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ABSTRACT

THE INFLUENCE OF TWO INSTRUCTIONAL APPROACHES
ON THE MOTOR SKILL ACQUISITION
OF YOUNG CHILDREN

By

Kathryn Cheryl Wiggins

While concerning itself with the comparative effects of two instructional approaches to the acquisition of fundamental motor skill, as well as with specific age group differences, this study applied a stage theory approach to analyzing movement. Sequenced, bodily movement characteristics made up the skill stages which were incorporated in the treatment presentation, as well as in the pre-post assessment of change in ability level. The combination of these qualitative stages with quantitative measures were analyzed to measure the treatment effects on the dependent variables.

One instructional approach, the mature treatment, presented instruction of only the most efficient movement patterns in the stage continuum involved in performing the skills. The other approach, the step-wise treatment, taught the preliminary stages of a skill prior to its mature performance. Both treatments were administered for 30 minutes twice a week for a period of ten weeks. Children aged three to six years old were used as subjects.

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Pre and post measures were taken on the following five dependent variables: throw quality, catch quality, long jump quality, catch quantity, and long jump quantity. The multivariate analysis of the residual gain scores obtained on the dependent variables indicated non-significant differences between the interactive effects of treatment with age group and the main effects of the two treatments. The examination of age group did show signficant differences between groups. Step-wise discriminate function analyses revealed that scores on throwing quality and scores on jumping quantity contributed most to the age group classification.

It was concluded that both instructional approaches similarly affect motor skill learning. Further, differences in skill level are, generally, apparent between children 3-4 years old and children 5-6 years old, with significant differences existing in the ability to throw in terms of quality, and the ability to jump for distance.

I dedicate this endeavor
to my mother, EDNA WIGGINS
Her example and support
nurtured the potential
within me.

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CHAPTER I

THE PROBLEM

Judging by the amount of research available, human movement, from its initiation to its skilled completion, has been maintained as an intriguing topic of focus for a variety of inquisitive populations. The rationale for this popularity is reflected in the importance that movement plays in human interaction. To many, movement is not merely overt behavior. It mirrors a combination of neuromuscular, cognitive, and affective processes and this "functional unity" defines the interdependence of mind and body (Erickson, 1963; Piaget, 1964; Gage, 1982). The resultant merger of actions, thoughts, and feelings determines the qualitative and quantitative behavior displayed by human beings.

The daily schedule of children revolves around movement activities. Through play tasks that involve locomotion, exploration, manipulation, communication, and controlling, information is gathered which helps in the acquisition of complex knowledge about self, others, and the environment.

How childhood movement behavior is influenced as it develops from rudimentary actions to skilled performance within a complex environment is a challenging question

and is the focus of this study. A currently popular method of studying motor development, which is based on a stage theory, will be utilized to view movement through a series of characteristic stages.

Stages are constructs that represent those simple to complex characteristic behaviors that individuals exhibit during the course of skill development. This method of identifying steps along the maturation continuum has been employed in a multitude of disciplines (i.e. psychology) and at varying degrees of complexity. The application of the stage theory approach assumes some underlying principles, three of which include "universality," "intransivity," and "stability" (Inhelder, 1971). Simply stated, development seems to occur through a series of stages which all people go through (universality) in an invariate order (intransivity). While in a stage, certain characteristic behaviors are consistently demonstrated (stability). With regard to analyzing motor development, the appropriateness of applying the stage theory is being tested actively, but research, thus far, seems to indicate the diagnostic benefits of its use in determining skill level.

Motor development researchers have proposed series of stages for several motor tasks (Wickstrom, 1977; Roberton & Halverson, 1977; Seefeldt & Haubenstricker,

1976; Seefeldt, Reuschlein & Vogel, 1972). Attempts are underway to validate their reliability across populations and ages. Roberton (1977), in a filmed study addressing the stage stability of the overarm throw in children, showed stability in the arm action, but not in the pelvic-spinal action. She concluded that a more flexible stage model based on body components rather than the total body configuration may be needed. Other similar studies show positive, yet inconclusive results regarding the stage theory approach to studying motor development. It would appear that viewing motor skills from the stage theory perspective has diagnostic worth in understanding how human movement evolves. Modifications in the theory may be necessary in establishing skill stages and sequences. Nevertheless, this overall approach of staging movement skills certainly seems to facilitate the identification of performance levels.

Assuming for the moment the theoretical worth of stages in motor skills, one is confronted with the question of how do individuals progress from one stage to another? This inquiry is prescriptive in nature and has direct association with instructional practices. Is stage progression accomplished merely by a natural process of growth and maturation on the part of the

individual, or do other important ingredients make a contributing difference in the realization of human potential?

Minerva (1935) attempted to determine whether maturation or experience contributed most to learning motor skills. After pretesting twin children in motor tasks (jumping over a cord, throwing for accuracy, and ball rolling for accuracy), one twin of each pair was given a training program. Results showed that training did not affect jumping ability but it did influence the rate of acquisition for the accuracy skills. Minerva concluded that the acquisition of complex tasks can be accelerated through training, but that more simple tasks are not affected.

Picker (1972), in a study of 700 children, expresses doubts about the validity of data concerning changes in motor development due to early training intervention. She pointed out that extraneous influences such as adult or other social stimulation may have affected the results of the data.

More recent data indicate that motor competencies can be accelerated with training during early childhood. Werner (1974) gave instruction on motor skills (balance board, kicking, jumping, and ball bouncing) to a group of children three to five years old and found marked

improvement after eight weeks of instruction.

Studies involving stimulus deprivation (Dennis & Najarian, 1952; Dennis, 1960; Spitz, 1945) indicate that a reduction or total lack of sensory stimulation results in lagging or inappropriate motor responses. These studies indicate the importance of external stimulation on human functional processes. How much stimulation is beneficial and at what time in the growing continuum is stimulation most effective are critical considerations.

Obviously, there is no precise indication as to which contributes more to the developmental process, maturation or experience, but it appears that both are necessary. The biological readiness of an organism must be combined with sensory stimulation if an individual is to grow both in mind and body (Money, 1969). Sensory stimulation should include a variety of experiences where the child is allowed to participate freely (Krogman, 1984).

Need for the Study

There is very little research available that investigates the effects of a stage approach to instructing motor skills. The need for experimental studies in this area is apparant from the variety of inquiries that surface as one examines the

feasibility and effects of presenting instruction based on stages. Realizing the importance of sensory stimulation within the developmental process, one may question whether normatively established sequences of movement, meant to identify performance levels, can be used as a basis for prescribing learning experiences. If a child is qualitatively assessed to be at an immature stage (stage one) in the sequence of throwing, does that indicate that the instructional activities should teach the child to perform at a stage two level and then a stage three level until finally, the most mature stage is achieved? In moving from one stage to another, are we risking the introduction of some immature movement habits? In adherence to the stage theory, it would seem logical that a maturing organism would be guided along the path of development in a step-wise fashion. Doubts surface about this reasoning when one realizes that only the most advanced stage for each skill utilizes the body in its most efficient form. Should our educational energies be devoted to promoting only this correct form or can the incremental, step-wise mode of instruction achieve the same movement results? Will the instruction of the most mature form of a skill be too large of a jump in the learning sequence for someone who is presently performing at the least mature stage? Which method of

instruction is better?

Purpose of the Study

The purpose of this study is to compare the effects of two instructional modes on the acquisition of motor skills by two groups of children (3-4 years old and 5-6 years old). One mode of instruction is referred to as the mature instructional mode wherein children were taught only the most complex stage in the skill sequence. In the step-wise mode of instruction, each stage was presented in the established sequence, beginning with a child's present level of performance. Both of these modes of instruction are based upon the stage approach to studying motor skill acquisition by incorporating skill stages into the development of instructional activities.

Research Questions

Two research questions are stated:

1. Is there a significant difference in the residual gain scores of throwing, catching, and long jumping between those taught by the mature method and those taught by the step-wise method ?
2. Is there a significant difference in the residual gain scores of throwing, catching, and long jumping between 3-4 years old

subjects and 5-6 years old subjects ?

Research Plan

The design of the study followed a 2 x 2 factorial model (treatment x age) and the dependent variables were: qualitative performances of throwing, catching, and long jumping and quantitative performances of catching and long jumping. The qualitative measures were obtained by viewing video-taped skill performances that were assessed by three raters. The ratings for each stage were based on the presence or absence of movement characteristics described in the sequence of each skill stage developed by researchers at Michigan State University (Seefeldt & Haubenstricker, 1976). The quantitative measures are the result of tallied and measured recordings of each subject's skill performance. All of the data were analyzed using multivariate analysis of residual gain scores for each of the dependent variables.

