreation at Michigan State University conducted the evaluations. One examiner worked directly with the child being tested, providing demonstrations of the

desired skills and eliciting those skills from the child. One to three other examiners observed the child's performance and recorded the stage of development for each of the ten fundamental skills according to the qualitative descriptions of Seefeldt and Haubenstricker. (See Appendix B for stage descriptions and details of the assessment procedures.) A minimum of three trials were provided for the skills involving object projection or reception. The locomotor skills were demonstrated by having the child move through a distance of twenty to thirty feet. Additional trials or distances were provided if it was deemed necessary to assure understanding and consistent performance on the part of the child.

Appointments were established so that each child could be tested individually. All children except for those attending the cooperating nursery schools were evaluated in the playroom used during the instructional program. The nursery school children were tested individually at their own facility in a room separate from that used by the main group.

Identical evaluative procedures were used at the conclusion of the program to measure changes in

performance that occurred during the eight-month interval. During the post-test sessions the experimenter elicited skills but did not participate in the evaluation process. At midyear an additional set of measures was taken on those children participating in the activity programs. These evaluations were made during regular class periods, however, and it was felt that the distractions attendant to the situation precluded accurate assessment of the children. Therefore, these measures were not included in the analysis, but they did provide some feedback on the value of the programs at that point in time.

Family Data

Questionnaires were distributed at the beginning of the program to obtain information about the families of children enrolled in the early childhood study. Of particular interest were the questions related to the activity level of individual family members and the amount of time parents spend in gross motor play with their children. A second questionnaire was administered at the termination of the program. Answered anonymously,

this one was designed to solicit parental opinions about the program and its effectiveness in developing motor and social skills. Copies of each questionnaire are located in Appendix C.

Treatment of Data

Fundamental Skills

The data obtained from stage assessments were subjected to Finn's Multivariate Analysis of Covariance (Scheifley and Schmidt, 1973). This is a versatile program which performs univariate and multivariate linear estimations and tests of hypotheses for crossed or nested designs. Age and pre-test scores were used as covariates to control for the study's lack of randomization. The MANCOVA, then, was run on the final test scores. Tests for significance were performed for the following ordered comparisons: 1) Control group versus all other groups, 2) Free Play group versus Traditional and Parent groups and 3) Traditional group versus Parent group. Three tests of interaction also were included in the analysis.

The complete Finn analysis was run twice, using a slight modification for the second program. In the first analysis the actual stage classification numbers derived from testing were utilized as the covariates and dependent variables. These values ranged from a low of 0 to a high of 3, 4 or 5 depending upon the skill. Since hopping was evaluated on both feet a total of eleven covariates (age plus ten pre-test scores) and ten dependent variables were entered into the program.

The second analysis involved the use of converted scores. A scale was devised with the intent of making a more sensitive scoring instrument for the detection of differences in the developmental skill level of young children. Six of the converted measures were derived from standards of performance obtained from the testing of 430 children between 27 and 72 months of age (Miller and others, 1977). Standards for the other three skills (hopping, punting and striking) had a smaller data base. To develop the scale, all the children throughout the age range performing at a certain stage level were grouped together. An SPSS Condescriptive Program (Nie and others, 1975) was used to sort the data and print

out the age of each child located within that particular stage classification. The ages were arranged in ascending order. This process was repeated separately for each sex and each stage level for each of the nine skills under investigation. Next, the age at which 10, 25, 50, 75 and 90 percent of the children were located within each stage level was determined. This was done by hand calculating the number of cases that would make up ten percent of the total number of children within one stage level, and then counting off that number of cases starting from the youngest child. The age of the child last counted as one of the cases was used as the ten percent mark. The foregoing procedure was repeated for the twenty-fifth, fiftieth, seventy-fifth and ninetieth percent levels for each stage of every skill. Finally, the fifty percent mark of each stage level was recorded as the standard for achievement of that particular stage. It was this value that was used as the converted score for any individual performing at that stage. Values for children in transition between stages (indicated by + or - on the original scale) were determined by interpolation. The total range of values generated by this latter method

was much greater than the restricted range of the original scale used in the first analysis. (See Appendix D for a clarification of the conversion procedures and tables.)

Since a non-orthagonal design was employed in the study, the contrasts had to be reordered to determine sex differences in the performance of the fundamental skills. A subsequent analysis was performed in which treatment group effects were analyzed before those of sex differences.

Questionnaires

The frequency and percentage of parents responding to various categories of the original questionnaire were calculated by an SPSS Condescriptive program (Nie and others, 1975). The final questionnaire was analyzed by hand calculating the number and percentage of respondents in each category for each group.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of this study was to investigate the facilitation of motor skill learning in preschool children. The research was designed to determine whether structured programs of physical education, or motoric free play within a specialized environment, could promote changes in fundamental skills greater than those that result from the maturational process. If positive changes were observed a secondary purpose was to determine the most effective teaching situations for the physical education of young children.

Results

The results of this study have been divided into three main sections. All of the findings pertaining to the MANCOVA analysis using raw scores are presented first. These are followed by the results of the significance

tests using converted scores. Finally, an analysis of the questionnaire results is presented.

Analysis of Raw Scores

Determination of Statistical Techniques

Age and the ten pre-test scores were used as covariates in the analysis. A multivariate test of the association between the eleven covariates and the dependent variables resulted in an F statistic of 2.06 which was significant at the $p < .0001$ level. (See Table 4.1.) Because of this significant relationship analysis of covariance was determined to be an appropriate statistical method for use with the data of this study.

TABLE 4.1

MULTIVARIATE F STATISTIC FOR THE ASSOCIATION BETWEEN THE COVARIATES AND THE DEPENDENT VARIABLES, USING RAW SCORES

Multivariate F	d.f.	p <
2.06	110,395	.0001

Since none of the interaction tests for the converted scores showed significant effects, only the results for main effects will be included in this section. The individual cell means and standard deviations for the converted

scores are provided in Appendix D. The final section will contain the results of the two questionnaires which were administered as part of the study.

Sex Differences

The MANCOVA procedure detected differences between the sexes on two of the ten dependent variables. The multivariate and the univariate and univariate F statistics presented in Table 4.2 show significant sex differences on

TABLE 4.2

MULTIVARIATE AND UNIVARIATE F STATISTICS FOR SEX DIFFERENCES ON TESTS OF FUNDAMENTAL MOTOR SKILLS, USING RAW SCORES

Multivariate F test	F = 2.69	d.f.=10,51	p < .010
Variable	Univariate F		p <
Throw	3.74		.058
Catch	.65		.423
Kick	.00		.953
Punt	2.45		.123
Strike	4.58		.037
Run	2.72		.104
Hop-R	5.62		.021
Hop-L	.06		.803
Skip	3.51		.066
Jump	2.40		.127

striking and hopping on the right foot. The least squares estimates and their standard errors provide an indication of the relative magnitude and direction of influence

exerted by each variable on the multivariate effect. Negative values indicate differences in favor of the males. Inspection of the estimates presented in Table 4.3 shows that the females excelled in hopping while the males were more proficient in striking. No significant differences between the sexes were found for any of the other skills considered.

TABLE 4.3

LEAST SQUARE ESTIMATES AND THEIR STANDARD ERRORS FOR SEX DIFFERENCES ON TESTS OF FUNDAMENTAL MOTOR SKILLS, USING RAW SCORES

Variable	Least Squares Estimate	Standard Error
Throw	-.60	.32
Catch	.11	.21
Kick	-.05	.22
Punt	-.33	.21
Strike	-.48	.22
Run	-.34	.21
Hop-R	.45	.19
Hop-L	.02	.19
Skip	.35	.20
Jump	-.24	.18

Treatment Effects

The relative effects of the treatment program were tested by Finn's Multivariate Analysis of Covariance (MANCOVA) procedure. The results for this analysis using raw scores (stage assignments) are presented in Table 4.4. From inspection of the table it is evident that no significant differences were found for any of the contrasts. It was reasoned that the range of the

TABLE 4.4

MANCOVA F STATISTICS FOR TREATMENT DIFFERENCES ON TESTS OF FUNDAMENTAL MOTOR SKILLS, USING RAW SCORES

Source	Multivariate F	d.f.	p
Contrast 1: Control Group vs. Combined Treatment Groups	1.11	14,43	.379
Contrast 2: Free Play Group vs. Combined Traditional and Parent Groups	1.17	14,43	.335
Contrast 3: Traditional Group vs. Parent Group	.77	14,43	.697

raw data (0 to 3,4, or 5, according to individual skills) was too restricted to detect subtle differences which

might have been present between the groups. Therefore, conversion scales were devised to provide a more definitive measure for use in the analysis. The methods employed to devise the scales were discussed in Chapter III. The resulting scales and some of their descriptive characteristics are located in Appendix D. The results for analyses using teh converted scores are presented below.

Analysis of Converted Scores

Determination of Statistical Techniques

As in the first analysis, age and the ten pretest scores were used as covariates. The multivariate test of the association between the covariates and the dependent variables resulted in an F statistic of 2.15, significant at the $p < .0001$ level. (See Table 4.5.) This relationship showed that covariance was an appropriate technique for use in the study.

TABLE 4.5

MULTIVARIATE F STATISTIC FOR THE ASSOCIATION BETWEEN THE COVARIATES AND THE DEPENDENT VARIABLES, USING CONVERTED SCORES

Multivariate	d.f.	p <
2.15	110,395	.0001

Sex Differences

Analysis of the sex differences using the converted scores necessitated a reordering of the contrasts due to the non-orthoginal nature of the design. Although this reordering caused the alpha level to be indeterminable, the results of the analysis are reported. When the converted scores were analyzed, significant sex differences were detected for the skills of kicking, striking, running and jumping. (See Table 4.6.)

TABLE 4.6

MULTIVARIATE AND UNIVARIATE F STATISTICS FOR SEX DIFFERENCES ON TESTS OF FUNDAMENTAL MOTOR SKILLS USING CONVERTED SCORES

Multivariate F test	F = 5.19	d.f. = 10,51	p < .0001
Variable	Univariate F	p <	
Throw	1.97	.166	
Catch	.30	.586	
Kick	22.64	.000	
Punt	3.28	.075	
Strike	6.71	.012	

TABLE 4.6--cont'd.

Variable	Univariate F	p <
Run	4.00	.050
Hop-R	3.47	.068
Hop-L	.45	.505
Skip	.42	.521
Jump	12.16	.001

The direction of the least squares estimates presented in Table 4.7 indicates that the females were more proficient in kicking while the males excelled in striking, running and jumping. No significant differences between the sexes were found for the skills of throwing, catching, punting, hopping and skipping.

TABLE 4.7

LEAST SQUARES ESTIMATES AND THEIR STANDARD ERRORS FOR SEX DIFFERENCES ON TESTS OF FUNDAMENTAL MOTOR SKILLS, USING CONVERTED SCORES

Variable	Least Squares Estimate	Standard Error
Throw	-0.54	1.08
Catch	.19	1.02
Kick	4.57	1.00
Punt	1.31	.81
Strike	-2.28	.96
Run	-0.86	.75
Hop-R	2.23	1.46

TABLE 4.7--cont'd.

Variable	Least Squares Estimate	Standard Error
Hop-L	.76	1.47
Skip	-0.41	1.27
Jump	-2.20	1.09

Treatment Effects

A series of contrasts were tested to reveal significant differences between the treatment groups on the achievement of fundamental skills. The specific contrasts were:

C_1: Control Group versus the combined Free Play, Traditional and Parent Groups

C_2: Free Play Group versus the combined Traditional and Parent Groups

C_3: Traditional Group versus the Parent Group

The order of contrasts was determined by the amount of structure and opportunities for instruction within each group. The Free Play Group, as the title suggests, was the least structured. The members of this group received no formal instruction in motor skills. Both the Traditional and Parent Groups were highly

structured. However, the Parent Group had more opportunities for instruction because of the high ratio of adults to children and the greater likelihood of instruction provided at home. It was hypothesized that the groups which were highly structured and which received systematic instruction would perform better on tests of fundamental skills than would less structured groups which received little or no instruction. Thus, three hypotheses were generated to be tested by the MANCOVA analysis. The results associated with each hypothesis are presented below.

H_1: The combined Free Play, Traditional and Parent Groups will perform better than the Control Group on tests of fundamental motor skills.

The MANCOVA analysis of converted scores revealed no significant effects for the first contrast, that of the Control Group versus the combined treatment groups. The multivariate F statistic for this contrast was .67 at $p < .750$. (See Table 4.8.) These results indicate that the Control Group performed as well as the combined treatment groups on tests of fundamental skills. Therefore, the hypothesis, H_1, was rejected.

TABLE 4.8

MANCOVA F STATISTICS FOR TREATMENT GROUP DIFFERENCES ON TESTS OF FUNDAMENTAL MOTOR SKILLS, USING CONVERTED SCORES

Source	Multiv F	d.f.	p <
C_1: Control Group vs. Combined Treatment Groups	.67	10,51	.750
C_2: Free Play Group vs. Combined Traditional & Parent Groups	2.12	10,51	.040
C_3: Traditional Group vs. Parent Group	1.69	10,51	.109

H_2: The combined Traditional and Parent Groups will perform better than the Free Play Group on tests of fundamental motor skills.

When the second contrast was tested by the MANCOVA procedure, significant differences were found. Inspection of Table 4.8 shows that the F statistic of 2.12 obtained for this contrast was significant at the $p < .040$ level.

The univariate F statistics in Table 4.9 indicate that the skills of punting and striking made the greatest contribution to the overall multivariate difference.

TABLE 4.9

UNIVARIATE F STATISTICS FOR THE DIFFERENCES BETWEEN THE FREE PLAY AND THE COMBINED TRADITIONAL AND PARENT GROUPS ON TESTS OF FUNDAMENTAL MOTOR SKILLS, USING CONVERTED SCORES

Source	Univariate F	d.f.	p
Throw	.24	1,60	.630
Catch	.12	1,60	.736
Kick	.40	1,60	.531
Punt	7.31	1,60	.009
Strike	6.00	1,60	.017
Run	2.98	1,60	.090
Hop-R	.01	1,60	.909
Hop-L	.00	1,60	.981
Skip	3.68	1,60	.060
Jump	2.03	1,60	.160

The least squares estimates and their standard errors for the contrast between the Free Play Group and the combined Traditional and Parent Groups are listed in Table 4.10. Negative values in this case show differences in favor of the combined groups. Reference to Table 4.10 shows the superiority of the combined groups over the Free Play Group. In nine out of ten skills the performance of the two instructed groups exceeded that of the Free Play Group. On both punting and striking the difference between the contrasted groups was more than plus or minus

TABLE 4.10

LEAST SQUARES ESTIMATES AND THEIR STANDARD ERRORS FOR DIFFERENCES BETWEEN THE FREE PLAY AND THE COMBINED TRADITIONAL AND PARENT GROUPS ON TESTS OF FUNDAMENTAL MOTOR SKILLS, USING CONVERTED SCORES

Variable	Least Squares Estimate	Standard Error
Throw	-0.55	1.42
Catch	-0.42	1.19
Kick	-1.05	1.19
Punt	-2.59	.94
Strike	-2.61	1.23
Run	1.56	.83
Hop-R	-0.64	1.89
Hop-L	-0.35	1.77
Skip	-2.38	1.28
Jump	-0.96	1.14

one standard deviation. The results of this analysis support the hypothesis predicting better performance by the instructed groups than by the Free Play Group. Therefore, the hypothesis, H_2, was accepted.

H_3: The Parent Group will perform better than the Traditional Group on tests of fundamental motor skills.

The third hypothesis was not supported at the .05 level of significance (see Table 4.8). The F

statistic for the contrast between the Traditional and Parent Groups was 1.69 at $p < .109$. Although this value was below the level of acceptance for this study there was a definite trend toward superior performances by the Parent Group. The negative values in Table 4.11 indicate differences in favor of the Parent Group. Inspection of the signs of the least squares estimates presented in Table 4.11 shows that children in the Parent Group performed better than those of the Traditional Group on every skill. However, since the overall test proved non-significant at the predetermined level the third hypothesis, H_3, was rejected.

TABLE 4.11

LEAST SQUARES ESTIMATES AND THEIR STANDARD ERRORS FOR DIFFERENCES BETWEEN THE TRADITIONAL AND PARENT GROUPS ON TESTS OF FUNDAMENTAL MOTOR SKILLS, USING CONVERTED SCORES

Variable	Least Squares Estimate	Standard Error
Throw	-3.12	1.62
Catch	-2.49	1.36
Kick	-0.83	1.36
Punt	-3.43	1.07
Strike	-1.09	1.40
Run	-1.39	.95
Hop-R	-0.83	2.16

TABLE 4.11--cont'd.

Variable	Least Squares Estimate	Standard Error
Hop-L	-3.00	2.02
Skip	-1.59	1.45
Jump	-0.34	1.30

Questionnaires

Two questionnaires were administered to parents of enrollees during the course of the study. The initial questionnaire was given at the start of the investigation, and the final questionnaire was administered at the conclusion of the program.

Initial Questionnaire

The initial questionnaire was designed to gather demographic data on the families participating in the study. Information relevant to the amount of fundamental skill practice received by children also was solicited. Returns for this questionnaire were 85 percent.

The frequency and percentage of responses for various categories of the questionnaire are tabulated in Appendix E. An analysis of variance was performed on the results of each of the questions related to the practice of skills in the home or community. The tables for those analyses found to be significant are presented within the context of the results. Some of the more interesting generalizations derived from the questionnaire are summarized below.

Parents

Most of the mothers (84 percent) of children participating in this study were between the ages of twenty-five and thirty-four. Over half of the sample fell within the thirty-to thirty-four year range. As is consistent with the general population, the fathers were slightly older. Seventy-two percent were between thirty and thirty-nine. The Free Play Group had the greatest percentage of older fathers with almost 30 percent being forty or above.