The treatment occurred over a period of ten weeks, with skill instruction scheduled twice a week for thirty minutes each lesson. The instruction was conducted by undergraduate physical education majors (juniors and seniors) who had received prior training in the two teaching modes. In order to maintain as much treatment

consistency as possible, the teacher participants were instructed in the use of task-specific feedback, verbal cueing, and modeling techniques used to enhance learning. The entire treatment procedure was supervised and monitored by two experienced college instructors.

As a model for putting theory into practice, this research project applies stage theory to instructional techniques and compares its effects. The data collected should allow some answers to be proposed to the important research questions inherent in this study.

Assumptions of the Study

This study was based on the following assumptions:

1. A stage theory approach to studying motor skill development is appropriate.
2. The two instructional approaches are different by nature and were effectively presented.
3. The monitoring system was effectively used to guarantee appropriate instructional presentation.
4. The children used as subjects in this study were capable of performing the activities that were presented.
5. The time-frame within which the treatment

occurs was sufficient to determine differences.

6. The randomization procedures used in this study balanced out any unique environmental and subject characteristics between the comparision groups.

Limitations of the Study

Limitations inherent in this study include the following:

1. The results may be generalized to pre-school and kindergarten children who possess similar characteristics of the subjects involved (class size, age, gender, location, race, socioeconomic level).
2. Because the subjects were pre-tested, the results can only be applied to other populations who have been pre-tested.
3. One treatment group received instruction as they rotated from one teacher to another. The other treatment group remained entirely with one teacher the length of the research project. All of the treatments were conducted simultaneously within one setting. This limits the application of

the results to similar classroom management situations.

4. The use of pre-service teachers to present the treatment and the presence of supervisors who monitored the on-going presentations may have had an effect on the results.
5. The gross units of measurement that were used to assess performance levels (i.e. stage 1, stage 2, etc.) may not have been sensitive enough to identify some finite learning changes that may have occurred.
6. The units of measurement that were used may have identified learning changes more for one group (i.e. step-wise) than the other.

Definition of Terms

In order to clearly identify the two instructional approaches used as treatments in this study, the following definitions have been developed:

Mature treatment - subjects are instructed in fundamental motor skills by practicing only the most advanced bodily movements associated with each skill.

Step-wise treatment - subjects are instructed in fundamental motor skills by practicing bodily movements that begin with the subject's current level of performance and gradually, in a step-by-step fashion, practicing the next more advanced level of performance until the most advanced bodily movements are acquired.

CHAPTER II

REVIEW OF THE LITERATURE

The literature contained within this review was selectively chosen to introduce background information that underlies the theoretical basis of this proposed research study. The first section of this chapter reviews the application of the stage theory to the study of motor development. Characteristics of stage theory, stage development, examples of stages for three motor skills, and a discussion of the assessment procedures utilized to test the validity and reliability of stage sequences are detailed. The second section includes a discussion of learning and teaching models and their component elements. They are used as a guide for making some generalizations regarding the learning environment in relation to motor skill acquisition. The final section of this review of literature will highlight methodology and results of studies which have investigated influences (teacher behaviors, instructional modes, and pupil characteristics) that have been found to have an effect on motor skill learning. Only those

influences that have a direct relationship to this study will be included.

Stage Theory

Human development has been studied often using a stage approach. After much observation and analysis, researchers have grouped characteristic behaviors and identified these groups as representative stages of development. Freud's psychoanalytic theory viewed development in terms of psychosexual stages (1962). Erikson (1963) described eight stages in the human life cycle which emphasized the role that environment plays in influencing development. Gesell (1945) described the ages at which children seem to demonstrate mastery of rudimentary movement abilities. She felt that these age-related abilities were indicators of social and emotional growth. Piaget (1969) focused on cognitive functioning and identified developmental periods as sensorimotor, preoperational, concrete, and formal. While looking at human development from many unique perspectives, these researchers were able to come to a clearer understanding of development by utilizing a stage approach.

The theory underlying a stage approach is not examined within the design of this research project, but a general description of the theory's characterstics,

based on Piagetian philosophy, may promote further understanding of the stage approach. The first of these characterstics is the presence of a hierarchical qualitative change wherein developmental steps are connected by periods of transition. The next characteristic necessary to have a stage is a hierarchical integration of skills. As an individual progresses toward skilled behavior, previously learned skills and plans are incorporated into new skills. Intransivity of a sequence is a characterstic of stage theory that does not permit the ordering of stages to be changed. This means that all individuals should pass through the stage sequence in the same order, although they could progress at their own rate. Horizontal decalage is the combining or integrating process involved in learning different skills and going from one stage to another in a gradual occurrence. As one skill improves, progress in another skill may lag. Structural wholeness refers to the apparent presence of all the task behaviors belonging to that skill stage within one performance. A final characterstic involves the means by which one moves from one stage to another. There will be periods of stability when performing in one stage, followed by periods of instability when changing from one stage to another in the course of development.

Acquiring the ability to move skillfully is a goal of physical education. Since skilled movement and its sub-skills are such broad topics, researchers have tried to define them more clearly by borrowing the descriptive techniques used in other fields and conceptually applying stage theory to the development of movement. One dimension of developmental stage theory refers to a simple to complex pattern of changes which are represented through specific stages of skill performance along a continuum. Each stage has unique movement characteristics. Paralleling the movement characteristics of a skill stage to that demonstrated in a child's performance can give clearer diagnostic direction to a prescriptive learning plan.

Attempts in applying stage theory to motor development are partly understandable because of the current interest in defining the qualitative changes of movement, as opposed to highlighting quantitative changes or the order in which movement occurred as was done in previous studies (Bayley, 1936; Halverson, 1931; Latchaw, 1954; Purdy, 1967; Halverson et al., 1977). Staging provides a convenient way to identify qualitative changes through a defined set of movements. Quantitative measures of the end product of skilled performance always have been

accessible, but with the addition of qualitative measures, the on-going performance of a skill can be appreciated and understood more fully. Applying criterion-referenced measurements to qualitative movements facilitates a clearer expression of skilled performance.

Research in motor development has resulted in finding many implications that warrant the application of a stage theory to skill development (Gallahue, 1976). Godfrey and Kephart (1968) describe learning as hierarchic. Fundamental motor patterns (balance and posture, locomotion, contact with objects, receipt and propulsion, spatial exploration) support future learning. The learning of motor skills proceeds in a gross to fine, large to small developmental pattern. Instruction and learning environments should be planned to conform to these patterns. Seefeldt (1980) concurs with earlier research (Shirley, 1931; Bayley, 1936; Dennis, 1957; Geber, 1958; Cratty, 1979) which indicates that skills are learned in an orderly progression and can be stimulated environmentally. Langendorfer (1981) summarizes some important points that motor development research has produced:

1. A motor pattern is a composite of

interrelated components which change over time,

2. The components of any pattern, vary according to the number of developmental levels,
3. The rate and extent of change will vary within a motor pattern across children, and
4. Developmental change occurs gradually.

Roberton (1978) suggests that if the stage theory really exists within motor skill development, then these previously stated characteristics must be tested longitudinally and found to exist within skill acquisition. In an attempt to test the application of two of these stage theory characteristics, universality and intransivity of a set of motor stages, Roberton (1977) examined movement across trials at one point in time using hypothesized stages of the forceful overarm throw. Observing seventy-three first graders, she attempted to determine the stability of a performance within a stage allowing ten trials of the throwing skill. She established her criterion level of stage stability as being five trials out of ten classified into the same stage. Variations of movements within an individual

should be characteristic of either the next lower stage or the next higher stage. This variation would indicate that the child was in a period of transition. The approach she used to analyze the throwing action was a component approach which categorized arm action and pelvic-spinal action. For the arm categories, she found that the children's performances only varied to adjacent categories and that half of the trials fell into one category classification. These findings supported the universal, intransitive characteristics of the stage theory. Conversely, the pelvic-spinal stages did not support the theory. One child did not perform the throw five times within the same stage and several children skipped to non-adjacent stages.

Although not conclusive, a great deal of the research utilizing stage theory supports its application in the realm of motor development. Further investigation should provide additional facts that will delineate the strengths and weaknesses of the stage theory and the appropriate manner in which it should be applied.

Application of Stage Theory

Historically, the stage theory has been applied to the study of motor development in a diagnostic manner using two different approaches, inter-skill analysis and

intra-skill analysis. Inter-skill refers to a variety of different skills included within the continuum of motor development, beginning at birth and ending with adulthood. Intra-skill focuses on one skill and the various phases, stages, or steps that one goes through to reach efficient, mature performance in that task.