As a group, the parents involved in this study were highly educated. All but five had some formal

education beyond high school and a large percentage of parents held either a bachelor's or master's degree (mothers, 72 percent; fathers, 44 percent). Mothers of the Free Play Group had slightly less formal education than those of the other groups. Traditional and Parent Group fathers were more highly educated than fathers of Free Play and Control children. When considered as a group, almost 60 percent of the fathers had attained a master's or doctorate degree. The parent age and education data of this study support the general finding that more highly educated people tend to postpone raising families until their educational or professional goals have been realized. Occupational data from parents of this study also reflect this trend. Almost 93 percent of the fathers were engaged in business or professional careers. Although most of the mothers were presently homemakers, 26 percent also had careers in the business or professional world.

Siblings

The majority of participants in this study were the youngest children of their respective families.

Only 15 percent had a younger male sibling and only 19 percent had a younger female sibling. Children in the Free Play Group had a much higher percentage of older male siblings (53 percent) than children of the other three groups (ranging from 25 to 36 percent). They also had the highest percentage of older female siblings although the differences on this variable were not as dramatic.

Activity Level

The parents of children enrolled in this study were quite active physically. Although there were a number of individuals (mostly mothers) who did not engage in any sport or fitness activities, the majority were regular participants. Sixty-eight percent of the fathers and 65 percent of the mothers engaged in sport or exercise events at least once a week, and a relatively high percentage of parents (35 and 27 percent, respectively) participated three or more times per week. Although the intensity and duration levels of activity were not disclosed, these results are indicative of a

higher level of participation than is usually found among the general public.

Both parents of children in the Traditional Group were less active individually than parents of children in the other groups. The activity level of the family was highest among members of the Parent Group. The largest percentage of families (44 percent) participated in one or two activities on an occasional basis, while one-fourth of the sample participated on a regular basis (one to two times per week). The activities in which families commonly engaged were walking, bicycle riding, yard games and swimming. The participation level of family units was found to be less than that of parents acting individually. This pattern might change, however, as the children mature and become capable of expanding their movement repertoire.

Early Motor Development

Sixty-three percent of the parents reported that their children's early motor skills[1] developed within the normal range of time. Twenty-two percent

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[1] sitting, creeping, walking, self-feeding, and the like.

of the sample were slightly advanced in these skills and small numbers were either markedly advanced or slightly delayed (4 percent and 9 percent, respectively). The distribution of children in the various categories (ranging from markedly delayed to markedly advanced) was fairly equal across the treatment groups.

Nursery School, Day Care

The majority of children (77 percent) participating in the study also were enrolled in nursery school or day care programs. Most of these children attended half-day sessions either two or three days per week (24 percent and 31 percent, respectively). Within groups, the percentage of children attending half-day programs of nursery school or day care ranged from a low of 59 percent in the Free Play Group to a high of 94 percent in the Control Group. Relatively high percentages of children in the Traditional and Parent Groups attended programs either four or five days per week. The percentages reflected the number of mothers employed outside the home in these two groups. The Parent Group had a high percentage of children attending half-day programs (86 percent) as well as the highest percentage of children enrolled for five

days per week (29 percent). Only four children in the sample of respondents (all members of the Traditional Group) attended nursery school or day care centers for full-day programs. Their attendance ranged from one to three days per week.

Practice Alone

It was found that children of the Control Group spent more time practicing fundamental skills alone than did the members of the other three groups. Although the difference between groups was not significant, the Control Group children practiced from three to seven more hours per week than children in the other groups. (See Appendix E for group means and standard deviations.) The Control Group females were reported to practice almost four more hours per week than their male counterparts. This trend was reversed in the Parent and Traditional Groups where the males spent two and four times as many hours in practice as the girls in their respective groups.

Practice with Parents

The overall mean number of hours parents spent with their children in the practice of motor skills was found to be 3.8 per week. This figure encompassed practice with either the mother, the father or both parents. Table 4.12 shows significant differences between the groups on this practice variable. Inspection of the group means disclosed that parents in the Control Group devoted a significantly greater amount of time to practice with their children than did parents of children in the other three groups (6.9 hours versus 2.6 to 3.1 hours per week).

TABLE 4.12

ANALYSIS OF VARIANCE FOR TREATMENT GROUP DIFFERENCES ON THE NUMBER OF HOURS PER WEEK PARENTS SPENT PRACTICING MOTOR SKILLS WITH THEIR CHILDREN

Source	S.S.	d.f.	M.S.	F	Sig.
Between	218.42	3	72.81	5.82	.001
Within	800.70	64	12.51		
Total	1019.12	67			

Practice with Male Siblings

Although the Control Group received more practice with male siblings than any other group, the differences were not statistically significant at the .05 level. Inspection of the group means, however, shows that the Control Group practiced two and one-half to three times more than the Free Play and Parent Groups and nine times more than the Traditional Group. When considered in terms of hours per week this is a meaningful difference. It was interesting to note that males of the Control Group played with male siblings a great deal more than the females did. The males of the Traditional Group did not play at all with male siblings.

Practice with Female Siblings

Children in the Control Group practiced with female siblings significantly more often than children in the treatment groups. (See Table 4.13.) The means for these latter groups ranged from 1.1 to 1.7 hours per week whereas those in the Control Group averaged 7.5 hours per week. Females of the Parent Group had no opportunities to play with female siblings and those

of the Traditional Group had very limited play contacts with their same-sexed siblings.

TABLE 4.13

ANALYSIS OF VARIANCE FOR TREATMENT GROUP DIFFERENCES ON THE NUMBER OF HOURS PER WEEK CHILDREN SPENT PRACTICING MOTOR SKILLS WITH FEMALE SIBLINGS

Source	S.S.	d.f.	M.S.	F	Sig.
Between	473.51	3	157.84	2.70	.053
Within	3740.43	64	58.44		
Total	4213.94	67			

Practice with Friends

None of the children in the entire sample spent much time practicing fundamental skills with neighborhood friends of either sex. In all but one case (Free Play Group playing with male friends), less than one hour per week was devoted to practice in this manner. In almost half the subgroups no practice was restricted to either males or females. The differences between groups were small and found to be non-significant when tested by analysis of variance. Significant differences were

present, however, when the groups were compared on the amount of practice with both male and female friends. (See Table 4.14.) The Control Group practiced an average of 7.5 hours per week while the other groups ranged from 2.5 to 4.1 hours of practice per week.

TABLE 4.14

ANALYSIS OF VARIANCE FOR TREATMENT GROUP DIFFERENCES ON THE NUMBER OF HOURS PER WEEK CHILDREN SPENT PRACTICING MOTOR SKILLS WITH MALE AND FEMALE FRIENDS

Source	S.S.	d.f.	M.S.	F	Sig.
Between	287.50	3	92.83	2.72	.052
Within	2185.38	64	34.15		
Total	2463.88	67			

Practice in Nursery School, Day Care Centers

The Traditional Group received the greatest amount of practice in the nursery school setting (5.5 hours per week). Children in the Control Group received four hours per week, while those in the other groups averaged about two hours per week. The differences between groups were not significant.

Total Hours of Practice

Comparison of the total number of hours per week spent in the practice of fundamental skills revealed significant differences between the groups. (See Table 4.15.) The three treatment groups each averaged about

TABLE 4.15

ANALYSIS OF VARIANCE FOR TREATMENT GROUP DIFFERENCES ON THE NUMBER OF HOURS PER WEEK CHILDREN SPENT PRACTICING MOTOR SKILLS UNDER ALL CONDITIONS COMBINED

Source	S.S.	d.f.	M.S.	F	Sig.
Between	9420.14	3	3140.05	8.99	.0000
Within	22354.14	64	349.28		
Total	31774.28	67			

twenty hours per week, but the Control Group average was forty-seven hours per week. This difference was expected since the Control Group was significantly higher than the others on three comparisons discussed previously and led the groups on two others which were not significant.

Summary

The parents of children in this study were highly educated and interested in providing a good educational environment for their offspring. Over three-fourths of the children enrolled in the study attended nursery school or day care programs two or more days per week. More mothers of children in the Traditional and Parent Groups worked outside the home than mothers in the other two groups. The majority of parents engaged in sport or fitness type activities on a regular basis, although parents in the Traditional Group indicated a lower level of participation than parents in the other groups. The amount of activity in which the family engaged as a unit was highest among members of the Parent Group. Children in the Free Play Group had more older siblings than those of any other group. Control Group children, however, spent more time practicing fundamental skills with siblings than did the children in the other groups. They also received significantly more practice alone, with their parents and with neighborhood friends than did the children in the other groups.

Final Questionnaire

The questionnaire administered at the end of the program was designed to obtain anonymous parent feedback on the value of the Early Childhood Program. Responses were obtained from fifty-three parents (95 percent) of the children in the treatment groups and nine parents (39 percent) of children in the Control Group. The number and percentage of parents within each group who responded to each category of the questionnaire are tabulated in Appendix E. Some of the more significant findings are summarized below.

Program Content, Class Atmosphere

The overwhelming majority of parents agreed that the program content was appropriate for the age, interests and abilities of their children. They also felt that the program offered sufficient variety and that class time was used efficiently. Most of the children enjoyed coming to class, although small percentages of the Traditional and Parent Groups did not (6 percent and 8 percent, respectively). A large majority of respondents believed

that the teachers were instructive, friendly, fair, interested in individuals and concerned with safety. A small percentage of parents in the Free Play and Parent Groups (9 percent and 8 percent, respectively) felt that more discipline should have been maintained, but overall, 80 percent responded favorably to the amount of discipline that was provided.

Fundamental Skills

Over the school year the majority of parents observed improvement in most all of the fundamental skills performed by their children. The skills in which the least improvement was noticed were hopping, skipping and punting, the three skills which were found to develop last on the age continuum (see Appendix D). Significantly less improvement in these three skills was observed among members of the Control Group than was found by parents of the children in the treatment groups. Control Group children also were reported to have improved less than the other groups in galloping, catching and kicking.

Basic Motor Abilities

Combining the categories of agree and strongly agree there were few differences between the groups in the reported improvement of strength and agility. Parents of children in the Control Group observed less improvement in balance and eye-foot coordination than did parents of the children in the other groups. Conversely, the Control Group children were observed to exceed the other children in eye-hand and overall coordination.

Psycho-Social Attributes

Overall, the majority of children showed improvement in each of the psycho-social variables considered. Few differences were found between the groups in the development of self-esteem, confidence in one's ability and the ability to share with others. The Traditional Group parents reported less progress in their children's willingness to try new activities than did the parents of the other groups. The Control Group, on the other hand, was high on this trait. Further comparison of the groups indicated that children of the Parent and Traditional Groups interacted less with other children and adults than did children in the other groups.

Amount and Quality of Gross Motor Play

The majority of parents throughout the groups reported that their children had increased the relative amount of gross motor play engaged in since the beginning of the school year. However, children in the treatment groups experienced a greater increase than those in the Control Group. The family's level of participation in gross motor play did not show an equivalent increase. More positive changes in the level of participation were associated with the Traditional and Parent Groups than the other groups, however. Improvement in the quality of gross motor play was reportedly higher for children than for families as a whole. Families in the Traditional and Parent Groups improved the quality of their gross motor play to a greater extent than Control and Free Play Families.

Summary

The majority of parents whose children participated in the treatment groups generally had favorable attitudes toward the program. By the end of the year,

all parents observed improved performance in several skills, although fewer changes were noted among children of the Control Group. Participation in any of the three treatment groups seemed to enhance interest in the practice of gross motor skills. Positive changes in the quality of gross motor play were noted, particularly among children and families in the Traditional and Parent Groups.

Evaluation of Questionnaires

Since the questionnaires were included as a supplement to the primary analysis of the study no attempt was made to determine their item validity or reliability. It is known that some of the questions, especially those related to practice, were difficult to answer. Parents of the Control Group may have experienced greater difficulty than others in the determination of accurate responses to the practice questions. Since Control Group children were higher in all but one aspect of the practice variable it is possible that their parents overestimated the number of hours spent in practice. Alternatively, they may have reported the total number of

hours spent in play without trying to distinguish the practice of fundamental skills from within the total context of that play. It is possible, however, that the Control Group children actually did receive a significantly greater amount of practice within the home or neighborhood setting. Their parents may have tried to compensate for the lack of a specific motor skill program by providing more motoric experiences at home. Furthermore, these parents may have had more time to devote to play with their children since they did not have to transport them to another facility twice a week.

It is difficult to draw inferences from the information obtained about the practice variables. More accurate responses could be obtained by requesting parents to observe their children's play practices over a course of time. The use of daily checklists or other specific guidelines for observation would greatly reduce error in this variable. However, the utilization of such instruments would require greater cooperation on the part of parents. It is obvious that more time must be devoted to the development of questionnaires if they are to constitute a major portion of a research

project. Those used in this study provided desired insights on the sample, but interpretations about children's activities must be made with caution. The low percentage of returns from the parents in the Control Group on the final questionnaire is also a detriment to accurate assessment.

Discussion

Significant differences in the attainment of fundamental motor skills were found when the Free Play Group was contrasted with the combined Traditional and Parent Groups. However, when the Control Group was contrasted with the combined treatment groups no significant differences were found. These results suggest that the Free Play and Control Groups were not different from each other. The children who had an opportunity to play in a specialized environment for twenty-seven weeks did not make greater gains in skill development than those children who played only at home and at nursery school. A close inspection of the programs of the nursery schools attended by the Control Group

children provides a reason for this finding. It was determined that children in the Control Group who attended the cooperating nursery schools (two-thirds of the entire group) had motor development equipment available to them on a free play basis. In addition, children enrolled in the Wesley Cooperative (almost one-third of the Control Group) experienced a more extensive motor skill program than is normally found in preschool programs. They had a separate room containing a balance beam, climber, mats, jumping apparatus and an area for the practice of ball skills. Each group spent at least one twenty-five minute period per week in this special environment and often more. Although the children were not given formal instruction in basic skills, their teacher was knowledgeable in the area of motor development and encouraged participation in the activities provided. Therefore, the experiences of this group were not markedly different from those of the Free Play Group in the study.

Since the Free Play Group was not significantly different from the Control, its inclusion in the analysis for the first contrast tended to mask the effects of the two instructional groups. When the effects of the

instructional groups were compared with those of the Free Play Group (Contrast 2) it became obvious that children who are provided with instruction and directed practice improve their fundamental skills to a greater extent than do children who only play in a specialized motor development environment. This result was not unexpected for within the free play setting it was noted that children often used the provided equipment for dramatic, rather than motoric play. Thus, cones became witches hats rather than objects to dodge or from which to strike a ball. Jump ropes were turned into lassos or binding material. Foam shapes were used as building blocks rather than objects to be thrown, kicked or jumped over. These examples are not meant to minimize the value of dramatic or free play. They are presented simply to illustrate the fact that, when left to their own devices, children usually do not practice a wide variety of fundamental motor skills. Even the spontaneous occurrence of basic locomotor patterns (other than walking or running) was seldom observed. Without some form of guidance from adults or older children, then, young children's movement patterns are likely to be underdeveloped and their repertoire of skills lacking in variety.

The results of the initial questionnaire lend additional support to the benefits of guided practice. The Control Group was reported to have received a significantly greater amount of practice within the home and neighborhood setting. However, children of this group did not experience as much improvement in their fundamental skills as those children in the instructional groups. It would appear then, that undirected gross motor play, even in large amounts, is not as beneficial as direct instruction for the enhancement of fundamental motor skill learning.

The fact that significant differences were not found when the Traditional and Control Groups were contrasted (Contrast 3) indicated that instruction is equally effective whether it is provided by teachers alone or by parents and teachers working cooperatively. Having the parents participate in class activities makes the teacher's task easier, but apparently does not affect the rate of learning. The interactions between specific parents and children probably complicate the issue of differences between these groups. Some children work most effectively with their parents while

others exert greater effort for adults outside the family unit.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this investigation was to determine the effectiveness of various programs of motor skill instruction for three and four year-old children. Seventy-nine children from the Greater Lansing area were volunteered by their parents to serve as subjects for the study. Each was assigned to one of three treatment groups. Two such groups received identical programs of instruction in gross motor skills. One group, labeled Traditional, was taught in the conventional manner by providing a predetermined number of teachers for a specific number of students. The other instructional group, labeled Parent, was provided with the same teacher-student ratio (1:6) but additionally required a parent of each child to participate in the program. Instructions relevant to skill improvement were directed to the parents who, in turn, were responsible for

disseminating the information to their children. A third group, entitled Free Play, was not exposed to any formal program of instruction. The children of this group were permitted to use all available equipment for self-initiated activities. Although two instructors were present to assist the group they refrained from teaching or correcting errors except in cases of potential danger. A fourth group, composed primarily of children attending two local nursery schools, was included in the study to control for the effects of maturation.

Each of the instructed and free play groups met at the same campus facility for one hour activity periods twice each week. The program was in operation for twenty-seven weeks thereby providing a total of fifty-four hours of directed activity or free play. The traditional and parent groups were taught by the same instructor who also supervised each free play section. An assistant was available to provide additional help in each group. The curriculum used for the two instructional groups emphasized the development of fundamental motor skills. Approximately forty percent of class time was devoted

to direct instruction in these skills. The remainder of the program was comprised of body management, rhythmic and creative movement activities.

All subjects were pre- and post-tested on ten fundamental motor skills: throwing, catching, kicking, punting, running, hopping (each foot), skipping and jumping. Each child's stage of development in the fundamental skills, as described by Seefeldt and Haubenstricker, was assessed by a team of trained observers.

The data were transformed to an expanded scale, then subjected to Finn's Multivariate Analysis of Covariance procedure. Age and pre-test scores were used as covariates and tests for significance were performed for the following ordered contrasts:

1. Control Group versus the Combined Free Play, Traditional and Parent Groups

2. Free Play Group versus the Combined Traditional and Parent Groups

3. Traditional Group versus the Parent Group.

No significant group effects were evident for the first contrast, that of the Control Group versus the combined treatment groups. However, significant differences were found when the Free Play Group was contrasted with the combined Traditional and Parent Groups. These results suggest that the Free Play and Control Groups were not different from each other. Children who participated in these groups performed equally well on tests of fundamental motor skills. The inclusion of the Free Play Group in the first analysis undoubtedly masked the differences between the Control Group and the combined treatment groups. When the Free Play Group was singularly tested against the combined Traditional and Parent Groups the effects of instruction became evident. The combined group performed significantly better, indicating that programs of directed practice and instruction are more effective than programs of free play in increasing the fundamental skill level of young children.

The third contrast failed to show a difference between the Traditional and Parent Groups. These results indicate that the two methods of instruction are equally effective in promoting the development of fundamental motor skills.

A close inspection of the nursery school programs revealed many similarities between the motoric experiences provided for children of the Free Play and Control Groups. Much of the equipment, content and methodology were essentially the same for each group. Most likely, it was these similarities that produced the statistical result of no significant differences between the groups.

The finding that directed practice and instruction resulted in greater gains in fundamental skills than those produced by maturation is of significance to those who are in charge of preschool educational programs. The fact that parents can be effective teachers of motor skills is also revealing and has many implications for the education of young children.

Conclusions

Within the limits of this study the following conclusions appear to be justified:

1. Programs of instruction for young children can increase the development of fundamental motor

skills beyond the level attained solely through the maturational process.

2. Instructional motor skill programs are more effective than programs of free play in promoting the development of fundamental motor skills in young children.

3. Instruction in fundamental motor skills is equally effective whether it is provided by physical education teachers alone or by parents working under the direction of physical education teachers.

4. Three and four year old males and females differ in their ability to perform specific fundamental motor skills.

5. Young children and their parents have favorable attitudes toward instructional programs emphasizing the development of fundamental motor skills.

Recommendations

For further study it is recommended that:

1. Children who participated in this study be re-evaluated on their fundamental motor skills to determine if any long-range effects occurred.

2. Parents of the children who participated in this study be questioned about the activity patterns of their children subsequent to their involvement in the Early Childhood Program.

3. Children who participated in this study be taught some novel activities to determine whether their approach to learning and the ease with which they learn new skills differs from that of children who did not participate in the Early Childhood Program.

4. The kindergarten and first grade records of children who participated in this study and records of a control group that did not, be examined for differences in cognitive, motoric and social competence.

5. Similar studies be conducted on larger samples of children employing the use of additional measures for (a) fundamental skills, (b) dynamic balance, (c) rhythmic ability and (d) eye-hand coordination.

6. Various teaching approaches (highly structured, problem-solving, parental-assisted and free play) be evaluated for their contribution to the social development of children.

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APPENDICES

APPENDIX A

EARLY CHILDHOOD MOTOR DEVELOPMENT PROGRAM

Objectives

Curriculum

Methods

Equipment

Objectives

1. To learn to move the body efficiently in a variety of ways.

2. To learn the fundamental skills necessary for participation in sports and games: throwing, catching, kicking, punting, running, hopping, skipping, jumping, and striking.

3. To develop the qualities of balance, strength, flexibility, coordination, agility, power, and endurance.

4. To develop a body image which includes (a) knowledge of the names, locations, and relationships of body parts, (b) a sense of laterality and directionality, and (c) an understanding of one's relative position in space.

5. To experience the concepts of space, time, force, and flow through movement: up, down, fast, slow, heavy, light, etc.

6. To learn to move in response to rhythm.

7. To learn to use movement as a form of personal expression and as a medium for dramatic enactment.

8. To develop creativity, initiative, self-confidence, and social skills through movement and group experience.

9. To experience the joy of moving.

Curriculum

The major curricular content areas and the amount of program time devoted to each are listed below. The sample activities provided under each heading were classified according to the area to which they make their greatest contribution. It must be recognized that many activities are multi-purposive, and, therefore, contribute to more than one major area of the curriculum.

Content Area		Time Allotment
Fundamental Motor Skills		40%
Locomotor	Non-locomotor	Object Projection & Reception
walk	bend	throw
run	stretch	roll
jump	swing	kick
gallop	sway	strike
slide	twist	trap
leap	turn	catch
hop	rock	dribble
skip	curl	punt
roll	push	
start	pull	
stop	lift	
bounce	hang	
fall	shake	
dodge		
climb		

Content Area	Time Allotment

Body Image and Body Management Activities — 30%

Body Image Activities

Identification of body parts (own and others); relationships of body parts; spacial awareness. Felt board puzzle, Angels in the Snow, games such as Hokey-Pokey, Busy Bee.

Body Management Activities

Self-testing activities

Challenges such as: How long can you balance? How high can you jump? Can you hang by your knees?

Tumbling, apparatus, obstacle course activities

Basic rolling, balancing, climbing, hanging and jumping activities. Use of balance beam, trampoline, cargo net, climber, ladder, mats, Swedish box; movement over, under, around and through objects.

Large manipulative activities

Movement employing the use of hoops, scooter boards, ropes, stretch ropes, parachute, tin can stilts, hoppity horses, foam shapes, streamers and scarves.

Rhythmic Activities — 15%

Copy a defined rhythm by clapping hands or using rhythm instruments.

Move in designated ways, such as hop, slide, and gallop, to rhythmical or musical accompaniment.

Finger plays, action songs, simple dances.

Exploratory and Creative Movement Experiences — 10%

Activities emphasizing the movement elements of time, space, force and flow (with and without equipment).

Story games, dramatic play

Act out various movement themes such as a trip to the zoo, playing in the snow; games such as Here We Go Round the Mulberry Bush.

Content Area	Time Allotment
Basic Motor Capacities	5%

Activities for the development of strength, flexibility, balance, coordination, endurance, power and agility.

Climbing, use of large and small apparatus.

Exploratory, rhythmic and body management activities.

Methods

Fundamental Skills

Initially, all fundamental skills were presented in isolation. The children were requested to demonstrate a particular skill with maximum effort so that the developmental stage of each individual could be observed by the instructors. Attempts then were made to help each child progress to the next stage through direct instruction in the techniques characteristic of that stage. For example, a child displaying a Stage One standing long jump was instructed to lean forward at takeoff, "wing" the arms and tuck the knees during flight and to land with the legs directly under the body. One or more of these Stage Two characteristics were emphasized during successive attempts at jumping. Whenever possible the desired techniques were elicited by using supplementary challenges or sub-tasks. Thus, to increase the forward component of the long jump the child might have been asked to reach out and touch a balloon suspended in front of him during the jump. To increase flexion in the hips and knees, jumping over a loosely supported rope or stick may have been requested. Although manipulation was used occasionally, demonstration and explanation were

the primary teaching techniques employed. Verbalization was kept to a minimum and the vocabulary used was adapted to the level of the child.

Once the basic techniques were practiced, the skill was employed in other situations. In the case of jumping, follow-up activities might have included "Jumping the Brook" (two non-parallel lines on the floor), jumping through a succession of hoops or playing kangaroo. The same general procedures were used each time a new skill was introduced or when a previously taught skill was reviewed.

Rhythmic Activities

Rhythmic activities were conducted in a group setting. Finger plays and rhythm-copying activities often were used to provide for rest after a period of vigorous activity. Normally, the children and teachers sat in a circle while participating in these activities. Once basic rhythms had been established, the children were asked to move about the room in response to a given rhythm. At first, suggestions for movement were provided (light run, slow walk, gallop, etc.) but later the children were encouraged to give their own responses. Singing games commonly were used near the end of the hour to provide a slower-paced group experience before leaving.

Exploratory and Creative Movement Activities

Exploratory activities were presented by two teachers in the manner prescribed by Gilliom.[1] All activities in this category were presented to all members of the class simultaneously. Problems or suggestions for activity were presented by the master teacher and assistance was provided by both teachers.

Body Image and Body Movement Activities

The activities classified under this heading were taught in a variety of ways. Self-testing and tumbling activities were presented either to the group as a whole, or to half of the group (six children) while the remaining children worked on fundamental skills under the supervision of the other teacher. The easiest stunts and tumbling activities were practiced early in the year. More difficult tasks were introduced as skill levels increased. An informal approach was used for many of the activities, but those that required spotting were more formally organized.

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[1] B. C. Gilliom, Basic Movement Education for Children (Reading, Mass.: Wesley Publishing Company, 1970).

Basic Motor Capacities

The development of basic motor capacities usually occurred as a result of activities incorporated from other areas of the curriculum. For example, rather than doing specific fitness-type activities, arm strength may have been developed by climbing, hanging, or the manipulation of scooter boards. A varied approach was used, ranging from highly structured situations to occasional periods of free play.

Equipment

The equipment used in the activity program was as follows:

Play balls - 10"
Playground balls - 6-1/2"
Tennis balls
Fleece balls
Foam balls
Bean bags
Cones
Bats
Ping-pong paddles
Balloons
Boxes
Yarn balls on rope
Carpet squares
Felt board, body pieces
Game tails
Tin can stilts
Jumping target
Animal markers
Triangles - cardboard
Tubes - 8' - cardboard
Bowling pins
Record player
Records
Tambourine
Rhythm instruments
Climber with detachable ladder
Balance beam
Trampoline
Mats
Hoops
Scooter boards
Hoppity horses
Stretch rope
Foam shapes
Parachute
Ropes
Streamers
Scarves

APPENDIX B

Evaluation Procedures

Test Directions

Developmental Sequences

Evaluation Procedures

The children enrolled in the experimental phase of the program were brought to the testing room by their parents. Most children arrived early enough to observe the previously scheduled child being evaluated. The parents stayed in the room throughout the ten- to fifteen-minute period required to test each child. The examiners who were observing and recording the performances sat at the side of the room. A similar procedure was followed when testing the children in the control group at the two nursery schools. Small groups of children were isolated until all had been tested, at which time they were returned to their classroom. Children who were shy or fearful of the testing situation were accompanied by their teacher who tried to make them feel more comfortable with the examiners and encouraged them to participate in the activities.

After observing each fundamental skill, the examiners recorded the appropriate stage of development on individual scoresheets. If a child was in transition between two stages, a plus or minus was added to the stage number assigned. For example, a child would be classified at the 3+ level if he displayed predominantly Stage 3 characteristics

but had elements of a Stage 4 pattern in his behavior. If he were performing primarily at a Stage 4 level but lacked total integration at that level or displayed some characteristics of a Stage 3, the child would be assigned a 4-. When examiners disagreed on the stage assignment the score recorded by the most experienced observer was used in the analysis. In most cases one or both of the faculty members who developed the stage sequences were part of the evaluation team. Their judgments, then, received highest priority. During final testing the primary investigator served as elicitor of the skills for all children, but did not participate in the decisions of stage determination.

Test Directions

Object Projection and Reception Skills

Throwing

Equipment: 3 tennis balls

Directions: Have the child stand approximately 25' away from a wall. Instruct the child to pick up a tennis ball and throw it overhand as hard as possible at the wall.

Catching

Equipment: 10" plastic play ball

Directions: Stand facing the child, 8' to 10' away. Using an underhand pattern toss the ball causing it to arc in the air and reach the child at chest height. Instruct the child to "get ready" to catch the ball when it arrives. If a child performs at the Stage 4 level toss the ball to the side to test for Stage 5.

Kicking

Equipment: 10" play ball, bean bag

Directions: Place the ball on top of the bean bag on the floor. Have the child stand behind the ball and instruct him to kick it as hard as possible. If at least a Stage 2 is demonstrated start the child about 6' behind the ball to initiate the kick with a run.

Punting

Equipment: 10" play ball

Directions: After demonstrating a punt have the child attempt the skill. If a Stage 2 punt is performed ask the child to punt harder or farther to test for Stage 3.

Striking

Equipment: lightweight plastic bat, 18" plastic cone, 6-1/2" rubber playground ball

Directions: Ask the child to demonstrate which way he/she likes to swing the bat. Place the child in the appropriate position for batting in accordance with the preferred side. Place the balloon on the cone and instruct the child to hit it, swinging with as much force as possible.

Locomotor Skills

Running, Hopping, Skipping

Equipment: None

Directions: Start the child at one end of the room and ask him to perform the desired locomotor skill to the other side of the room. Demonstrate the skill, if necessary. Encourage fast running; and, hopping across a distance rather than stationary hopping. Evaluate hopping for each foot.

Jumping

Equipment: Mat with tape-marked starting line and tape markers at one-foot intervals parallel to the starting line.

Directions: Instruct the child to stand behind the starting line and jump as far as possible, landing on two feet. Demonstrate, if necessary. If young children fail to understand the concept of jumping for distance, place a bean bag approximately 6" in front of the starting line and ask them to jump over the bean bag.

Developmental Sequences

The developmental sequences for nine fundamental skills are presented below. Each sequence describes a succession of stages which lead toward the mature form of the skill. The sequences were developed by Seefeldt and Haubenstricker (1974-1977) from observations of filmed performances.

Developmental Sequence of Throwing

Stage 1. The throwing motion is essentially posterior-anterior in direction. The feet usually remain stationary during the throw. Infrequently, the performer may step or walk just prior to moving the ball into position for throwing. There is little or no trunk rotation in the most rudimentary pattern at this stage, but those at the point of transition between stages one and two may evoke slight trunk rotation in preparation for the throw and extensive hip and trunk rotation in the "follow-through" phase. In the typical stage one the force for projecting the ball comes from hip flexion, shoulder protraction and elbow extension.

Stage 2. The distinctive feature of this stage is the rotation of the body about an imaginary vertical axis, with the hips, spine and shoulders rotating as one unit. The performer may step forward with either an ipsilateral or contralateral pattern, but the arm is brought forward in a transverse plane. The motion may resemble a "sling" rather than a throw due to the extended arm position during the course of the throw.

Stage 3. The distinctive pattern in stage three is the ipsilateral arm-leg action. The ball is placed into a throwing position above the shoulder by a vertical and posterior motion of the arm at the time that the ipsilateral leg is moving forward. This stage involves little or no rotation of the spine and hips in preparation for the throw. The follow-through phase includes flexion at the hip joint and some trunk rotation toward the side opposite the throwing arm.

Stage 4. The movement is contralateral, with the leg opposite the throwing arm striding forward as the throwing arm is moved in a vertical and posterior direction during the "wind-up" phase. There is little or no rotation of the hips and spine during the wind-up phase; thus, the motion of the trunk and arm closely resemble those of stages one and three. The stride forward with the contralateral leg provides for a wide base of support and greater stability during the force production phase of the throw.

Stage 5. The "wind-up" phase begins with the throwing hand moving in a downward arc and then backward as the opposite leg moves forward. This concurrent action rotates the hip and spine into position for forceful derotation. As the contralateral foot strikes the surface the hips, spine and shoulder begin derotating in sequence. The contralateral leg begins to extend at the knee, providing an equal and opposite reaction to the throwing arm. The arm opposite the throwing limb also moves forcefully toward the body to assist in the "equal and opposite" reaction.

Developmental Sequence of Catching

Stage 1. The child presents his arms directly in front of him, with the elbows extended and the palms facing upward or inward toward the mid saggital plane. As the ball contacts the hands or arms the elbows are flexed and the arms and hands attempt to secure the ball by holding it against the chest.

Stage 2. The child prepares to receive the object with the arms in front of the body, the elbows extended or slightly flexed. Upon presentation of the ball the arms begin an encircling

motion which culminates by securing the ball against the chest. Stage two also differs from Stage one in that the receiver initiates the arm action prior to ball-arm contact in Stage two.

Stage 3. The child prepares to receive the ball with arms which are slightly flexed and extended forward at the shoulder. Many children also receive the ball with arms which are flexed at the elbow, with the elbow ahead of a frontal plane.

Substage 1. The child uses his chest as the first contact point of the ball and attempts to secure the ball by holding it to his chest with the hands and arms.

Substage 2. The child attempts to catch the ball with his hands. Upon his failure to hold it securely he maneuvers it to his chest, where it is controlled by hands and arms.

Stage 4. The child prepares to receive the ball by flexing the elbows and presenting the arms ahead of the frontal plane. Skillful performers may keep the elbows at the sides and flex the arms simultaneously as they bring them forward to meet the ball. The ball is caught with the hands, without making contact with any other body parts.

Stage 5. The upper segmental action is identical to Stage four. In addition, the child is required to change his stationary base in order to receive the ball. Stage five is included because of the apparent difficulty which many children encounter when they are required to move in relation to an approaching object.

Developmental Sequence of Kicking

Stage 1. The performer is usually stationary with the leg of the striking foot slightly flexed at the knee prior to the foot striking the ball. If the performer moves forward prior to the kick, the steps are short and result as a part of the approach rather than a primary preparation for striking the ball. The thigh of the striking leg is perpendicular to

the surface or ahead of the mid-frontal plane as the knee of the striking leg is flexed. The slight knee flexion results in a kick with a pushing action rather than a forceful striking motion. There is little follow-through of the kicking foot, and frequently it is withdrawn from the ball after contact.

Stage 2. The body is stationary during the initiation of the kicking action. The preparatory motion involves hyperextension at the hip joint and hyperflexion at the knee joint, with the thigh of the striking leg in a position behind the mid-frontal plane. Opposition of upper and lower extremities is present during the kicking motion. The body pivots on the supporting leg, but the force of the kick usually is not sufficient to move the body forward after striking the ball.