Using the inter-skill approach, one may study motor development by beginning with reflexive actions and progressing to voluntary complex, skilled movements. The emergence of movement types (reflexive, rudimentary, fundamental, etc.) within the parameters of movement development is an intricate phenomenon not so easily described due to the uniqueness of each individual's general background and rate of maturation. These factors have been shown to be influential in the dynamic relationship a child has with the environment. An overriding implication gleaned from the review of inter-skill research is that if a child does not master the fundamentals, future skilled ability is unlikely (Cratty, 1979; Branta et al., 1982; Gallahue, 1982). Movement acquisition within the individual begins simply and develops sequentially in a stage by stage manner. The combination of a maturationally ready individual who is placed within an appropriate environment can and should

ultimately form the catalyst for motor learning to occur.

Another approach to applying the stage theory utilizes intra-task stages (Halverson et al., 1973) or intra-skill stages (Seefeldt et al., 1972). This form of investigation focuses on the movement characteristics involved in the acquisition of a single skill. Learning seems to progress through certain stages (Gagne, 1965). Researchers first ventured to study one skill in terms of age and rate of development (Wellman, 1937). Examples of such works include Bayley's monograph (1935) on the Development of Motor Abilities in Young Children. After studying the skill of jumping she presented a skill sequence that begins with the ability to jump off the floor with both feet and leads through several other forms of jumping, to being able to jump for distance. Her study indicates that age seems to be related to one's ability to jump and the method used. Guttridge (1939) also studied a variety of jumping techniques and generalized that forty-two percent of preschool children can jump fairly well by three years of age, seventy-two percent can be considered skillful jumpers by four and a half years old, and eighty percent have good mastery by the time they reach six years old.

In addition to generalizations about age and skill, other researchers have strived to determine and test the reliability and validity of a set of stages for various fundamental motor skills (Wickstrom, 1977; Roberton, 1977; Fountain, Ulrich, Haubenstricker & Seefeldt, 1981; Gallahue, 1982; Seefeldt & Haubenstricker, 1982; Haubenstricker, Branta & Seefeldt, 1983). By applying the stage theory in intra-skill analysis, each fundamental motor skill (walk, run, gallop, jump, etc.) has been described in terms of mechanics, initiating with the most rudimentary attempt of the skill and culminating with the most efficient, mature performance behavior. These stages have been, and are being, tested through visual observation and film analysis of the performance of children. Each skill differs in the number of stages it takes to go from immature to mature performance, and the more complex skills tend to have a larger number of stages than do the less complex skills.

Other findings from intra-skill stage analysis have shown that most children will go through a set of stages, but that they will progress at their own rate. Some young children display mature levels of performance, while some older students may exhibit immature levels of performance. Performance analysis also shows that a

child who may be in an advanced stage in kicking, may not be necessarily in that same stage for another skill. Skills do not seem to be interdependent (Roberton, 1977).

Since 1966, researchers at Michigan State University (Seefeldt & Haubenstricker, 1982) have collected data on children in order to study the development of motor skills, to identify common elements within these skills, and to formulate a resultant set of stages. By viewing the total bodily configuration of a performer, a noticeable change in the position of one or more limbs or body parts would permit stage determination. They report that using the total body approach to intra-stage determination is the simplest way to describe performance levels. Evolving from their studies is the "Developmental Sequence of Fundamental Motor Skills Inventory" (Seefeldt & Haubenstricker, 1976; Haubenstricker et al., 1981). Ten fundamental motor patterns (walk, skip, hop, run, strike, kick, catch, throw, jump, and punt) were studied from the film analysis of longitudinal and cross-sectional performances. The developmental stages for each of these skills have been arranged on a continuum ranging from immature (stage one) to mature (stage three, four or five) performance. Details of these stages will be

presented in the next section of this chapter.

McClenaghan and Gallahue (1978) also developed a motor skill assessment instrument using stages. Their identification scheme divides skill performance into "initial," "elementary," and "mature" stages of development which are described in the following manner:

1. Initial Stage: This stage is characterized by the child's first observable attempts at the movement.
2. Elementary: This is a transitional stage where the child gradually gains more body control. More components are integrated even though they may be performed incorrectly.
3. Mature: In this stage, the body moves through the skill in a coordinated, purposeful manner.

Original skill sequences for throwing, catching, kicking, running, and jumping were based on a biomechanical approach that has shown a high degree of reliability. The instrument provides qualitative

measures and is intended to assess developmental changes over time. Examples of the sets of stages for throwing, catching, and long jumping will be presented in the next section of this chapter.

Using an intra-skill approach, investigators developed some criterion-referenced developmental scales (Earls, 1977; Roberton & Halverson, 1977) based on longitudinal research. They used a structured component approach to determine skill level. Instead of looking at total body movement, a profile is obtained for each separate part of the body while a skill is performed. Roberton (1977) states that studying movement components within skills will show qualitative changes characteristic of stages. Using the total body approach may be an inadequate reflection of a performance. Results from her research indicated that skilled movement in different body parts within individual children did not develop at the same rate. Quite often, a performer's arm action would fit a given stage pattern, but the trunk or feet would not. According to Roberton (1978), if stages do exist in motor development, then perhaps they only exist related to component body parts rather than to total body movement.

Thus, stage theory has been applied to motor skill

development by looking at various skills (inter-skill or intra-skill) within the continuum. Research on intra-skill analysis has a whole body approach, a component approach, or a combination approach. Which method actually produces the most reliable information is still an issue and may vary by situation (i.e., research or teaching). It would seem to this researcher that if the component approach is used, in whatever context, there is a need to prioritize the importance of body parts as they contribute to a specific skill action. Possibly, then, a system could be tested that incorporates both total and component perspectives when determining skill level.

Testing Sequences of Stages

How one develops a sequence of skill stages is a time consuming and tedious task. Initially, some sequential pattern of movement must be envisioned. This schema is probably based upon a review of previous literature on the topic and/or numerous observations of the skill being performed. In order to validate this preliminary skill sequence, data must be collected longitudinally. However, Roberton et al. (1980) recently suggested that single-age or cross-sectional age group data should be implemented as screenings of hypothesized sequences. In this way, if a sequence proves worthy in

this initial investigative process, then a longitudinal study should be approached with any necessary modifications being made prior to testing. One could refer to the preliminary cross-sectional study as a pilot study. Basically, research on developmental sequences involves identifying tasks that reflect progressive development and studying the movement characteristics of specific populations (Wohlwill, 1973).

The validity of each of the proposed developmental sequences for throwing, catching, and long jumping (Seefeldt et al., 1972; Seefeldt & Haubenstricker, 1976; Haubenstricker et al., 1983) has been determined from mixed longitudinal data. Skill level was determined by applying descriptive criteria for each of the three trials performed for each skill. Percentage scores of the children performing at various stages by age and gender for each skill were obtained, graphed, and were examined for appropriately increasing values. The results for boys and girls supported the proposed five-level sequence for throwing and catching and the four-level sequence for long jumping.

Roberton (1977) tested the stability of the throwing pattern over repeated trials and analyzed it in terms of arm action and pelvic-spinal categories. The results

showed that fifty-two percent of the children were completely consistent across trials in their arm category and that the average number of trials in the same stage was 8.97 out of 10 per child. The frequency distribution for categories of pelvic-spinal action was similar to that of arm action with the children also averaging 8.9 trials out of 10 trials within the same category. These results indicated to Roberton that development within component parts may precede at different rates within the same individual. Moreover, the degree of stability of of the component parts may vary within any one individual and is different for each individual.

Following this initial study of throwing, Roberton (1978) tested the categories in a longitudinal film study of seventy-six children observed for two to three years. Categories describing the action of the humerus and forearm were found to be stable within one testing period and intransitive over other testing periods. Categories for the pelvic-spinal action did not meet either of these two criteria.

Stages for Throwing, Catching, and Long Jumping

Since this study is concerned with the ability of children to throw, catch, and jump, examples of stage

sequences for these three skills will be presented. Each researcher has based his/her proposed sequence upon the analysis of live and filmed performances of children.

A study of the overhand throw done by Wild (1938) resulted in one of the first proposed sequences of developmental stages for a motor skill. Her stages were modified by Seefeldt et al., (1972) and again revised (Seefeldt & Haubenstricker, 1976) to include an additional stage in the sequence. They proposed the following sequence of stages:

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. 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 derotation 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.