Stage 3. The preparatory phase involves an approach to the ball that includes a deliberate step or series of steps. The striking foot remains near the surface in its approach, indicating a reduction in knee flexion in contrast to Stage two. The force of the striking foot is less than maximum, reflected by an upright posture of the trunk. The follow-through may result in the performer moving past the point of contact if the approach was rapid or the performer may remain near the point of contact if the approach was deliberate and cautious.

Stage 4. The approach to the ball involves one or more steps, but the distance just prior to the kick is covered by a leap. In other words, the kicker must be airborne in the approach to qualify as a Stage four kicker. The knee of the kicking leg is slightly flexed by the action of the long leap just prior to kicking. The trunk is inclined backward prior to and during contact, in order to place the rectus femorus muscle in the most efficient position for contraction. The momentum of the kick is dissipated by hopping on the support leg and then stepping in the direction of the object which has been struck.

Developmental Sequence of Punting

Stage 1. The performer is stationary as the hands and feet prepare for the punting action. The ball is held with both hands at waist height or higher prior to placing it in position for punting. The ball may be manipulated in a variety of ways for punting: (a) it may be held in both hands as the punting foot is lifted forward and upward with hip and knee flexion. The punting force in this situation represents a push as the ball is contacted by the plantar side of the foot when the knee extends. (b) The ball may be tossed up and forward into the air. The performer then must move forward to get the body into punting position. (c) The performer may bounce the ball and attempt to punt it as it rebounds from the surface. Whatever the mode of placing the ball into a punting position, the primary characteristics of Stage one are a stationary preparatory position and flexion at the hip and knee of the punting leg, placing these segments in front of the mid-frontal plane.

Stage 2. The performer is stationary during the preparatory phase. The ball is held in both hands and may be dropped or tossed forward or upward in preparation for punting it with the foot. The non-support leg is flexed at the knee, and the thigh is perpendicular to the surface or behind the mid-frontal plane as the leg is placed into punting position. As the punting leg moves forward, its momentum may carry the performer forward for a step, but generally the force is upward, causing the punter to step backward after striking the ball.

Stage 3. The performer moves forward deliberately for one or more steps in preparation for punting the ball. The ball is generally released in a forward and downward direction. The knee is flexed at 90° or less, but the thigh is farther behind the mid-frontal plane than in Stage two, due to the stepping action. The follow-through of the striking leg will generally carry the punter ahead of the point where the ball was contacted.

Stage 4. The punter's approach is rapid, usually comprising one or more steps, culminating in a leap just prior to contacting the ball. If the leap does not precede the punt, the forward

momentum may be enhanced by taking a large step. The ball is contacted at or below knee height as a result of the ball having been released in a forward and downward direction. The momentum of the swinging leg carries the punter off of the surface in an upward and forward direction after the punt.

Developmental Sequence of Striking

Striking with a bat

Stage 1. The motion is primarily posterior-anterior in direction. The movement begins with hip extension, slight spinal extension, and retraction of the shoulder on the striking side of the body. The elbows flex fully. The feet remain stationary throughout the movement with the primary force coming from extension of the flexed joints.

Stage 2. The feet may remain stationary, or either the right or left foot may receive the weight as the body moves toward the approaching ball. The primary pattern is the unitary rotation of the hip-spinal linkage about an imaginary vertical axis. The forward movement of the bat is in a transverse plane.

Stage 3. The shift of weight to the front-supporting foot occurs in an ipsilateral pattern. The trunk rotation-derotation is decreased markedly in comparison to Stage two and the movement of the bat is in an oblique-vertical plane instead of the transverse path as seen in Stage two.

Stage 4. The transfer of weight in rotation-derotation is in a contralateral pattern. The shift of weight to the forward foot occurs while the bat is still moving backward and the hips, spine and shoulder girdle assume their force-producing positions. At the initiation of the forward movement, the bat is kept near the body. Extension of the elbow and supination-pronation of the hands, however, do not occur until the arms and hands are well forward and ready to extend the lever in preparation of meeting the ball. At contact the weight is on the forward foot.

Developmental Sequence of Running

Stage 1. The arms are extended sideward at shoulder height (high-guard position). The stride is short, and of shoulder width. The surface contact is made with the entire foot, simultaneously. Little knee flexion is seen. The feet remain near the surface at all times.

Stage 2. Arms are carried at the "middle guard" position (waist height) and the stride is longer and approaches the mid-saggital line. Contact usually is made with the entire foot striking the surface simultaneously. Greater knee flexion is noted in the restraining phase. The swing leg is flexed and the movement of the legs becomes anterior-posterior.

Stage 3. The arms are no longer used primarily for balance. Arms are carried below waist level and may flex and assume a counter-rotary action. The foot contact is "heel-toe." Stride length increases and both feet move along a mid-saggital line. The swing leg flexion may be as great as 90 degrees.

Stage 4. Foot contact is heel-toe at slow or modest velocities but may be entirely on the metatarsal arch during sprint running. Arm action is in direct opposition to leg action. Knee flexion is used to maintain the momentum during the support phase. The swing leg may flex until it is nearly in contact with the buttocks during its recovery phase.

Developmental Stages of Hopping

Stage 1. The non-support knee is flexed at 90° or less with the non-support thigh parallel to the surface. This position places the non-support foot in front of the body so that it may be used for support in the event that balance is lost. The body is held in an upright position with the arms flexed at the elbows. The hands are held near shoulder height and slightly to the side in a stabilizing position. Force production is generally limited so that little height or distance is achieved in a single hop.

Stage 2. The non-support knee is fully flexed so that the foot is near the buttocks. The thigh of the non-support leg is nearly parallel to the surface. The trunk is flexed at the hip resulting in a slight forward lean. The performer gains considerable height by flexing and extending the joints of the supporting leg and by extending at the hip joint. In addition, the thigh of the non-support leg aids in force production by flexing at the hip joint. Upon landing, the force is absorbed by flexion at the hips and the supporting knee. The arms participate vigorously in force production as they move up and down in a bilateral manner. Due to the vigorous action and precarious balance of performers at this stage, the number of hops generally ranges between two and four.

Stage 3. The thigh of the non-support leg is in a vertical position with the knee flexed at 90° or less. Performers exhibit greater body lean forward than in Stages one or two, with the result that the hips are farther in front of the support leg upon take-off. This forward lean of the trunk results in greater distance in relation to the height of the hop.

The thigh of the non-support leg remains near the vertical (frontal) plane, but knee flexion may vary as the body is projected and received by the supporting leg. The arms are used in force production, moving bilaterally upward during the force production phase.

Stage 4. The knee of the non-support leg is flexed at 90° or less, but the entire leg swings back and forth like a pendulum as it aids in force production. The arms are carried close to the sides of the body, with elbow flexion at 90°. As the non-support leg increases its force production, that of the arms seems to diminish.

Developmental Sequence of Skipping

Stage 1. A deliberate step-hop pattern is employed; an occasional double hop is present; there is little effective use of the arms to provide momentum; an exaggerated step or leap is present during the transfer of weight from one supporting limb to the other; and the total action appears segmented.

Stage 2. Rhythmical transfer of weight during the step phase; increased use of arms in providing forward and upward momentum; and exaggeration of vertical component during airborne phase, i.e. while executing the hop.

Stage 3. Rhythmical transfer of weight during all phases; reduced arm action during transfer of weight phase; and foot of supporting limb carried near surface during hopping phase.

Developmental Sequence of the Standing Long Jump

Stage 1. Vertical component of force may be greater than horizontal; resulting jump is then upward rather than forward. Arms move backward, acting as brakes to stop the momentum of the trunk, as the legs extend in front of the center of mass.

Stage 2. The arms move in an anterior-posterior direction during the preparatory phase, but move sideward (winging action) during the "in-flight" phase. The knees and hips flex and extend more fully than in Stage one. The angle of take off is still markedly above 45°. The landing is made with the center of gravity above the base of support, with the thighs perpendicular to the surface rather than parallel as in the "reaching" position of Stage four.

Stage 3. The arms swing backward and then forward during the preparatory phase. The knees and hips flex fully prior to take-off. Upon take-off the arms extend and move forward but do not exceed the height of the head. The knee extension may be complete but the take-off angle is still greater than 45°. Upon landing, the thigh is still less than parallel to the surface and the center of gravity is near the base of support when viewed from the frontal plane.

Stage 4. The arms extend vigorously forward and upward upon take-off, reaching full extension above the head at "lift-off." The hips and knees are extended fully with the take-off angle at 45° or less. In preparation for landing the arms are brought downward and the legs are thrust forward until the thigh is parallel to the surface. The center of gravity is

far behind the base of support upon foot contact, but at the moment of contact the knees are flexed and the arms are thrust forward in order to maintain the momentum to carry the center of gravity beyond the feet.

APPENDIX C

QUESTIONNAIRES

Initial

Final

Initial Questionnaire

Motor Performance Study - Early Childhood Program

Parental Questionnaire

Fall, 1975

The purpose of this questionnaire is to determine the relationship between certain variables within the home environment and the motor performance of young children. A knowledge of several factors which influence the child's motor development will enable the investigator to make more accurate judgments about the value of the present experimental programs. Please provide information for the following questions to the best of your ability. The information received will be held in strictest confidence. Only norms and summary data will be used in future reports and publications.

Name of child_____ M/F Birthday_____

Mother_____ Age_____

Father_____ Age_____

Siblings: M/F Age

_____

_____

_____

Check highest level of education obtained:

	High School	Trade School	College-Years	Bachelor's Degree	Masters Degree	Doctorate
Mother						
Father						

Occupation and place of employment:

Mother_____

Father_____

Is your family presently enrolled in the regular Motor Performance Study (not the preschool program)?

_____ Yes _____ No

Child's general state of health:

____ Excellent ____ Good ____ Fair ____ Poor

Explain conditions that may cause your child to move with restrictions.

_____

_____

_____

In general, did your child's early motor skills emerge within the normal range of development (i.e. did he learn to sit, stand, walk, feed himself, etc. at approximately the same age that other children learn these skills)?

____ Normal ____ Slightly advanced ____ Very advanced

____ Slightly delayed ____ Markedly delayed

Approximately how many hours per week does your child engage in the practice of fundamental motor skills (running, jumping, throwing, catching, kicking, etc.)?

Hours/week					
_____	Alone				
_____	With parent(s)				
_____	With siblings	___ male	___ female	__both	
_____	Neighborhood friends	___ male	___ female	__both	
_____	In nursery school programs				
_____	Other situations:				

Other activities of the child:

Nursery school or day care:

____ 1/2 days per week ____ full days per week

Instructional programs:

____ Swimming	____ Movement education
____ Skating	____ Dance
____ Tumbling, gymnastics	____ Other

Other activities:

____ Art programs
____ Library story hour
____ Other_____

Please indicate the frequency of participation in physical activities (fitness programs, sports, dance, aquatics, etc.)

Activities	Occasionally during season	Once per week	Twice per week	3 or more times/week
Father				

Activities	Occasionally during season	Once per week	Twice per week	3 or more times/week
Mother				
Family				
as a				
unit				

Please check the items of equipment in your home or yard that are used by your child.

____ Balls	____ Beanbags	___Swing set
____ Bat	____ Ice skates	___Balance beam
____ Paddle	____ Roller skates	___Walking board
____ Scoop	____ Kiddy car	___Tumbling mat
____ Frisbee	____ Tricycle	or rug
____ Jump rope	____ Bicycle	___Wagon
____ Bowling pins	____ Climber	___"Big Wheel"
____ Ring toss	____ Swing	
Junior size:	____ Swimming pool	
____ Badminton racket	(deep enough for	
____ Tennis racket	submersion)	
____ Golf Club	____ Skis	
	____ Other	

Thank you very much for taking the time to complete this form. Your cooperation is deeply appreciated and the data received will be of great value to the study.

Final Questionnaire for Treatment Groups

MOTOR PERFORMANCE STUDY
Early Childhood Program

Spring, 1976

The purpose of this questionnaire is to help determine parental reaction to the Early Childhood Program and its effects upon the child and family. Please answer the questions to the best of your ability. Your responses are greatly appreciated both for the completion of this study and for the guidance of future programs.

Section Attended:

_____M-W 10:00 _____T-Th 2:15

_____T-Th 10:00 _____W 5:00, S 9:30

_____T-Th 1:00 _____W 6:15, S 10:45

Code: SA: Strongly Agree D: Disagree
A: Agree SD: Strongly Disagree
N: Neither Agree or Disagree O: No Basis for Opinion

	(SA)	(A)	(N)	(D)	(SD)	(O)
1. The program content was appropriate for the age, interests and abilities of your child.	( )	( )	( )	( )	( )	( )
2. The program offered sufficient variety.	( )	( )	( )	( )	( )	( )

	(SA)	(A)	(N)	(D)	(SD)	(O)
3. The class time was used efficiently.	( )	( )	( )	( )	( )	( )
4. Your child enjoyed coming to class.	( )	( )	( )	( )	( )	( )
5. The teachers were:						
Instructive	( )	( )	( )	( )	( )	( )
Warm and friendly	( )	( )	( )	( )	( )	( )
Interested in individuals	( )	( )	( )	( )	( )	( )
Fair with all children	( )	( )	( )	( )	( )	( )
Concerned with safety	( )	( )	( )	( )	( )	( )
Maintaining enough discipline	( )	( )	( )	( )	( )	( )
6. Since the beginning of the program, you have observed improvement in your child's fundamental motor skills:						
Running	( )	( )	( )	( )	( )	( )
Jumping	( )	( )	( )	( )	( )	( )
Hopping	( )	( )	( )	( )	( )	( )
Galloping	( )	( )	( )	( )	( )	( )
Skipping	( )	( )	( )	( )	( )	( )
Sliding	( )	( )	( )	( )	( )	( )
Throwing	( )	( )	( )	( )	( )	( )
Catching	( )	( )	( )	( )	( )	( )
Kicking	( )	( )	( )	( )	( )	( )

	(SA)	(A)	(N)	(D)	(SD)	(O)
Punting	( )	( )	( )	( )	( )	( )
Strength	( )	( )	( )	( )	( )	( )
Balance	( )	( )	( )	( )	( )	( )
Agility (ability to start and stop quickly and make quick changes in direction)	( )	( )	( )	( )	( )	( )
Rhythmic ability	( )	( )	( )	( )	( )	( )
Coordination:						
Eye-hand	( )	( )	( )	( )	( )	( )
Eye-foot	( )	( )	( )	( )	( )	( )
Overall	( )	( )	( )	( )	( )	( )
Self-esteem	( )	( )	( )	( )	( )	( )
Approach to motor activity:						
Increased confidence in ability	( )	( )	( )	( )	( )	( )
Greater willingness to try new activities	( )	( )	( )	( )	( )	( )
Expanded use of motor play equipment	( )	( )	( )	( )	( )	( )
Social skills:						
Greater ability to share, take turns	( )	( )	( )	( )	( )	( )
Increased interaction with others	( )	( )	( )	( )	( )	( )

	(SA)	(A)	(N)	(D)	(SD)	(O)
7. Your child engages in more gross motor play than he or she did at the beginning of the school year.	( )	( )	( )	( )	( )	( )
8. The quality of your child's gross motor play has improved since the beginning of the school year.	( )	( )	( )	( )	( )	( )
9. Your family engages in more gross motor play than it did at the beginning of the school year.	( )	( )	( )	( )	( )	( )
10. The quality of your family's gross motor play has improved since the beginning of the school year.	( )	( )	( )	( )	( )	( )

Final Questionnaire for Control Group

The control group was administered the questionnaire above, with the exception of the first five questions. Since the control group children did not participate in any of the experimental programs, the questions related to program attributes were omitted.

APPENDIX D

STAGE CONVERSION SCALES

AND DISCUSSION

CELL MEANS AND STANDARD DEVIATIONS FOR TRANSFORMED DATA

Stage Conversion Scales

When the fundamental motor skill data from previous studies by Lerner (1975) and Miller and others (1977) were plotted along an age-based continuum, the results shown in Figure D.1 were obtained. The graphs were drawn separately for each stage and sex. Vertical crossbars represent the age below which 10, 25, 50, 75, and 90 percent of the children within a defined stage fall. If insufficient cases were obtained to draw a graph for a particular stage, the individual data points were plotted. The age in months at which fifty percent of the children were located within a stage was recorded as the standard for achievement of that particular stage. Scores of children in transition between stages were determined by interpolation. The resulting scales for conversion of stage evaluations into age-based standards are depicted in Table D.1. Any child evaluated at a particular stage was awarded the value of the fifty percent level of that stage. For example, a female performing a Stage 3 run would be awarded forty-six points, the fifty percent level of all females performing at that stage.