Another proposed set of stages for the throw is contributed by McClenaghan (1976) and McClenaghan and Gallahue (1978). The components of the throw vary

depending upon which factor (form, accuracy, or distance) the thrower is concentrating on and the assumed starting position.

Stage 1 - Initial:

a. The action is mainly from the elbow.
b. Elbow of the throwing arm remains in front of the body; action resembles a push.
c. Fingers spread at release.
d. Follow through is forward and downward.
e. Trunk remains perpendicular to the target.
f. Little rotary action during the throw.
g. Body weight shifts slightly rearward to maintain balance.
h. Feet remain stationary.
i. There is often purposeless shifting of feet during preparation for the throw.

Stage 2 - Elementary:

a. In preparation, the arm is swung upward, sideward, and backward to a position of elbow flexion.
b. Ball is held behind the head.
c. Arm is swung forward, high over the shoulder.
d. Trunk rotates toward the throwing side

during the preparatory action.

Stage 3 - Mature:

a. Arm is swung backward in preparation.

b. Opposite elbow is raised for balance as a preparatory action in the throwing arm.

c. Throwing elbow moves forward horizontally as it extends.

d. Forearm rotates and thumb ends up pointing downward.

e. Trunk markedly rotates to throwing side during the preparatory action.

f. Throwing shoulder drops slightly.

g. A definite rotation through hips, legs, spine, and shoulders during throw.

h. Weight during preparatory movement is on the rear foot.

i. As the weight is shifted, there is a step with the opposite foot.

Using a component analysis approach, Roberton (1978) developed the following stages for the throw:

Development of Trunk Action

Stage 1: No trunk action.

Stage 2: Extension and/or flexion of the trunk.

Stage 3: Spinal rotation or spinal-then-pelvic

rotation.

Stage 4: Block rotation of trunk.

Stage 5: Block rotation and lateral flexion of the trunk.

Development of Action in the Humerus (upper arm):

Stage 1: Humerus moves forward in an oblique path to the trunk.

Stage 2: Humerus aligned with shoulders but independent of the trunk action.

Stage 3: Humerus lags behind trunk.

Development of Elbow Action:

Stage 1: Elbow collapsed (flexed) or extended.

Stage 2: Elbow is maintained in a partially flexed angle.

Stage 3: Elbow held at a right angle until front facing is reached.

Development of Forearm Positioning:

Stage 1: No forearm lag.

Stage 2: Partial forearm lag.

Stage 3: Complete forearm lag.

Generally speaking, each of the proposed sequences for throwing involves common elements. The arm action and trunk rotation of the performer seem to be

highlighted in all sequences. As one goes from immature to mature skill level, a more coordinated, appropriate windup and follow through of the arm and trunk are seen. An analysis of the foot action has been used as an important stage indicator by many researchers (Wild, 1937; Seefeldt et al., 1972; McClenaghan, 1976), but Roberton feels that its observable variability makes it an unreliable indicator. She does generalize that all forms of foot action are associated with arm and trunk action in early learning, but only contralateral foot action occurs with advanced performance.

For the skill of catching, Seefeldt's definition allows for other body parts to be used in conjunction with, or exclusive of, the hands (1972). Therefore, the stages he proposes are based upon the actions of the total body and are derived from mixed-longitudinal observations of one hundred and fifty children between eighteen months old and eight years old. Seefeldt suggests that the final act of catching, rather than the preparatory stage, is more reliable in describing catching behavior. His sequence of stages for catching is as follows (1976):

Stage 1: The child presents the arms directly to the front, 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.

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 the frontal plane.

Substage 3a. The child uses the chest as the first contact point of the ball and attempts to secure the ball by holding it to the chest with the hands and arms.

Substage 3b. The child attempts to catch the

ball with the hands. Upon failure to hold the ball securely with the hands, it is maneuvered to the 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 move the feet 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.

The following developmental sequence of catching is based on McClenaghan's study (1976):

Stage 1 - Initial:

a. There is often an avoidance reaction of

turning the face away or protecting the face with the arms (the avoidance reaction is learned and, therefore, may not be present.)

b. Arms are extended and held in front of the body.

c. Body movement is limited until contact.

d. The catch resembles a scooping action.

e. Use of the body to trap ball.

f. Palms are held upward.

g. Fingers are extended and held tense.

h. Hands are not utilized in the catching action.

Stage 2 - Elementary:

a. Avoidance reaction is limited to the eyes closing at contact with ball.

b. Elbows are held at the sides with an approximately 90 degree bend.

c. Since initial attempt at contact with the child's hands is often unsuccessful, the arms trap the ball.

d. Hands are held in opposition to each other; thumbs are held upward.

e. At contact the hands attempt to squeeze the ball in a poorly timed and uneven motion.

Stage 3 - Mature:

a. No avoidance reaction.
b. Eyes watch the ball as it travels.
c. Arms are held relaxed at the sides, and the forearms are held in front of the body.
d. Arms give on contact to absorb the force of the ball.
e. Arms adjust to the flight of the ball.
f. Thumbs are held in opposition to each other.
g. Hands grasp the ball in a well-timed, simultaneous motion.
h. Fingers grasp more effectively.

The arm action appears to be the main focus in stage determination for catching, unlike that for throwing where trunk and arms are equally addressed. Additionally, timing seems to be important when performing a catch. As the object to be caught approaches, the performer needs to know when to extend and flex the arms and fingers. Both of the proposed sequences, as they go from inefficient to efficient movement, describe the performer's ability to anticipate the contact, to keep eyes on the object, to extend and give with the object, and eventually to control the object using the hands only. The most mature stage

proposed by Seefeldt also suggests that the ability to move to the approaching object is a further indication of skilled performance.

The coordinated action of the arms, head, trunk, and legs are necessary to perform an efficient long jump for distance. Filmed analysis of this skill is probably the most thorough manner in which to assess a performer's skill level, because there is so much to view within a very brief time. Being able to review and slow down a performance through the use of audio-visual equipment promotes accuracy in assessment procedures. Both of the stage sequences that follow are based on filmed analysis as well as observations of live performances of children. The developmental sequence of the standing long jump as proposed by Seefeldt and Haubenstricker (1976) is as follows:

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 takeoff is still markedly above 45 degrees. 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 takeoff. Upon takeoff the arms extend and move forward but do not exceed the height of the head. The knee extension may be complete but the takeoff angle is still greater than 45 degrees. 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 takeoff reaching full extension above the head at lift-off. The hips and knees are extended fully with the takeoff angle at 45 degrees 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.

The following is the developmental sequence of stages for long jumping as proposed by McClenaghan (1976):

Stage 1 - Initial:

a. Limited swing; the arms do not initiate the jumping action.
b. During flight, the arms move sideward-downward or rearward-upward to maintain balance.
c. The trunk moves in a vertical direction with little emphasis on length of jump.
d. Preparatory crouch is inconsistent in terms of leg flexion.
e. Difficulty in using both feet.
f. Extension of the ankles, knees, and hips at takeoff is limited.
g. Body weight falls backward at landing.

Stage 2 - Elementary:

a. Arms initiate jumping action.

b. Arms remain toward the front of the body during the preparatory crouch.

c. Arms move out to side to maintain balance during flight.

d. Preparatory crouch is deeper and more consistent.

e. Extension of the knees and hips is more complete at takeoff.

f. Hips are flexed during flight, and the thighs are held in a flexed position.

Stage 3 - Mature:

a. Arms move high and to the rear during the preparatory crouch.

b. During takeoff, the arms swing forward with force and reach high.

c. Arms are held high throughout the jumping action.

d. Trunk is propelled at approximately a 45 degree angle.

e. Major emphasis is on horizontal distance.

f. Preparatory crouch is deep and consistent.

g. Complete extension of ankles, knees, and hips at takeoff.

h. Thighs are held parallel to ground during flight; lower leg hangs vertically.

i. Body weight is forward at landing.

As with other skill sequences, the actions of those body parts that contribute most to the movement are used to determine stage level. The least and the most mature stages of both sequences for jumping describe similar movement behaviors. Differences are seen with regard to the middle stages where Seefeldt and Haubenstricker break the characteristics down into two separate stages and McClenaghan combines the behaviors into one stage.

If the number of proposed stage sequences is an indication of the applicability and possible implementation of the stage theory in movement analysis, then the review of literature supports its use. Although the number of stages describing the continuum for each skill's development is unique to each researcher, the behaviors described are very similar in nature. For purposes of this research project, the sequences proposed by Seefeldt and Haubenstricker will be used as they are highly regarded by motor development experts and provide an efficient and effective approach to movement analysis for the purposes of this study. The author is very familiar with these stages and has had a multitude of opportunities to apply them.

Learning and Teaching Models

Knowledge about the art and science of teaching and learning comes from a wide variety of sources. Among these sources are philosophers and psychologists who strive to remind participants of the importance of the interaction between teacher and learner and focus on the individuals within the educational schema. Research on such topics as motivation and arousal levels, expectations of self and others, uses of feedback and reinforcement, and information processing has resulted in a myriad of facts about the learning process (Inhelder & Piaget, 1958; Bruner, 1966; Gagne, 1965; Glasser, 1966; Good et al., 1975; Brophy, 1979; Goldberger, 1980).

Motor learning definitions abound in the literature. Four distinct characteristics serve to define it according to Schmidt (1982). First, it is a process where, through practice, changes or modifications occur that permit an individual to become skilled. The second characteristic of learning is that it is directly affected by practice or experience. Third, the actual learning processes leading to change are internal and, therefore, defy direct measurement. And lastly, it is assumed that learning causes behavior changes which are relatively permanent.

Many early studies of motor skill learning focused on the role of growth and maturation in the change and development of motor responses (Bilodeau, 1966). Valuable data were collected that gave rise to further research which focused on the critical role of opportunity and experience in learning. The influences of maturation and experiential learning are interdependent and may defy separation with regard to their effects on the learner (Thompson, 1962). The responsibility of those investigating motor skill learning is to address all of the factors that influence learning and to design experiences that will result in desirable changes which lead individuals toward full development. The role of the teacher and parent in promoting learning would be to determine the time at which children are ready to learn and then arrange the environment to effectively promote development (Oxendine, 1968). Learning involves a team effort that includes the collaboration of investigators, parents, teachers, and students.

One purpose of a model is to provide guides to be followed, whether it be for the completion of an artistic endeavor, a feat of engineering, or the use of a teaching technique. Participants have a step-by-step outline of

what tasks are needed in order to achieve a goal. Mirroring ideas or facts that have some interrelatedness, a model is a construct that brings parts together into a whole pictorial. From this construct, the discovery of further facts and relationships is more easily envisioned.

The following representative models and theoretical perceptions are applicable to motor skill acquisition and seem to incorporate the characteristics of learning defined by Schmidt. Based upon research, they show the reciprocal activities of students and teachers participating in a learning process.

Fitts and Posner (1967) distinguish three main phases of learning in their model. The early or cognitive phase is an intellectual thought process that guides the learner to an understanding of the demands of the task and what strategies work best to produce the desired movements. The cognitive map or plan is a program of instruction which directs the actions and responses of the learner. The instructor may assist in the development of the plan by outlining the objectives and presenting demonstrations. According to Fitts and Posner, visual control is a major error-correcting mechanism used by learners. The teacher, therefore, should reduce the amount of irrelevant stimuli and

instruct the student to attend to only certain stimuli.

The second phase is the intermediate or associative phase. During this phase, part-skills and temporal aspects are refined into more efficient movement, and these part-skills are combined into unitary sub-skills leading toward total performance. In this phase, the teacher must be a movement diagnostician and a prescriber. The quality of the learning situation is very much dependent upon the teacher's ability to identify an individual's level of performance and then to plan appropriate activities to nurture further development.

The final or autonomous phase is where learners no longer need cues, and the skills are executed smoothly and precisely. The skills should be performed in a variety of ways and the performer should have practice performing under different kinds of stress. Although the teacher should continue to organize practice sessions and to motivate participation, the performer must demonstrate a self motivating desire to continue participating and be able to assess his/her own progress without relying on external influences.

Gentile's model (1972) centers on external environmental influences and the nature or unique demands

and characteristics of the skill to be learned. A stationary environment produces minimal time stress on the motor plan and consistent performance is highly predictable. Conversely, when the environment and/or task requires movement, more complex motor planning is required. Apparant from Gentile's model is that no individual motor pattern can be used to accomplish a goal under all environmental conditions. To be a skilled performer, one must have a repertoire of motor patterns available for use. In order for a teacher to facilitate learning, Gentile suggests that verbal communication be provided along with visual and other non-verbal input. Also, the teacher should position the learner within the setting and structure of the environment. This is done to reduce distractions during learning and to help the performer to concentrate on the most important cues.

The following list summarizes the activities of both the learner and the teacher in Gentile's skill acquisition model (Gentile, 1972).

Stage One: The learner perceives the goal while the teacher clarifies and establishes a motive.

Stage Two: The learner attends to important task components while the teacher presents

facilitating cues.

Stage Three: The learner plans the action while the teacher gives specific directions.

Stage Four: The learner attempts the task while the teacher observes.

Stage Five: The learner processes the feedback that the teacher gives.

Stage Six: The learner reorganizes motor plans while the teacher provides motivation.

Stage Seven: The learner attempts the task again while the teacher motivates, provides feedback, and monitors the practice.

Throughout this process, Gentile emphasizes that it is the student, not the teacher, who must do the learning. This model reflects the merged activities of teacher and student in a unified attempt to accomplish a mutual goal.

Stallings (1973) suggests that the three major factors to be considered by the practitioner who teaches physical skils are the state of the learner, the nature of the skill, and the methods of instruction. One must be aware, continually, of the inter-relationships that exist among these three factors. The goal of optimal skill development requires their interaction.

The state of the learner refers to the learner's degree of maturation and this, to a large extent, influences the degree to which a skill can be acquired. There are no simple ways to identify and group children. Correlations between physical growth factors such as height and weight and quality of skilled performance are usually low and non-significant (Latchaw, 1954; Solley, 1957). Since most school systems rely on chronological age to divide their students, a teacher must find a way of sub-dividing the classroom into groups of students based on maturational needs. Another important aspect in understanding the young learner is his/her arousal level during skill acquisition. An optimal level of arousal should be maintained to ensure successful learning. Because children have had fewer past experiences than adults, they are less able to control their arousal (Crabbe, 1973; May, 1972).

Nature of the skill refers to all of the unique characteristics of the skill that is being performed: what quantitative and qualitative capabilities are required, what prerequisite skills are needed, and in what environmental setting does the skill take place? Some skills require simple, discrete movements that must be executed in an all-or-none fashion. Other skills are

more complex and require the chaining together of simpler parts into a smoothly performed whole. Some skills demand that the performer move, while others require performer stability. In many skills the environment is constantly changing, forcing the performer to adjust continually. Eventually, to achieve skilled ability, one must perform at the appropriate speed, utilizing accurate movements that are in perfect form, and be able to adapt to variable and unexpected situations (Singer, 1975).

The acquisition of skill does not come about simply because a person matures (Stallings, 1973). Skills must be taught and learned. Therefore, the method of instruction and the regulation of practice are important responsibilities of the physical educator. Appropriately matching the mode of instruction with the characteristics and needs of the learner is a challenge, but one that must be met if learning is to occur.

Merrill's (1971) discussion of a psychomotor paradigm describes motor behavior at three levels of performance:

1. A specific muscular-skeletal response to a specific stimulus cue,
2. A series of coordinated muscular-skeletal responses to a specific stimulus cue, and

3. A complex combination of many coordinated series of responses to a set of specific stimulus cues.

Through the use of stimulus cues, this model guides an individual to perform one movement, then a series of movements, and finally, a complex series of movements. The acquisition of psychomotor behavior, according to Merrill, depends on the basic learning process of discrimination, generalization, and chaining. It is through instruction that the environment is manipulated in order to enhance and combine these learning processes. Based upon the presence of a particular stimulus situation, the individual must perceive that stimulus, discriminate it from other cues, and determine which response to perform. Attaining the ability to discriminate and generalize is promoted through a process called chaining. It involves presenting a complex task in a series of parts that are strung together and complimented by external stimulus cues. As a person gradually acquires the ability to perform each segmented part, his/her own internal proprioceptive senses provide adequate performance cues. Eventually, the performer is not dependent upon an external source for feedback. Developing this internal system allows the performer to

continually modify actions until a smooth response is evident.

Merrill (1971) suggests that the teacher should direct the learner's attention to the stimulus cue and that by a process of gradual approximations called shaping, the desired response will be attained. Verbal directions or commands, as well as external praise and knowledge of results, should accompany the shaping process.

Piaget (1964) also gives credence to early skill acquisition involving active participation on the part of learners. According to Piaget's stages of intellectual development, the child has acquired sensorimotor control by the age of two. Between the ages of two and four, the child is capable of extracting concepts from experiences. As the actions to be learned are repeated and varied, they begin to intercoordinate with each other and become internalized.