TABLE D.1

AGE-BASED STANDARDS (IN MONTHS) OF ACHIEVEMENT FOR DEVELOPMENTAL STAGES OF FUNDAMENTAL MOTOR SKILLS

Stage	Run		Skip		Throw		Catch		Kick	
	F	M	F	M	F	M	F	M	F	M
0			44.67	44						
1-			46.34	47		38				
1			48	50	43	39	36	34	38	37
1+			49.67	53	44	40	38	38	42.67	40
2-			51.34	56	45	41	40	42	47.34	43
2	34	31	53	59	46	42	42	46	52	46
2+	38	35	55	60	47	43	44.33	46.67	53	47
3-	42	39	57	61	48	44	46.66	47.34	54	48
3	46	43	59	62	49	45	49	48	55	49
3+	48	45.34			50	47	50.67	49.67	56	51.67
4-	50	47.67			51	49	52.34	51.34		54.34
4	52	50			52	51	54	53		57
4+						53	56	55		
5-						55	58	57		
5						57	60	59		

Stage	Strike		Jump		Punt		Hop-L		Hop-R	
	F	M	F	M	F	M	F	M	F	M
0			32.67		38	37.67			39.67	
1-			36.34	37.34	41	41.34			41.34	
1	37	37	40	41	44	43	50	49	43	50
1+	41.67	41	43.67	44.67	47	44.67			44.67	
2-	46.34	45	47.34	48.34	50	46.34			46.34	
2	51	49	51	52	53	47	45	48	48	48
2+	51.67	50.34	51.67	52.5	53.67	47.67			50	
3-	52.34	51.67	52.34	53	54.34	48.34			52	
3	53	53	53	53.5	55	49	50		54	
3+	54	54.33	55	54		49.67				
4-	55	55.67	57	54.5						
4	56	57	59	55						
4+										
5-										
5										

*Median values

The figures show some general features which are of developmental interest. First, there is a great deal of overlap between stages. Although a general progression with age can be noted, the achievement of higher level stages is not always age-dependent. Secondly, there are differences between the sexes on all skills. Some of these differences are minimal while others are quite dramatic. Finally, by vertical inspection of the graphs the overall pattern of skill development can be observed. The age at which individual skills emerge and develop is clearly depicted for the age range studied. Some of the most impressive features of the graphs for individual skills are presented below.

Run. Running is one of the first fundamental skills attempted by young children. It is also the skill in which the largest proportion of children attain a mature level of performance at an early age. Virtually all the children in the study ran using at least a Stage 2 level. The majority (57 percent) of girls were categorized as Stage 3 runners, while most (57 percent) of the boys used the mature, Stage 4 pattern. The boys showed more advanced movement patterns at every level, probably due to the practice factor. Males by nature are more active and aggressive and tend to run more than females. Culturally, this is not only permitted, but encouraged as well.

Throw. The stages of throwing overlapped to a great extent, although progressive increases in the ages at which the percentage benchmarks were achieved were apparent for all but one stage (Females, Stage 3). In comparison to other skills, throwing showed the greatest range in the ages of children performing at any one stage level. Males and females followed the same general pattern in the achievement of various percentile ranks. Females began using the contralateral pattern earlier than males (10 percent at 30 months as opposed to 38 months in males). However, by age five three times as many males as females threw with the mature pattern. Like running, this is probably due to the fact that boys have practiced throwing more often than the girls have.

Catch. Catching behavior also showed progressive increases in the age at which stage benchmarks are achieved. As in throwing, there was a great deal of overlap between stages, especially among the second, third, and fourth levels. By four years of age most children had advanced beyond the first stage of catching. Males and females essentially paralleled each other in the development of catching skill until age five, after which a larger proportion of girls demonstrated the more mature forms of behavior. Since males are superior to females in throwing ability at all ages they might be expected to perform better than females in catching too. However,

a comparison of the complexity of the two tasks leads one to believe that catching is a higher-order skill than throwing. It requires the precise integration of perceptual and motor processes, a task for which girls are better prepared, maturationally. In this skill the effects of practice (assuming that boys receive more practice at catching than girls) cannot transcend the maturational requirements of the task.

Kick. The basic pattern of kicking was present at an early age (30 months). Development progressed quite regularly throughout the early childhood period, although only one child was able to perform at the mature level. The males showed more advanced kicking skill than the females at every age. Like throwing, they probably practiced this skill more often. They also tended to exert more force while projecting objects and this requires the use of higher-level patterns.

Jump. The standing long jump appeared early in life (30 months), but, like kicking and several other skills, required a long time to mature. For both males and females there was almost a full year's age difference in the fifty percent level of Stages one and two. Girls were generally more proficient at jumping throughout the age range, probably because of their advanced biological maturity. Jumping is a skill which seems to be more phylogenetically determined,

so as in catching, the practice effect probably did not exert as much influence over this skill as it did for the others.

Strike. The basic concept of striking a stationary object was present at two and one half years of age. The 50 percent level of Stage one appeared at 37 months, about the same time as that of kicking, but later than that of throwing and catching. Few children (.03 percent) exhibited the Stage three level of striking which employs the use of an ipsilateral pattern. This form is more likely to occur when a ball is tossed to the performer rather than struck from a stationary position. Dramatic differences between the sexes were evident at the mature level of performance. A significantly larger ratio of boys demonstrated mature striking patterns. These results most likely reflect cultural influences on behavior. Boys are expected to learn how to play baseball at an early age so parents and others encourage the practice of striking. Being a more ontogenetically determined skill, the effects of practice are more influential.

Punt. The punt is a little-practiced skill in early childhood. Many children do not attempt to punt before the age of four unless encouraged to do so. The 50 percent mark of Stage one occurred at about 43 months, considerably later than that of the other skills described. Most children (60 percent) performed at the beginning

level of punting, although some had advanced to the second or third stage. The males generally showed more mature patterns than the females, and about 14 percent of them were able to execute the Stage three punt. These findings contradicted the author's expectations. Since the punt requires a great deal of eye-hand-foot coordination, one would expect the biologically more advanced females to perform better. This was observed in catching but did not hold true for punting. Perhaps boys practice this skill more, and viewing it as a power event, put more energy into their punts. It could be reasoned that boys perform better at kicking and therefore should do better at punting since the two tasks are similar. However, the intercorrelation between kicking and punting is usually too low to expect a greater than chance relationship. (In this study the r was .40.)

Hop. The hop is one of the last fundamental skills to emerge in early childhood. Girls begin hopping earlier than boys and generally are more proficient throughout the age range. Hopping was the only skill studied that did not show a progressive, developmental trend in terms of the percentile marks. In three out of four of the hopping graphs, the 50 percent mark of the second stage occurred at a lower age than that of the first stage. The graph for females hopping on the right foot is the only one that presently shows a

true developmental trend. Therefore, this graph was used for all data transformations involving hopping. When additional data points are added to the analysis, the results for each phase of hopping probably will reflect the developmental nature of the skill. If they do not, a re-analysis of the stages of hopping would be indicated.

Skip. Since skipping is a very difficult skill it was not surprising to find this as the last skill of those studied to emerge in the early childhood period. Males began skipping earlier than the females and experienced a more even rate of skill development. Ten percent of the females attained a minimal level of skill at about forty-five months. From that point on they exceeded the boys at every age level. This was expected because of the neurologically higher-order requirement of the skill.

In summary, it was found that children of all ages perform fundamental motor skills with varying levels of proficiency. Although this is not an original finding, the graphic display of overlapping stages on the age-based continuum helps to solidify the concept. The developmental nature of fundamental sports skills also was demonstrated by the use of the graphs. Sex differences in the achievement of various skills levels were noted and the degree to which they were biologically or culturally determined was discussed.

AGES (IN MONTHS) OF 10, 25, 50, 75 AND 90 PERCENT OF THE CHILDREN PERFORMING AT EACH STAGE OF EACH FUNDAMENTAL MOTOR SKILL*

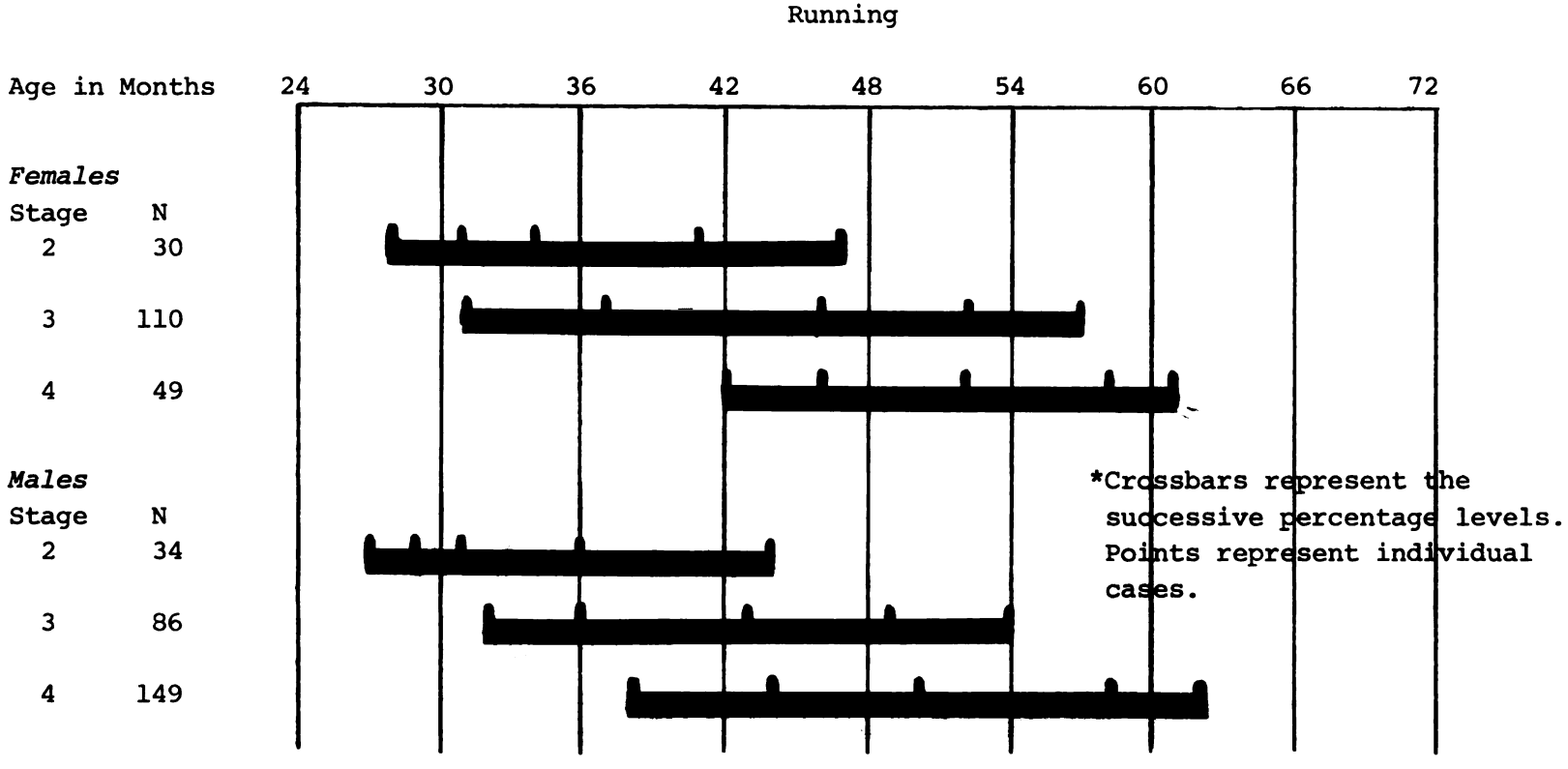
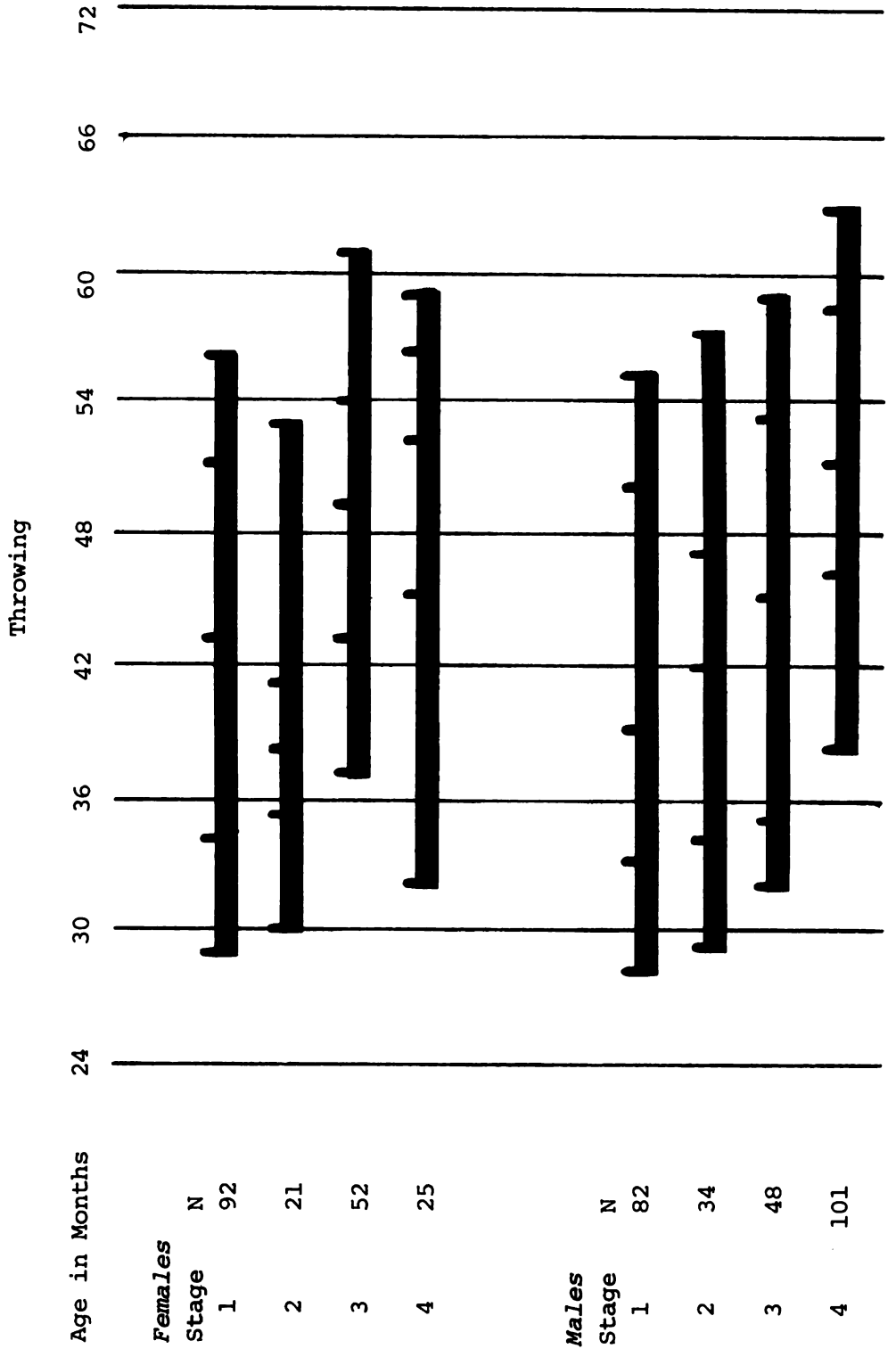
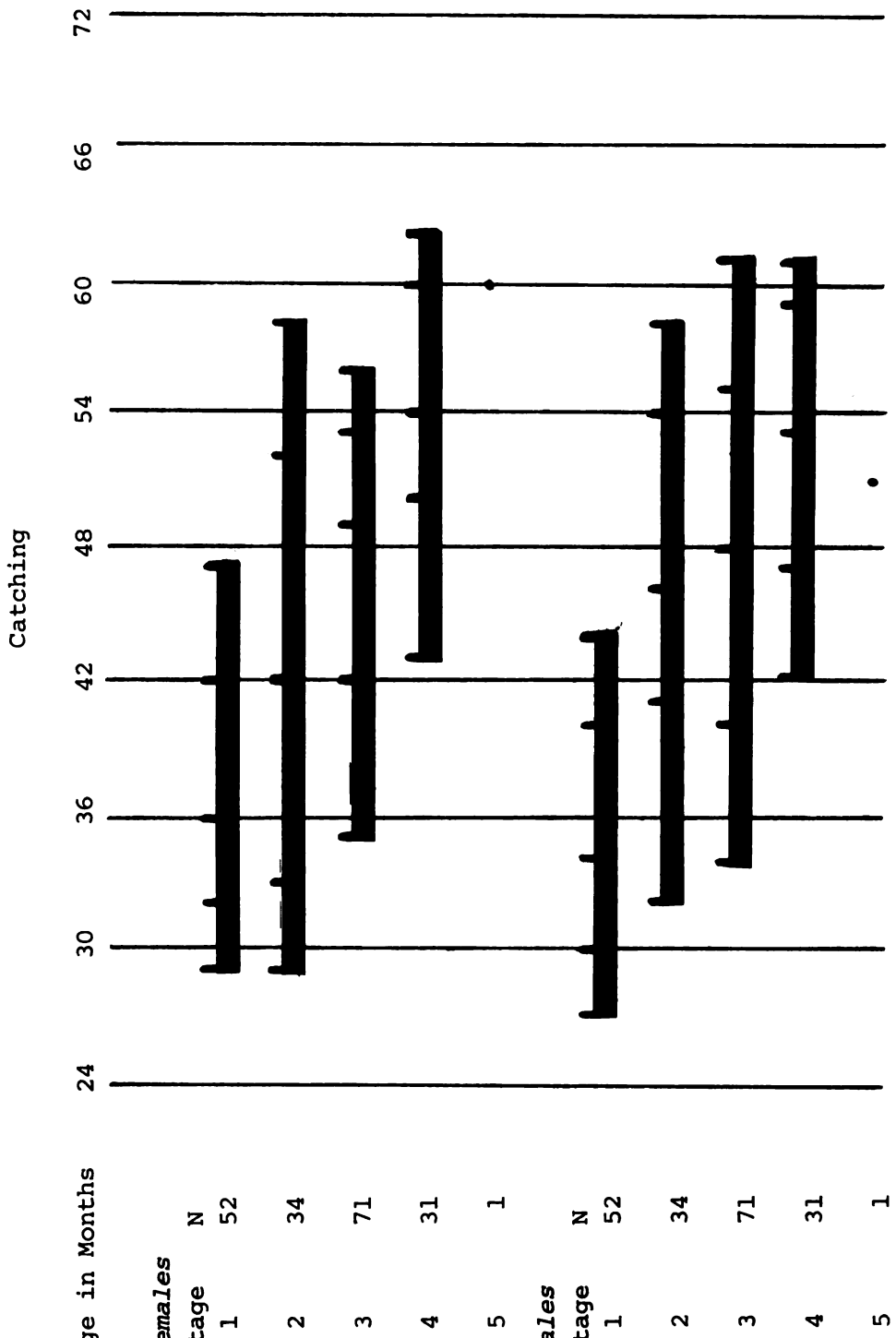
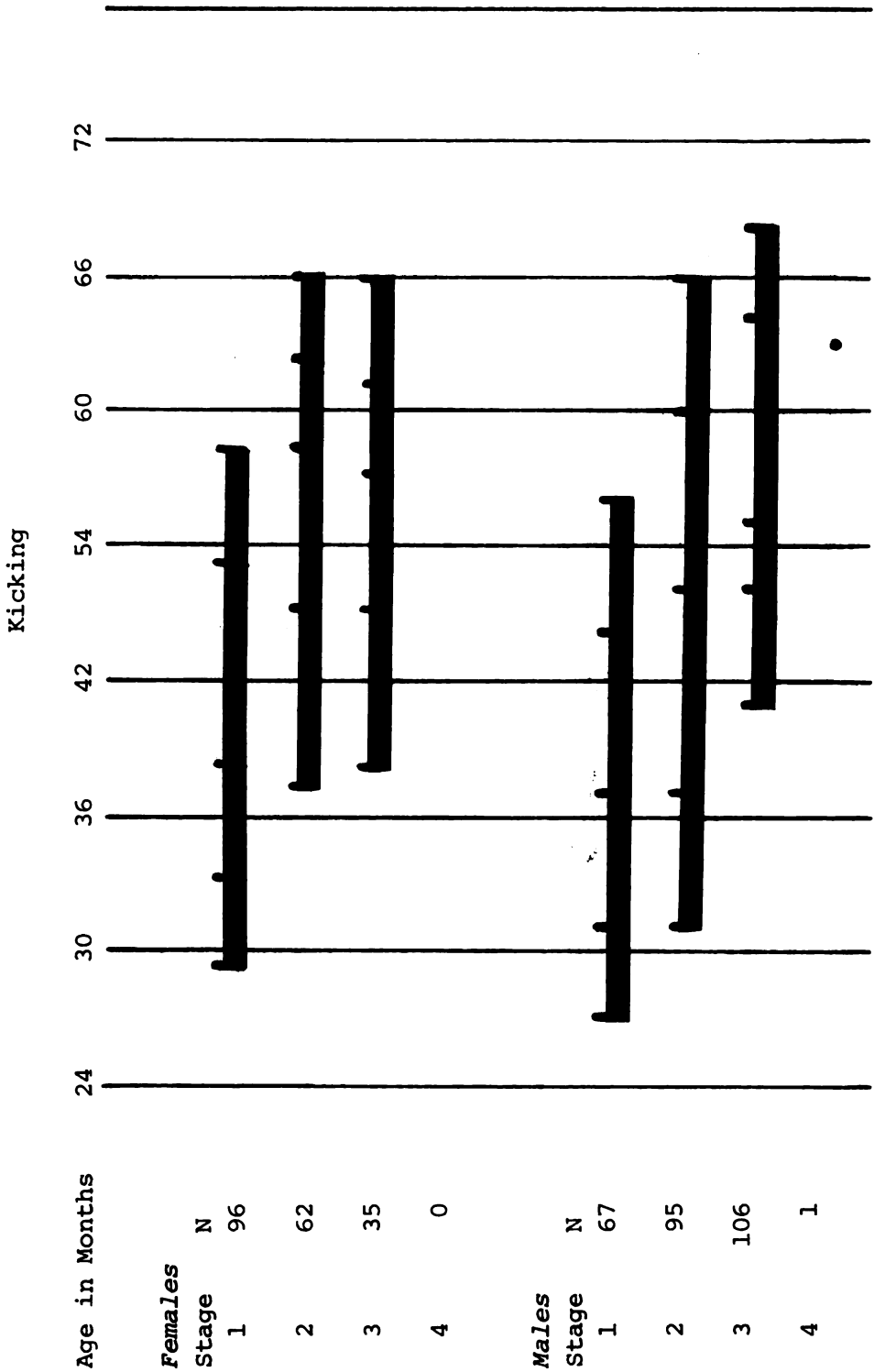
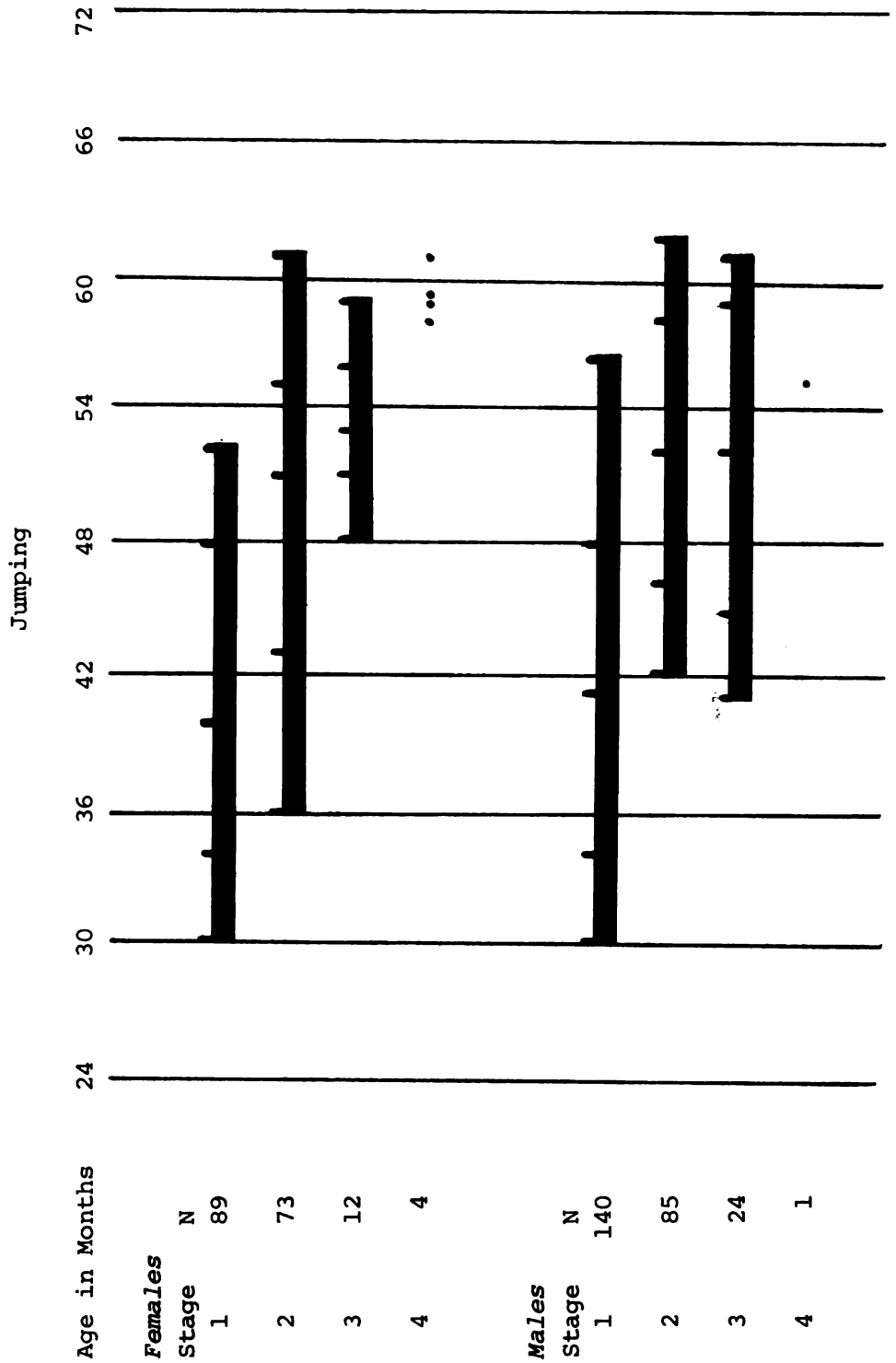


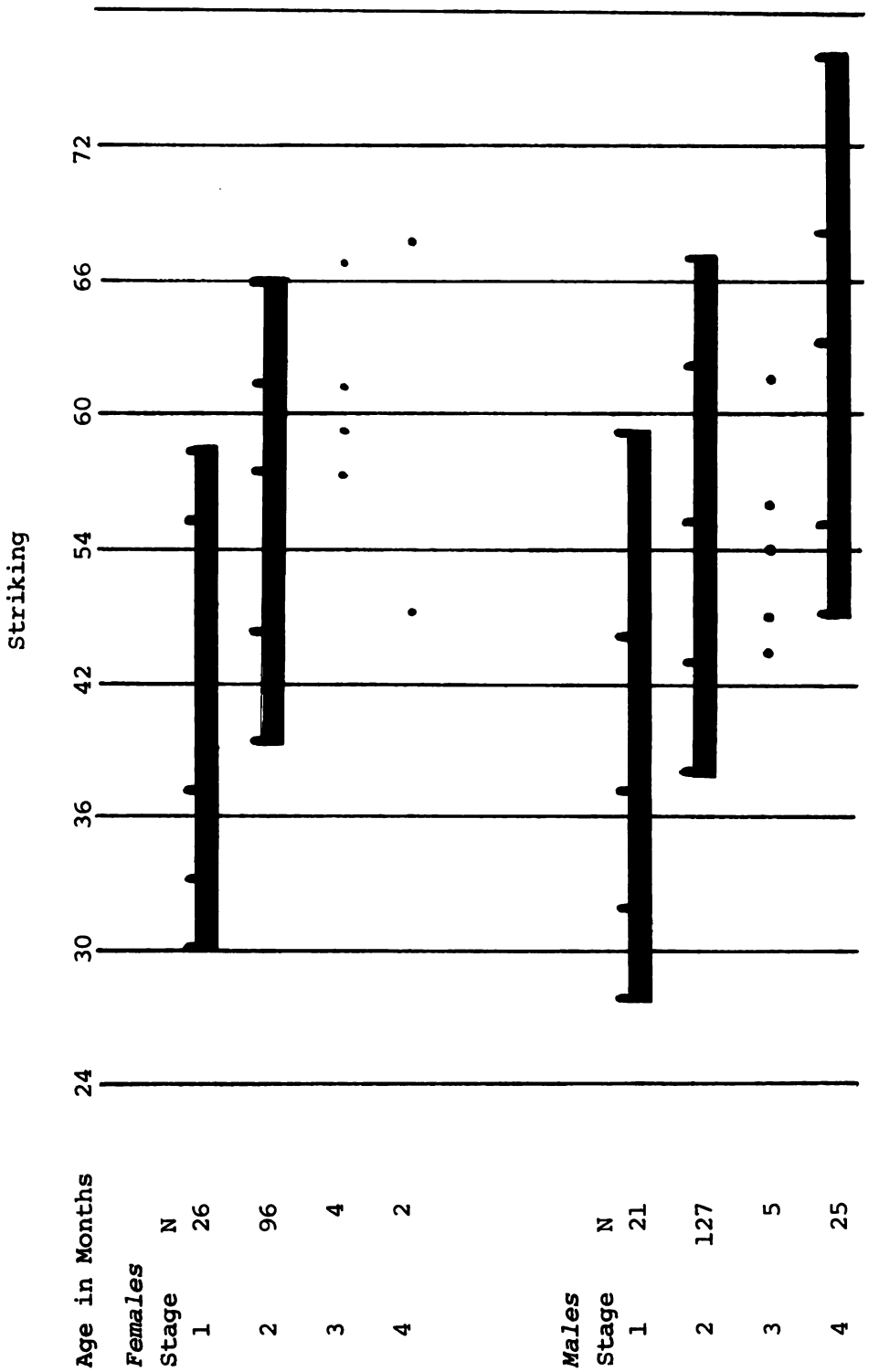
FIG. D.1.--Stage Conversion Scales

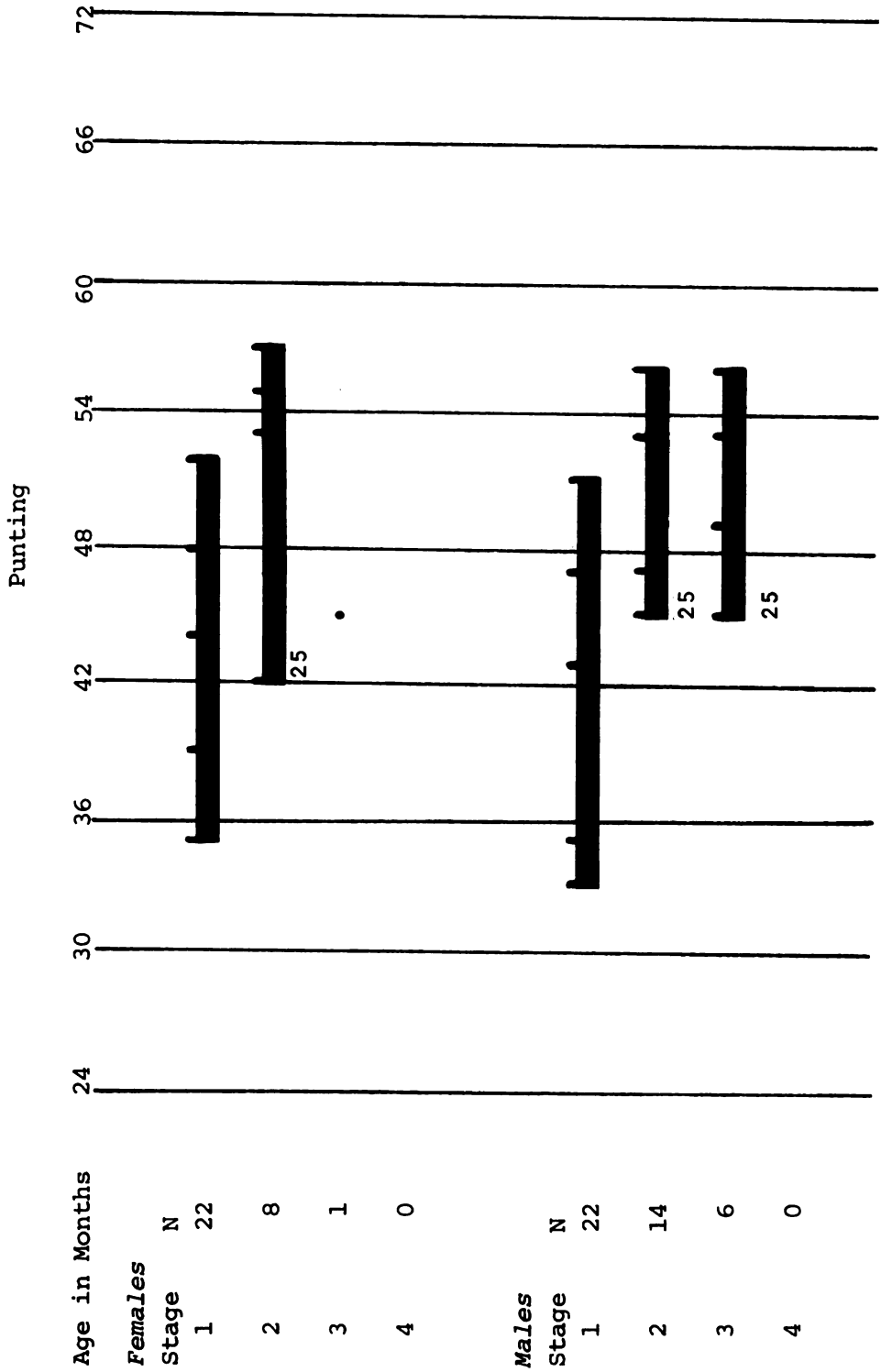

Throwing
Age in Months
24
30
36
42
48
54
60
66
72
Females
Stage N
1 92
2 21
3 52
4 25
Males
Stage N
1 82
2 34
3 48
4 101