Gagne (1977) presents a comprehensive model for guided learning versus discovery learning. He suggests that learning prerequisites are hierarchical. In a step-wise approach, the learner proceeds through this hierarchy of prerequisites until the desired behavior is obtained. Effective instruction, to Gagne, requires careful sequencing of learning tasks. Prerequisite component

skills must be well learned before the later stages of learning occur. He suggests a mode of instruction where the task presentation includes demonstrations, guided practice, and then self initiated practice until the behavior is accomplished.

As one aspect of learning, Mosston (1972) defines eight interconnected teaching styles (A through H) in his "Spectrum of Teaching Styles" (see Figure 1). The theoretical structure of each style is determined by who, teacher or learner, maximally or minimally makes which decisions, and whether these decisions are pre-impact (planning decisions), impact (executive decisions), or post-impact (assessment decisions).

	Teaching Styles								
Pre-impact	T	T	T	T	T	T	T	T	
Impact	T	L	Per	L	L	L	L	L	
Post-impact	T	L	Obs	L	L	L	L	L	
Teacher									Teacher
Maximum									Minimum
Learner	A	B	C	D	E	F	G	H	Learner
Minimum	Command Style	Practice Style	Reciprocal Style	Self-check Style	Slanty Rope Style	Guided Discovery Style	Problem Solving Style	Learner Designed Program Style	Maximum

T = decisions made by teacher
L = decisions made by learner
Per = performer decisions
Obs = observer decisions

Figure 1: Mosston's (1972) Spectrum of Teaching Styles

An analysis of these teaching styles has not indicated that any one style has universal effects on all learning outcomes. Each style has assets and liabilities and the characteristics present within a learning situation dictate which style would be most appropriate. Mosston does suggest that the command style be utilized when dealing with motor skill acquisition. As can be seen in this model (see Figure 2), the teacher is the sole decision maker with regard to the entire learning experience. It appears to be the most direct and time efficient manner to use in order to accomplish a learning goal involving very young children. Everything is pre-planned and directed by one person. Within the realistic time frame given to this experiment, it is this teaching style that has been utilized in this project. If previous research results are correct, this teaching style should improve experimental control over such influences as exactness of lesson content, efficient classroom management, direct communication between teacher and student, and hopefully, improved student attention.

In summary, all of the models discussed in this section suggest a dynamic teaching-learning process that requires the participants to engage actively. The

Decision set	Decisions made by the teacher	Decisions by student
Pre-Impact	1. Whom to teach	not involved
	2. What to teach	not involved
	3. Where to teach	not involved
	4. Time	not involved
	5. Quantity	not involved
	6. Quality	not involved
	7. Teaching-learning transactions	not involved
	8. Anticipated learning style	not involved
	9. Class climate	not involved
	10. Communication	not involved
	11. Why?	not involved
	12. Evaluative procedures	not involved
	13. Other	not involved
Impact	1-10. Implementation decisions	Student responds as prescrived
	11. Adjustment decisions	not involved
	12. Other	not involved
Post-impact	1. Feedback	not involved
	2. Reinforcement	not involved
	3. Corrections	not involved
	4. Evaluation:	
	a. Procedures	not involved
	b. Frequency	not involved
	c. Norms	not involved
	5. Teaching-learning transaction	not involved

Figure 2: Mosston's (1972) Anatomy of the Command Teaching Style

following composite (see Figure 3) is based on all of the model elements presented previously and reflects the teaching-learning model that will be applied to this study. Mosston's decision categories also are identified. The teachers who presented the treatment within this study performed the teacher activities listed on the composite model. Most of the learner activities involve intrinsic brain functioning. No matter what a teacher does to promote understanding, clear indications of that internal learning seem to evade thorough description. Consequently, observable behaviors are used in this experiment as determinants of learning, both quantitative and qualitative measures. The qualitative measures were made possible through an application of a stage theory approach for identifying the performer's stage of motor ability.

Mosston's Command Style Decisions	Teacher Activities	Learner Activities
Pre-impact	Identifies & Diagnoses Groups Appropriately Prescribes Activities Plans: Goals & Objectives Skill Components Sequence Components Teaching Methods Environment Classroom Management Practice Activities	
Impact	Motivates Attention Presents & Clarifies Goals Directs Learner's Attention to task components (chain) Reduces Distractions Provides Cues: Verbal Directions Demonstrations Visuals Auditory Observes Practice Provides Feedback and KR Monitors Practice Motivates and Provides Feedback	Attends Perceives Goals Perceives Components Practices Components Combines Components Processes Feedback Reorganizes Plan Rehearses Task
Post-Impact	Monitors Practice Motivates and Provides Feedback Evaluates	Refines Skill Self-Assessment Processes Feedback

Figure 3: Composite of All Model Elements

Teaching Behaviors, Modes of Instruction, and Pupil Characteristics

Motor development specialists have provided a vast factual contribution to what we know and understand about motor skill learning. Extensive reviews of earlier research on skill acquisition can be found in Bilodeau's work (1966) and more recent reviews by Schurr (1975) and Locke (1977). Many directives were gleaned from these research endeavors, and the information had an influence on the intent, design, and methodology used within this proposed experimental project. This next section of the review will limit its scope specifically to research on teacher behaviors, modes of instruction, and pupil characteristics and how these influence motor skill acquisition. Research specific to the motor skills of throwing, catching, and long jumping have been included.

Teaching Behaviors

Correlational studies looking at effective teaching behaviors by observing actual classroom processes have reaped similar findings. The instructional behaviors that seemed to promote achievement in the elementary classroom were efficient classroom management, teacher-centered focus, and positive teacher attitudes and

expectations (Brophy, 1979). The research done on these three categories does not present specific, all-encompassing lists of behaviors that a teacher can model in an effort to be effective. Variability in research methodology and setting make this impossible. However, recent research does show that teachers trained in certain behavioral techniques show greater student gains than do those teachers not trained (McDonald & Elias, 1976; Brophy & Evertson, 1976; Good & Grouws, 1977; Soar & Soar, 1976; Brophy, 1979; Gage, 1979). One important point that is clear from all of the findings is that successful teaching behaviors vary from situation to situation (Brophy, 1979; Gage, 1979). Knowing when to employ different behaviors is the key to effective instruction.

Less research has been done on teaching behaviors in the physical education setting than in the elementary classroom setting. One set of studies in physical education showed that behavior modification techniques or teacher training procedures can promote the use of certain behaviors during instruction (Darst, 1976; Rushall & MacEachern, 1977; Rushall & Smith, 1979).

Yerg (1977) designed a study using a process-product model to measure effectiveness of three instructional

behaviors:

a. clarity of task presentation,
b. guided and supported practice, and
c. specific task-related instructional feedback.

The recorded frequencies of these behaviors were correlated to pupil learning of a cartwheel. Results indicated that no specific teacher behavior variables were identified that influenced final scores achieved by subjects. In a subsequent paper that discussed the procedures and problems of the original study, Yerg (1981) reported that it may have been an inappropriate choice of teacher behavior indicators that caused the results in the original study. She suggests that teacher behaviors which are detrimental, such as those that inhibit practice, may be more potent factors than the ones she studied. She also said that the observation system was weak and only measured quantity.

Skill acquisition models emphasize the importance of presenting task instruction in a succinct, precise manner (Gentile, 1972; Merrill, 1971; Martenuik, 1976). The learner's attention must be focused, information overload should be avoided, and demonstration should be utilized to facilitate learning. Schaafsma (1968) concluded that

the enhancing effects of verbal task presentation are dependent upon the learner's capability and prior experience and the complexity of the task.

Realizing that the ability of a young child to attend selectively is not fully developed, a teacher should accompany the instruction of a motor task with a multitude of cues that will entice the child to attend. Imposing these task specific cues early in learning will enhance a child's ability to selectively attend and block out other influences.

The teaching behavior of modeling has been shown to positively promote motor skill learning (Feltz & Landers, 1976; Martens, Burwitz & Zuckermann, 1976). Karling and Mortimer (1963) reported that visual demonstration is one of the most effective ways to enhance the learning of motor skills. In a study of the combined factors of demonstration and feedback, Anderson (1968) reported that demonstration alone did not facilitate learning. The fact that this study involved a complex motor skill (Backman ladder climbing) may have influenced the results and, therefore, the results cannot be generalized to include all motor tasks. Four experiments conducted by Martens et al. (1976), studied the influences of three different types of models on skill acquisition. The

model types included a correct demonstration of climbing the Bachman ladder, a trial and error learning sequence demonstration, and an incorrect demonstration. The results varied for each experiment. In experiment one, results showed that the correct model and the learning sequence model facilitated performance on ten trials, but not thereafter. The second experiment showed that observing the correct model and the learning sequence model improved performance. The third experiment revealed pronounced modeling effects for the correct and learning sequence models on a difficult task. The fourth and final experiment showed no difference between live models and filmed models. Mosston (1972) points out that through demonstration a standard of performance is implicitly or explicitly established. This would inhibit alternative procedures and actually label an act as being inferior or incorrect.