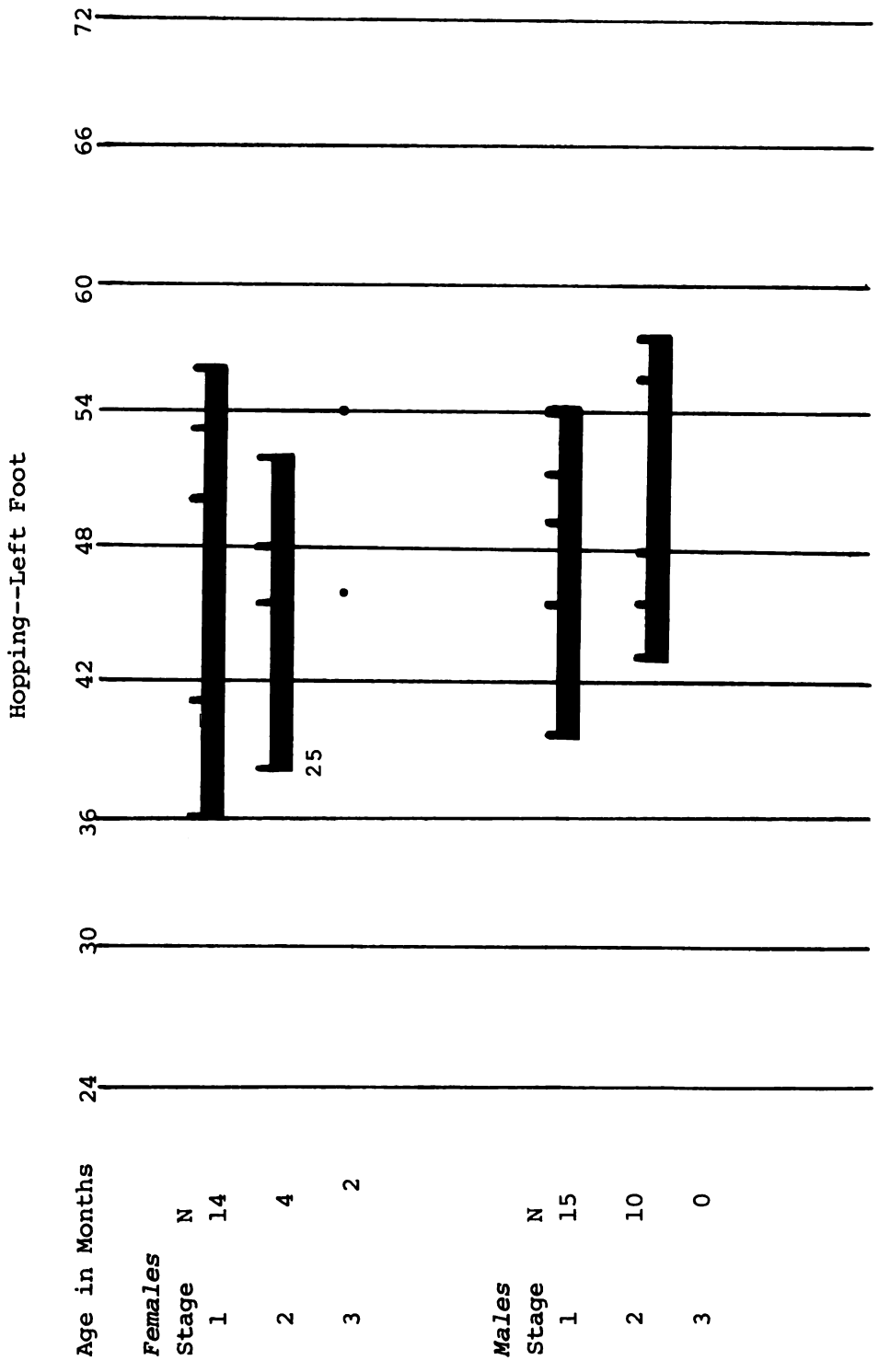

Catching
Age in Months
24
30
36
42
48
54
60
66
72
Females
Stage N
1 52
2 34
3 71
4 31
5 1
Males
Stage N
1 52
2 34
3 71
4 31
5 1

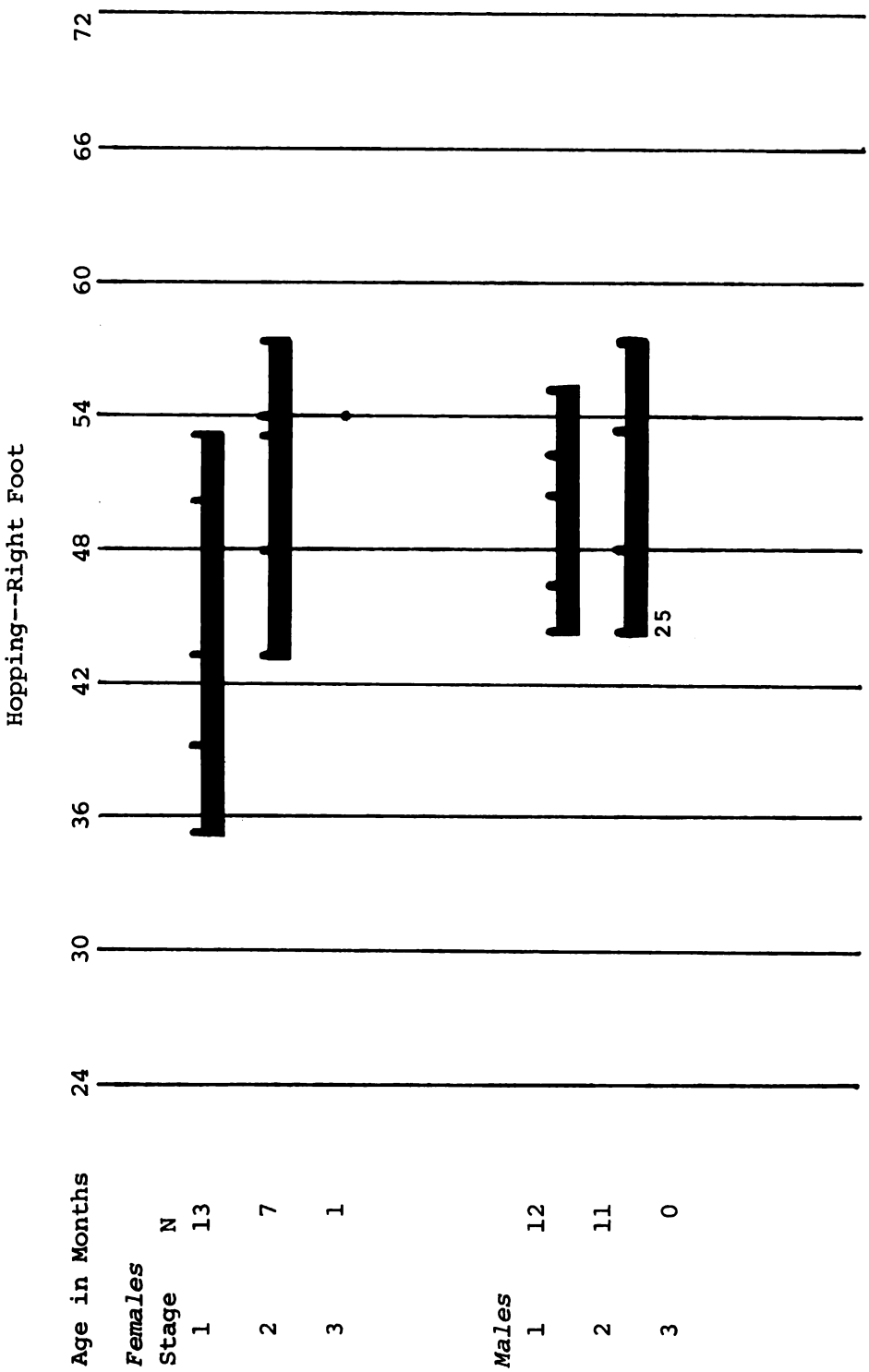

Kicking
Age in Months
24
30
36
42
54
60
66
72
Females
Stage N
1 96
2 62
3 35
4 0
Males
Stage N
1 67
2 95
3 106
4 1


Jumping
Age in Months
24
30
36
42
48
54
60
66
72
Females
Stage N
1 89
2 73
3 12
4 4
Males
Stage N
1 140
2 85
3 24
4 1


Striking
24
30
36
42
54
60
66
72
Age in Months
Females
Stage N
1 26
2 96
3 4
4 2
Males
Stage N
1 21
2 127
3 5
4 25


Punting
Age in Months
24
30
36
42
48
54
60
66
72
Females
Stage N
1 22
2 8
3 1
4 0
Males
Stage N
1 22
2 14
3 6
4 0
25
25
25


Hopping--Left Foot
Age in Months
24
30
36
42
48
54
60
66
72
25
Females
Stage N
1 14
2 4
3 2
Males
Stage N
1 15
2 10
3 0


Hopping--Right Foot
Age in Months
24
30
36
42
48
54
60
66
72
Females
Stage N
1 13
2 7
3 1
Males
1 12
2 11
3 0
25

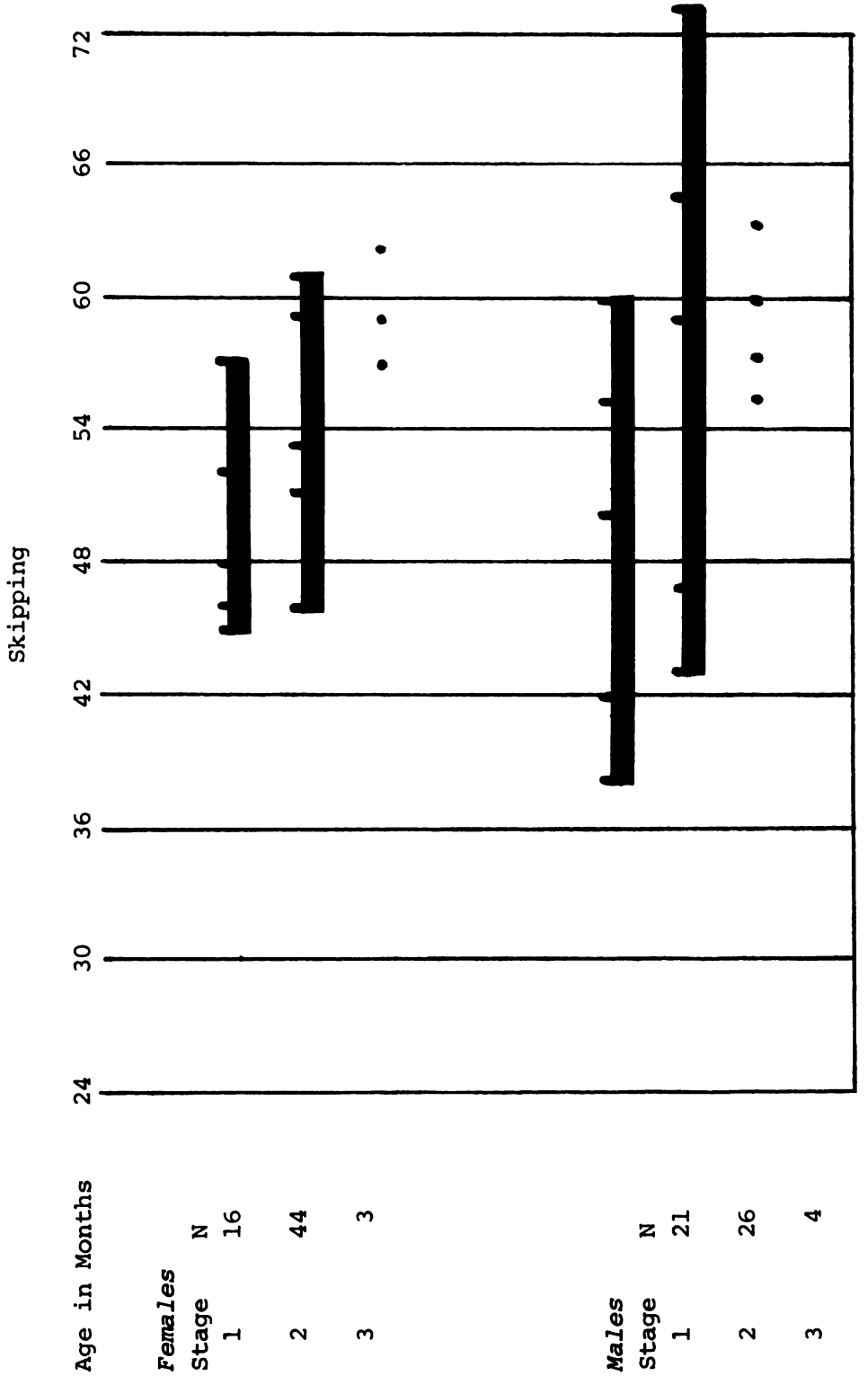

Skipping
Age in Months
24
30
36
42
48
54
60
66
72
Females
Stage N
1 16
2 44
3 3
Males
Stage N
1 21
2 26
3 4

TABLE D.2

CELL MEANS AND STANDARD DEVIATIONS FOR TRANSFORMED DATA

Cell	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
	Age		*Throw*		*Catch*		*Kick*		*Punt*		*Strike*		*Run*	
Control -F	43.42	7.89	46.75	3.17	50.86	3.63	52.56	5.53	46.95	4.81	47.58	6.61	46.67	4.78
Control -M	47.09	8.18	48.45	4.52	49.36	6.33	49.33	1.58	47.30	2.77	52.03	4.43	49.97	.97
Free P. -F	45.86	8.11	49.57	4.58	51.62	2.52	52.29	6.32	45.81	2.43	51.38	1.80	49.14	2.54
Free P. -M	45.64	7.79	47.36	5.80	49.30	3.33	48.39	5.73	45.12	2.51	50.21	4.71	48.52	2.40
Trad. -F	45.50	9.56	48.13	3.00	49.00	5.18	54.04	2.29	47.25	4.40	51.75	1.35	46.50	3.82
Trad. -M	45.92	7.18	47.77	6.30	49.28	5.79	47.08	4.87	46.59	2.29	54.33	3.73	47.31	3.28
Parent -F	43.44	5.70	49.00	1.73	49.59	2.69	53.41	3.43	50.52	4.93	51.59	2.57	48.00	3.32
Parent -M	42.25	5.90	52.00	5.86	52.38	3.02	49.21	1.05	46.25	2.82	54.83	3.63	47.96	3.16
	Hop-R		*Hop-L*		*Skip*		*Jump*							
Control -F	45.83	3.36	45.39	3.26	49.54	3.83	47.64	5.03						
Control -M	44.36	3.23	44.67	3.65	50.29	6.62	49.99	4.66						
Free P. -F	46.24	4.52	46.00	4.45	48.16	3.86	50.53	4.42						
Free P. -M	44.97	2.45	45.27	2.71	48.09	5.29	49.03	5.35						
Trad. -F	47.67	2.23	44.04	3.56	50.54	4.16	46.42	6.31						
Trad. -M	43.26	13.47	42.92	13.55	51.56	6.61	53.31	1.92						
Parent -F	46.45	3.96	45.78	2.89	50.87	5.23	49.29	5.04						
Parent -M	44.67	3.78	45.29	3.86	50.81	7.01	50.33	4.84						

APPENDIX E

QUESTIONNAIRE RESULTS

TABLE E.1

FREQUENCY AND PERCENTAGE OF RESPONDENTS TO VARIOUS CATEGORIES OF THE INITIAL QUESTIONNAIRE*

	Age of Mother									
	20-24		25-29		30-34		35-39		40+	
	N	%	N	%	N	%	N	%	N	%
Control	0	0	6	35.3	11	64.7	0	0	0	0
Free Play	0	0	3	17.6	9	52.9	4	23.5	1	5.9
Traditional	0	0	7	35.0	8	40.0	3	15.0	2	10.0
Parent	1	7.1	2	14.3	11	78.6	0	0	0	0
	1	1.5	18	26.5	39	57.4	7	10.3	3	4.4
	Age of Father									
Control	0	0	4	23.5	6	35.3	5	29.4	2	11.8
Free Play	0	0	1	5.9	5	29.4	6	35.3	5	29.4
Traditional	0	0	3	15.0	10	50.0	5	25.0	2	10.0
Parent	0	0	0	0	9	64.3	3	21.4	2	14.3
	0	0	8	11.8	30	44.1	19	27.9	11	16.2

*Total N's which do not sum to 68 reflect missing data.

TABLE E.1--Cont'd.

	High School		Trade School/ Some College		Bachelors' Degree		Masters Degree		Doctorate	
	N	%	N	%	N	%	N	%	N	%
Education of Mother										
Control	0	0	5	29.4	10	58.8	2	11.8	0	0
Free Play	0	0	6	35.3	7	41.2	4	23.5	0	0
Traditional	3	15	1	5.0	5	25.0	10	50.0	1	5.0
Parent	0	0	3	21.4	7	50.0	4	28.6	0	0
	3	15	15	22.1	29	42.6	20	29.4	1	1.5
Education of Father										
Control	1	5.9	1	5.9	8	47.1	2	11.8	5	29.4
Free Play	0	0	3	17.6	6	35.3	1	5.9	7	41.2
Traditional	1	5.0	2	10.0	2	10.0	7	35.0	8	40.0
Parent	0	0	2	14.3	2	14.3	2	14.3	8	57.1
	2	2.9	8	11.8	18	26.5	12	17.6	28	41.2

	Unskilled Laborer		Skilled Laborer		Clerical		Business		Professional		Homemaker		Student	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Occupation of Mother														
Control	0	0	0	0	1	5.9	0	0	2	11.8	13	76.5	1	5.9
Free Play	0	0	0	0	0	0	1	5.9	2	11.8	12	70.6	2	11.8
Traditional	0	0	1	5.0	0	0	1	5.0	6	30.0	11	55.0	1	5.0
Parent	1	7.1	0	0	0	0	1	7.1	5	35.7	7	50.0	0	0
	1	1.5	1	1.5	1	1.5	3	4.4	15	22.1	43	63.2	4	5.9
Occupation of Father														
Control	0	0	1	5.9	0	0	1	5.9	13	76.5	0	0	2	11.8
Free Play	0	0	1	5.9	0	0	3	17.6	13	76.5	0	0	0	0
Traditional	0	0	0	0	0	0	4	20.0	16	80.0	0	0	0	0
Parent	1	7.1	0	0	0	0	1	7.1	12	85.7	0	0	0	0
	1	1.5	2	2.9	0	0	9	13.2	54	79.4	0	0	2	2.9

TABLE E.1--Cont'd.

	None		One		Two	
	N	%	N	%	N	%
Siblings-Older Males						
Control	11	64.7	5	29.4	1	5.9
Free Play	8	47.1	6	35.3	3	17.6
Traditional	15	75.0	4	20.0	1	5.0
Parent	9	64.3	3	21.4	2	14.3
	43	63.2	18	26.5	7	10.3
Siblings-Older Females						
Control	11	64.7	5	29.4	1	5.9
Free Play	9	52.9	7	41.2	1	5.9
Traditional	15	75.0	5	25.0	0	0
Parent	10	71.4	1	7.1	3	21.4
	45	66.2	18	26.5	5	7.4
Siblings-Younger Males						
Control	12	70.6	5	23.4	0	0
Free Play	16	94.1	1	5.9	0	0
Traditional	18	90.0	2	10.0	0	0
Parent	11	78.6	3	21.4	0	0
	57	83.8	11	15.2	0	0
Siblings-Younger Females						
Control	15	88.2	2	11.8	0	0
Free Play	14	82.4	3	17.6	0	0
Traditional	14	70.0	6	30.0	0	0
Parent	12	85.7	2	14.3	0	0
	55	80.9	13	19.1	0	0

TABLE E.1--Cont'd.