Weiss (1983) studied two different age groups of children (four and five years old in one group and seven and eight years old in the other group). The study was designed to examine the effects of age, modeling, and verbal self-instruction on the performance of a sequential motor task. The activities involved in this study were in the form of an obstacle course composed of several simple motor tasks. Results revealed that older

children performed better than younger children on motor, verbal-cognitive and attentional measures. Also, model effectiveness depended upon the age of the observer as well as the type of model. Specifically, seven to eight year old children performed equally well after observing a silent or verbal model, while four to five year old children performed best when given a verbal model only. In general, these findings support the notion that age-related or developmental factors such as attention, retention and verbal-cognitive abilities play a critical role in the modeling process.

Feedback pertains to information about the process or outcome of performance. It is generally agreed that feedback is essential for learning to occur. The amount, quality, and timing of the given feedback are still issues of debate. Morgan (1971) concluded that video tape feedback and the video tape plus verbal cues were superior to verbal cues only for learning swimming skills. Penman (1969), in teaching beginning tumbling with the use of instant replay video-tape, found no significant differences in learning between groups with and without the video-tape. The effects might have been confounded in this study due to the loss of practice time while watching the video-tape. Regarding the specificity of feedback, Smoll (1972) concluded that there might be

an optimal level of specificity for improving performance depending on the individual's ability to process information. Fishman (1971) developed a system to describe feedback behavior of physical education teachers. Using this system, Tobey (1974) described feedback in physical education classes as mostly verbal, directed toward a single student, and often non-specific. Other literature supports both specificity and task relatedness of feedback as being appropriate for skilled learners (Gagne, 1974; Bilodeau, 1966). There is a difference between instrinsic feedback and augmented feedback. Intrinsic feedback has to do with the proprioceptive "feel" of a movement as one performs. Augmented feedback can be provided by knowledge of results or from verbal comments by a teacher. It is important that various kinds of external stimulation be employed to guide the learning process (Bilodeau, 1966).

There is evidence that indicates that the immediacy of feedback may be an important enhancer of learning (Gagne, 1974). In addition to being immediate, the information accuracy of feedback has been found to exert a facilitating influence on motor skill learning (Fitts & Posner, 1967).

Since feedback contains information about the outcome or the process of performing, instructors should

provide cues that enable the performer to create a mental picture of the position or movement. Picture-laden cues are especially helpful to young children and beginners who rely more on visual and auditory information than on proprioceptive feedback (Robb, 1972; Kerr, 1976).

Practice enhances kinesthetic awareness and allows a person to repeat essential bodily movements and thereby learn to discriminate between correct and incorrect performance (Gagne, 1974). As one practices, the smoothness, timing, and precision of movements are improved. Realistic expectations must be considered when developing practice schedules.

In descriptive-analytic studies in physical education, there has been a predominance of teacher talk reported (Bahneman, 1971). One study found that two-thirds of the class time was spent on teacher talk. Nygaard (1975) reported that about four-fifths of the total class time was devoted to lecturing and giving directions. It would seem that, based on the research premise that practice time is extremely important in the achievement of learning, excessive amounts of teacher talk take away from practice time and, subsequently, the amount of learning that could take place.

It is generally accepted that physical practice is a necessary component toward efficient skill development

(Gallahue, 1976). Gentile (1972) suggested that learners must execute and evaluate a motor plan in order for learning to occur. Thorpe, West, and Davies (1971) attributed a difference in learning badminton skills to the amount of opportunity to practice the skills. Providing opportunity for practice, in addition to other relevant conditions, positively affects learning in both the cognitive and psychomotor domains (Rosenshine, 1978; Oxendine, 1968). Berlin (1959) reported that the amount of practice was a significant factor in facilitating learning. The second most effective strategy, according to Berlin, was a combination of verbal description, visual aids and practice. This supports the use of a variety of modes of information input with the learning environment.

Through practice sessions designed to influence skill development, Hanson (1961) studied the overarm throwing pattern of five-year-old children. A guided practice group was taught for a total of fifteen quarter-hour periods. The children were placed physically in the starting position consistent with the mature throwing pattern. She concluded that the throwing patterns of the instructed group did mature more rapidly than the non-instructed group.

Research comparing various forms of whole and part practice presents a simple conclusion. If the performer is familiar and comfortable with the method of practice involved, neither form of whole or part practice is likely to enhance learning more than the other (Nixon & Locke, 1973). In the review of studies conducted, none showed one method better than the other; although some modified uses of the whole method were associated with superior learning (Knapp & Dixon, 1952; Purdy & Stallard, 1967). Some skills (eg. a front dive) seem more appropriate for the whole method. On the other hand, there are skills (eg. a golf swing) with individual parts that might need attention. Teachers often use the part method of instruction to make the demands of skill performance more realistic for the learner, although there is no verification that this teaching technique works (Roberts, 1967).

In summary, variability in research methods and settings make it impossible to conclude that certain teaching behaviors promote learning in all settings. But, the research does indicate that teachers trained in selected behavior techniques show greater student gains. Some of the behavioral techniques used by teachers that have been reported to enhance learning include modeling,

providing verbal and visual cues, avoiding information overload, and providing an optimal level of immediate, task-specific feedback. In addition to providing appropriate instruction, students must be given an adequate amount of opportunity to practice the skills being focused. Through practice and guided instruction, individuals learn to discriminate between correct and incorrect movement behaviors.

The information obtained from research on instructional effectiveness was incorporated within this project in order to maximize any learning that might occur. Teachers were trained to use modeling, cueing and feedback techniques. Additionally, they received instruction on appropriate planning of lessons that present the right amount of information to the young subjects in the study and provide the subjects with the opportunity to practice the tasks at hand. A detailed explanation regarding the teacher training procedures and the treatment presentation are found in Chapter III.

Modes of Instruction

Many studies have been conducted to validate the effectiveness of different teaching methods. While some methods have shown superiority with a particular age group, type of learner, or situation, the majority of

resultant data shows no one successful method for teaching physical education. This generalization concurrs with data obtained from research studies of teaching effectiveness in the regular classroom setting (Brophy, 1979; Evertson, 1980). Their studies indicated that differences among learners, their interests and needs, and environmental characteristics create unique demands from any mode of instruction or teacher.

A paper presented by Earls (1982) reported procedures and results from a series of studies examining motoric responses to instructional variables. Some of the experimentally controlled variables included: point of object arrival, performer movement, speed of object, background and contrast, etc. The experimental research occurred in both a university movement laboratory of three to ten year old children, and in an elementary school physical education class of first through fifth grade children. The experiments demonstrated that the quality of students' movement patterns is affected by varying teaching actions, environmental factors, and task characteristics.

A variety of research has looked at whether or not instruction makes a greater difference in skill acquisition than does free play. Masche (1969) tested the differences between an experimental group which was

given a structured program of motor skill instruction and a control group which received a program that combined low organized play and movement exploration. Volleyball and basketball skills were taught to the experimental group. The findings indicated that there was a significant difference between the two methods of instruction in the development of motor performance of second graders. The experimental group, which received specific instruction, performed motor skills significantly better than did the group that received play and movement exploration experiences.

In a study done by Miller (1977), the effectiveness of various programs of motor skill instruction was examined involving pre-school children. Incorporated into the study were four groups including a control group, a free play group, a traditionally taught group, and a group involving parents who directed practice activities. The latter two groups received instruction in gross motor skills. The results signified that free play and control groups were not different from each other. When comparisions were made between the free play group and the traditional and parent groups, the free play group performed significantly poorer than the other two groups. This indicates that instruction is more effective than

programs of free play.

Reidinger (1973) studied the effects of teaching methods and no instruction in badminton for elementary students. She concluded that the instructed group was significantly better than the no-instruction group.