	Early Motor Development									
	Normal		Slightly Delayed		Markedly Delayed		Slightly Advanced		Markedly Advanced	
	N	%	N	%	N	%	N	%	N	%
Control	11	64.7	2	11.8	0	0	3	17.6	0	0
Free Play	11	64.7	2	11.8	0	0	4	23.5	0	0
Traditional	12	60.0	1	5.0	0	0	5	25.0	2	10.0
Parent	9	64.3	1	7.1	0	0	3	21.4	1	7.1
	43	63.2	6	8.8	0	0	15	22.1	3	4.4

	Activity Level of Father									
	Inactive		1-2 Sports Occasionally or 1 Sport in Season		3 or More Sports Occasionally or 2 Sports in Season		Regular Participation (1-2 x/wk)		Active Participation (3+ x per week)	
	N	%	N	%	N	%	N	%	N	%
Control	1	5.9	2	11.8	2	11.8	5	29.4	7	41.2
Free Play	0	0	3	17.6	2	11.8	5	29.4	7	41.2
Traditional	2	10.0	4	20.0	1	5.0	6	30.0	6	30.0
Parent	0	0	1	7.1	3	21.4	6	42.9	4	28.6
	3	4.4	10	14.7	8	11.8	22	32.4	24	35.3
	Activity Level of Mother									
Control	1	5.9	6	35.3	1	5.9	7	41.2	2	11.8
Free Play	2	11.8	3	17.6	0	0	7	41.2	5	29.4
Traditional	3	15.0	2	10.0	2	10.0	6	30.0	6	30.0
Parent	0	0	0	0	2	14.3	6	42.9	5	35.7
	6	8.8	11	16.2	5	7.4	26	38.2	18	26.5

TABLE E.1--Cont'd.

	Activity Level of Family									
	Inactive		1-2 Sports Occasionally or 1 Sport in Season		3 or More Sports Occasionally or 2 Sports in Season		Regular Participation (1-2 x/wk)		Active Participation (3+ x per week)	
	N	%	N	%	N	%	N	%	N	%
Control	1	5.9	13	76.5	0	0	1	5.9	2	11.8
Free Play	3	17.6	8	47.1	1	5.9	5	29.4	0	0
Traditional	5	25.0	5	25.0	2	10.0	5	25.0	0	0
Parent	1	7.1	4	28.6	2	14.3	7	50.0	0	0
	10	14.7	30	44.1	5	7.4	18	26.5	2	2.9

Nursery School or Day Care Attendance-Half Days/Week

	0		1		2		3		4		5	
	N	%	N	%	N	%	N	%	N	%	N	%
Control	1	5.9	0	0	8	47.1	8	47.1	0	0	0	0
Free Play	7	41.2	0	0	4	23.5	3	17.6	2	11.8	1	5.9
Traditional	6	30.0	1	5.0	2	10.0	6	30.0	5	25.0	0	0
Parent	2	14.3	0	0	2	14.3	4	28.6	2	14.3	4	28.6
	16	23.5	1	1.5	16	23.5	21	30.9	9	13.2	5	7.4

Nursery School or Day Care Attendance-Full Days/Week

Control	17	100	0	0	0	0	0	0	0	0	0	0
Free Play	17	100	0	0	0	0	0	0	0	0	0	0
Traditional	16	80	1	5.0	2	10.0	1	5.0	0	0	0	0
Parent	14	100	0	0	0	0	0	0	0	0	0	0
	64	94.1	1	1.5	2	2.9	1	1.5				

TABLE E.2

GROUP MEANS AND STANDARD DEVIATIONS FOR THE NUMBER OF HOURS PER WEEK SPENT IN THE PRACTICE OF FUNDAMENTAL MOTOR SKILLS

Practice	Mean	Standard Deviation
Practice Alone		
Group		
Control	10.0	9.5
Females	12.1	12.0
Males	8.5	7.7
Free Play	3.1	3.7
Females	2.1	2.0
Males	3.8	4.5
Traditional	6.8	10.2
Females	2.3	2.6
Males	9.2	11.9
Parent	7.1	9.3
Females	5.1	6.0
Males	10.8	13.7
Total Groups	6.8	8.8
Practice with Parents		
Group		
Control	6.9	4.2
Females	8.3	4.2
Males	5.9	4.1
Free Play	2.8	2.7
Females	2.0	1.5
Males	3.3	3.2

TABLE E.2--Cont'd.

Practice	Mean	Standard Deviation
Traditional	2.6	4.4
Females	.7	1.1
Males	3.5	5.1
Parent	3.1	1.9
Females	2.6	1.5
Males	4.0	2.1
Total Groups	3.8	3.9
Practice with Male Siblings		
Control	6.3	12.3
Females	2.4	4.2
Males	9.0	15.4
Free Play	1.9	3.9
Females	.3	.8
Males	3.1	4.8
Traditional	.7	1.9
Females	2.0	2.9
Males	0	0
Parent	2.4	5.4
Females	3.2	6.5
Males	1.0	2.2
Total Groups	2.8	7.1
Practice with Female Siblings		
Control	7.5	14.5
Females	8.4	10.3
Males	6.9	17.4
Free Play	1.7	3.0
Females	1.7	2.0
Males	1.7	3.7

TABLE E.2--Cont'd.

Practice	Mean	Standard Deviation
Traditional	1.5	2.8
Females	.4	1.1
Males	2.0	3.3
Parent	1.1	2.5
Females	0	0
Males	3.2	3.6
Total Groups	3.0	7.9
Practice with Male and Female Siblings		
Control	3.3	13.6
Females	8.0	21.2
Males	0	0
Free Play	1.2	2.7
Females	2.1	3.9
Males	.5	1.1
Traditional	0	0
Females	0	0
Males	0	0
Parent	.4	1.3
Females	.5	1.7
Males	0	0
Total Groups	1.2	6.9
Practice with Male Friends		
Control	.5	1.5
Females	0	0
Males	.8	1.9
Free Play	1.7	4.1
Females	.7	1.9
Males	2.4	5.1

TABLE E.2--Cont'd.

Practice	Mean	Standard Deviation
Traditional	.3	1.1
Females	0	0
Males	.4	1.4
Parent	.3	.7
Females	0	0
Males	.8	1.1
Total Groups	.7	2.3
Practice with Female Friends		
Control	.5	1.7
Females	1.2	2.6
Males	0	0
Free Play	.4	1.7
Females	0	0
Males	.7	2.2
Traditional	.8	3.4
Females	2.1	5.7
Males	0	0
Parent	.2	.8
Females	.3	1.0
Males	0	0
Total Groups	.5	2.2
Practice with Male and Female Friends		
Control	7.5	9.3
Females	5.4	6.9
Males	9.0	10.8
Free Play	2.5	3.1
Females	4.0	3.8
Males	1.4	2.1

TABLE E.2--Cont'd.

Practice	Mean	Standard Deviation
Traditional	2.8	4.5
Females	2.4	5.6
Males	3.0	4.0
Parent	4.1	4.5
Females	5.3	4.9
Males	2.0	3.1
Total Groups	4.2	6.1
Practice in Nursery School, Day Care		
Control	4.1	2.5
Females	4.9	1.8
Males	3.5	2.8
Free Play	1.9	2.4
Females	1.3	1.4
Males	2.3	2.9
Traditional	5.5	8.9
Females	2.7	3.5
Males	7.0	10.6
Parent	2.6	2.1
Females	2.1	2.4
Males	3.4	.9
Total Groups	3.6	5.3
Practice in Other Situations		
Control	.7	1.8
Females	.4	1.1
Males	.8	2.2
Free Play	.2	.7
Females	.6	1.0
Males	0	0

TABLE E.2--Cont'd.

Practice	Mean	Standard Deviation
Traditional	1.45	4.5
Females	.6	1.5
Males	1.9	5.4
Parent	0	0
Females	0	0
Males	0	0
Total Groups	.6	2.6
Total Hours of Practice		
Control	47.2	25.4
Females	51.3	22.8
Males	44.4	27.8
Free Play	17.4	8.5
Females	14.9	5.2
Males	19.2	10.1
Traditional	22.2	20.5
Females	13.3	11.6
Males	27.1	22.9
Parent	21.4	15.0
Females	19.2	12.5
Males	25.2	19.8
Total Groups	27.1	21.8

TABLE E.3

MEAN NUMBER OF ITEMS OF SPORTS EQUIPMENT
AVAILABLE IN THE HOME OR YARD

Group	Mean	Standard Deviation
Control	12.1	3.9
Females	11.9	4.5
Males	12.2	3.7
Free Play	10.5	3.8
Females	8.4	2.9
Males	11.9	3.9
Traditional	10.1	4.7
Females	7.0	4.7
Males	11.7	4.0
Parent	11.2	2.4
Females	10.7	2.2
Males	12.2	2.7
Total Groups	10.9	3.9

TABLE E.4

MEAN NUMBER OF INSTRUCTIONAL PROGRAMS
ENGAGED IN BY CHILDREN

Group	Mean	Standard Deviation
Control	.9	1.1
Females	1.6	1.0
Males	.4	1.0
Free Play	1.4	1.0
Females	1.3	1.1
Males	1.4	1.0
Traditional	1.1	1.2
Females	1.0	1.2
Males	1.0	1.3
Parent	.9	.7
Females	.7	.7
Males	1.4	.5
Total Groups	1.1	1.0

TABLE E.5

PERCENTAGE OF RESPONDENTS TO EACH CATEGORY
OF THE FINAL QUESTIONNAIRE

		Group	SA*	A*	NA/D*	D*	SD*	NBO*
1.	The program content was appropriate for the age, interests, and abilities of your child.	Free Play	70	30	0	0	0	0
		Traditional	47	53	0	0	0	0
		Parent	31	54	0	8	0	8
2.	The program offered sufficient variety.	Free Play	57	39	4	0	0	0
		Traditional	53	47	0	0	0	0
		Parent	54	23	8	8	0	8
3.	The class time was used efficiently.	Free Play	61	35	0	0	0	4
		Traditional	41	59	0	0	0	0
		Parent	38	38	8	8	0	8
4.	Your child enjoyed coming to class.	Free Play	57	39	4	0	0	0
		Traditional	53	23	18	0	6	0
		Parent	38	23	31	0	8	0
5.	The teachers were:							
	Instructive	Free Play	61	39	0	0	0	0
		Traditional	65	35	0	0	0	0
		Parent	54	38	0	0	0	8
	Warm and friendly	Free Play	87	13	0	0	0	0
		Traditional	71	24	6	0	0	0
		Parent	69	23	0	0	0	8
	Interested in individuals	Free Play	74	22	4	0	0	0
		Traditional	53	41	6	0	0	0
		Parent	67	25	0	0	0	8

*SA = Strongly Agree; A = Agree; NA/D = Neither Agree or Disagree; D = Disagree; SD = Strongly Disagree; NBO = No Basis for Opinion.

TABLE E.5--Cont'd.

	Group	SA*	A*	NA/D*	D*	SD*	NBO*
Fair with all children	Free Play	74	17	4	0	0	4
	Traditional	59	41	0	0	0	0
	Parent	69	23	0	0	0	8
Concerned with safety	Free Play	74	22	4	0	0	0
	Traditional	65	29	6	0	0	0
	Parent	62	31	0	0	0	8
Maintaining enough discipline	Free Play	39	48	4	9	0	0
	Traditional	29	47	24	0	0	0
	Parent	46	31	8	8	0	8
6. Since the beginning of the program (school year) you have observed improvement in your child's:							
Fundamental Motor Skills:							
Running	Control	33	56	11	0	0	0
	Free Play	26	52	22	0	0	0
	Traditional	12	65	18	0	0	6
	Parent	0	58	33	8	0	0
Jumping	Control	0	89	11	0	0	0
	Free Play	41	45	14	0	0	0
	Traditional	35	59	0	0	0	6
	Parent	46	38	15	0	0	0
Hopping	Control	11	33	45	11	0	0
	Free Play	23	36	36	5	0	0
	Traditional	35	59	6	0	0	0
	Parent	38	38	8	8	0	8

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TABLE E.5--Cont'd.

	Group	SA*	A*	NA/D*	D*	SD*	NBO*
Galloping	Control	11	44	44	0	0	0
	Free Play	18	55	18	0	0	9
	Traditional	24	47	18	0	0	12
	Parent	15	62	15	0	0	8
Skipping	Control	0	22	45	22	11	0
	Free Play	23	23	32	9	0	14
	Traditional	29	41	24	0	0	6
	Parent	23	23	31	8	0	15
Sliding	Control	11	45	22	0	0	22
	Free Play	9	55	27	0	0	9
	Traditional	18	41	24	0	0	18
	Parent	15	46	31	8	0	0
Throwing	Control	11	78	11	0	0	0
	Free Play	32	64	5	0	0	0
	Traditional	35	41	18	0	0	6
	Parent	46	38	8	8	0	0
Catching	Control	11	45	33	11	0	0
	Free Play	45	50	5	0	0	0
	Traditional	47	41	6	0	0	0
	Parent	46	46	8	0	0	0
Kicking	Control	0	67	33	0	0	0
	Free Play	36	45	18	0	0	0
	Traditional	35	41	18	0	0	6
	Parent	31	54	8	0	8	0
Punting	Control	0	22	33	22	0	22
	Free Play	32	27	23	9	0	9
	Traditional	29	35	18	0	0	18
	Parent	23	46	15	0	8	8

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TABLE E.5--Cont'd.

	Group	SA*	A*	NA/D*	D*	SD*	NBO*
Basic Motor Capacities:							
Strength	Control	0	44	56	0	0	0
	Free Play	17	30	48	4	0	0
	Traditional	29	24	41	0	0	6
	Parent	15	46	23	0	0	15
Balance	Control	22	45	22	11	0	0
	Free Play	35	43	22	0	0	0
	Traditional	47	41	6	0	0	6
	Parent	38	38	23	0	0	0
Agility	Control	0	67	22	0	0	11
	Free Play	13	52	30	4	0	0
	Traditional	19	44	25	0	0	12
	Parent	8	62	31	0	0	0
Rhythmic Ability	Control	0	56	33	0	0	11
	Free Play	19	57	24	0	0	0
	Traditional	6	53	41	0	0	0
	Parent	8	58	33	0	0	0
Eye-hand Coordination	Control	0	100	0	0	0	0
	Free Play	26	57	17	0	0	0
	Traditional	24	59	12	0	0	0
	Parent	23	62	15	0	0	0
Eye-foot Coordination	Control	0	56	22	11	0	11
	Free Play	27	36	36	0	0	0
	Traditional	24	47	24	0	0	6
	Parent	15	54	23	8	0	0
Overall Coordination	Control	0	100	0	0	0	0
	Free Play	30	48	17	0	0	4
	Traditional	29	65	6	0	0	0
	Parent	31	38	31	0	0	0

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TABLE E.5--Cont'd.

	Group	SA*	A*	NA/D*	D*	SD*	NBO*
Psycho-Social Attributes:							
Self-esteem	Control	22	56	22	0	0	0
	Free Play	35	52	9	0	0	4
	Traditional	24	47	24	0	0	6
	Parent	31	31	31	0	8	0
Confidence in ability	Control	22	56	22	0	0	0
	Free Play	43	48	4	4	0	0
	Traditional	29	59	12	0	0	0
	Parent	31	46	23	0	0	0
Willingness to try new activities	Control	11	89	0	0	0	0
	Free Play	43	39	17	0	0	0
	Traditional	29	18	47	0	0	6
	Parent	38	23	31	0	8	0
Expanded use of motor play equipment	Control	22	67	11	0	0	0
	Free Play	35	52	13	0	0	0
	Traditional	35	59	6	0	0	0
	Parent	23	69	8	0	0	0
Ability to share, take turns	Control	11	67	11	11	0	0
	Free Play	27	41	32	0	0	0
	Traditional	24	47	24	0	0	6
	Parent	17	50	33	0	0	0
Interaction with others	Control	33	56	11	0	0	0
	Free Play	30	48	22	0	0	0
	Traditional	18	53	24	0	0	6
	Parent	15	54	31	0	0	0

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TABLE E.5--Cont'd.

		Group	SA*	A*	NA/D*	D*	SD*	NBO*
7.	Your child engages in more gross motor play than he/she did at the beginning of the school year.	Control	11	56	22	11	0	0
		Free Play	17	61	13	9	0	0
		Traditional	24	59	6	6	0	6
		Parent	15	69	15	0	0	0
8.	The quality of your child's gross motor play has improved since the beginning of the school year.	Control	11	78	0	11	0	0
		Free Play	35	61	4	0	0	0
		Traditional	29	71	0	0	0	0
		Parent	31	54	15	0	0	0
9.	Your family engages in more gross motor play than it did at the beginning of the school year.	Control	0	22	33	45	0	0
		Free Play	0	38	43	19	0	0
		Traditional	24	18	53	6	0	0
		Parent	15	31	46	0	8	0
10.	The quality of your family's gross motor play has improved since the beginning of the school year.	Control	0	33	33	33	0	0
		Free Play	5	33	48	14	0	0
		Traditional	18	29	47	6	0	0
		Parent	15	38	38	0	8	0

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NUMBER OF PARENTS WHO RESPONDED TO THE FINAL QUESTIONNAIRE

Group	Number
Control	9
Free Play	23
Traditional	17
Parent	13
Total	62