Rarick (1972) conducted a study of the effect of instruction on the overhand throw of kindergarten children. A total of 120 minutes of instruction did not significantly increase throwing velocity, but it did produce improvements in throwing technique. For a small group of children, this intervention program promoted one motor outcome, but not another. More research of this type is needed in order to understand exactly what can positively influence motor skill acquisition. Halverson and Roberton (1979) conducted a similar study and found that instruction did make a difference in skill development, but that a quantitative measure was not necessarily a complete indication of development. Development can be viewed through qualitative and/or quantitative changes in performances. Both authors state that measures of quality and quantity should be included when studying the developmental process.

The question of whether direct instruction is better than open or non-traditional instruction still remains after years of investigation (Ward & Barcher, 1975;

Rosenshine, 1976; Gage, 1978; Peterson, 1979). Direct instruction, according to Rosenshine (1978), has an academic focus, is teacher-centered (leaving little student choice of activity), and uses large rather than small groups for instruction. Open instruction, conversely, involves flexible teaching, abundant student choice of activity, integration of curricular areas, and individual small group instruction. There are a number of advantages to using the traditional method. This method is time efficient and goal directed. It can be applied to the general ability level of a group as well as when teaching specific skills. On the other hand, the traditional method can restrict the learners' participation and creative expression. An advantage to the exploratory method is that it permits greater involvement and encourages creativity on an individual basis. But, the disadvantage of the open method is that it is time-consuming and works best when skill, form, and accuracy are not the focus of instruction (Solomon & Dendall, 1976; Vannier, 1973).

Dusenberry (1952) studied the effect of a five-week training program on learning process involved in ball throwing for distance. Children three to four years old and children five to six years old were divided into an experimental group and a control group. Pre-assessment

measures were taken prior to the training program, and post-assessment measures were made following the five-week period. Some general results revealed:

a. Boys were superior to girls in throwing for distance.

b. Both the practice and the control groups gained in distance scores from initial to final test. This suggested to Dusenberry that, due to training in throwing, learning occurred over and above the effects of maturation and general practice.

c. The three and four year old children in the trained groups showed little improvement, whereas the gain made by the five and six year olds was marked. She suggests that the older children profited more by training in throwing.

d. The children were found to vary greatly in their manner of throwing. On the average, the boys used their bodies more efficiently than the girls.

The ages of the subjects used in the Dusenberry study are identical to the ages of the subjects to be used in this research project. One could hypothesize,

based on the results of this previous study, that the older children will show greater improvement than the younger children due to the older children's ability to attend more closely to the information being given by the teacher. The younger children may not be mature enough to block out distractions. Other alternative reasons for the better performance of the older children include having a more developed kinesthetic sense and overall bodily coordination. The older child has had more time to practice controlling his/her body.

When comparing formal and nonformal teaching methods used with first graders, Scott (1967) concluded that the methods did not vary in their affects on perceptual motor ability, although both of these methods were better than no physical education instruction at all. It was determined that the nonformal method was more effective in the development of creative ability than was the formal method.

Several studies incorporating Mosston's (1972) Spectrum of Teaching Styles in an analysis of learning obtained varied results. Pitchert et al. (1976) found that teachers trained to use the spectrum of teaching styles on a regular basis appeared to give more attention to students. They also maintained less dominance in academic discussions and used class time more

efficiently. Mariani (1970) studied the effects of the command and practice styles of teaching on tennis stroke performance of older children. She reported that the group taught with the practice style displayed significantly better performance. Dougherty (1970) compared the command, practice, and the self-check styles of teaching on the development of physical fitness and selected motor skills. Results yielded no significant difference among the groups. Virgilio (1979) compared the effects of a direct teacher assessment strategy with the reciprocal teaching style, where students assessed each other. No significant difference was found as a result of treatments. Goldberger (1980) studied the effects of three teaching styles in terms of the motor skill acquisition and the social skill development of ninety-six randomly selected fifth grade children. The task involved in this study was a hockey pass for accuracy. All three teaching styles showed effectiveness in facilitating learning of the task. The reciprocal style, in which one subject performed the task while the other provided formative feedback, was found not only to produce comparable task learning, but also to enhance social skill development significantly.

Halverson et al. (1977) studied the effect of guided practice on the overhand throw of kindergarten children.

An experimental group received a movement program that included 120 minutes of guided practice in the overhand throw while a control group received the same movement program but no exposure to the throw. The design involved a pre-test, eight weeks of treatment, and a post-test. The results were analyzed using an analysis of variance technique. The results showed that no significant difference was evident on the velocity of the thrown ball between groups either before or after instruction.

A study done to compare the direct and exploratory methods of teaching the overhand throw to kindergarten children was done by Moore et al. (1981). Instruction was given three times per week for four weeks. The exploratory method provided variable practice because the students used a variety of balls with which to throw. The direct treatment gave specific instruction and the children only practiced throwing with three inch plastic balls. Pre-test and post-test measures included both accuracy and distance of throws. Intact classes were given a treatment with the individual children's scores used as the statistical unit of analysis. Data were analyzed in a 3x2x2 (instruction x gender x tests) analysis of variance with repeated measures on the third factor. A 2x2 (instruction x gender) analysis of

variance also was calculated for a novel throw for accuracy. Results showed that boys threw longer and more accurately than girls. There were no significant interaction effects among instruction, gender, and tests. In the discussion, it was suggested that the measurement used to determine throwing change (distance and accuracy) may not have been sensitive enough to measure changes in throwing. Roberton et al. (1979) concur with this point and state that there are many differences in the mechanics of the throw and that future research should measure qualitative in addition to quantitative measures of a skill.

The purposes of a study done by Toole (1982) were to evaluate transfer of movement education training to new skill performance and to evaluate skill improvements as a result of movement education or a traditional training program. Forty-seven first grade children were taught twice a week (a thirty minute class and a twenty minute class) for twenty weeks. Results showed that the teaching approach groups were not significantly different when measuring the transfer of training effect. Traditional learning was better than movement education in developing throwing, catching, and batting performances. These results suggest that when one's objective is to teach a specific skill within a

relatively short period of time, a command style with demonstrations is better than a movement education style.

In motor learning, the question remains whether error should be allowed, minimized, or eliminated. The psychological effects of continually performing incorrectly may cause frustration and discourage an individual from further participation (Singer, 1977). There is much disagreement about the function and desirability of error making in the process of learning. Some contend that learners benefit from their errors, that errors aid in problem solving development, and that the learner is more actively involved (Skinner, 1968).

Advocates of error minimization, on the other hand, express the concern that errors introduce poor habits that are repeated and thus learned (Kay, 1951; VonWright, 1957). In order for the correct response to be learned, the interferring errors must be unlearned. Therefore, making errors may impair later learning. Holding (1970) investigated the effects of error making in early learning on later learning. He found that subjects did tend to repeat errors but he concluded that making errors early in the acquisition of a skill had little effect on later learning.

Another important aspect of learning should be considered with the inclusion of errors. It has been

postulated that the difficulty involved with eliminating errors increases with age (Kay, 1951). Evidence to this fact is supported by a study done by Belbin, Downs and Moore (1970). They concluded that the older learner takes longer to emit a response and, therefore, will not as readily accept the notion that this original response is incorrect.

Prather (1969, 1971) conducted an experiment involving ninety-six student pilots who were trained on range estimation problems of an approaching target. Three groups were trained by trial and error involving feedback and three groups were trained by an errorless method. Overall, performances by the trial and error subjects were superior to the errorless subjects on all experimentally produced conditions. Conclusions from this experiment suggest that trial and error is a superior method of training if the task involved requires difficult perceptual learning. Possibly this method could be used when teaching perceptual motor skills. Other support has produced results that favor minimizing errors when instructing a basic task and time is a factor (Craig, 1953; Singer & Gaines, 1975; Singer & Pease, 1976).

Since this project's focus is fundamental motor skill acquisition and the effects of instruction, it

seems most appropriate, based on research results, to utilize a direct mode of instruction which is teacher centered. Literature verifies that this type of instruction is more effective when working with young children in a relatively limited time frame and when dealing with specific motor skills. One of the two treatments given to the subjects requires them gradually to gain mastery of a skill by initially performing inefficient movement. The data collected will allow a comparison of the learning gains of this group to those of the group that was guided through an error-free practice.

Pupil Characteristics

Research suggests that the optimal time to study motor abilities is in the early years due to varying types of practice situations and motivating influences from outside sources that seem to affect older children. In a longitudinal study, findings on children two and one-half to five and one-half years of age showed that they behaved in a uniform fashion and thus could be reliably tested on motor skills (Goodenough, 1935). Overall, many rapid changes in the motor ability traits of the growing child are seen the first five to six years of life as they experiment in an attempt to learn about

themselves and the environment (Cratty, 1979; Gallahue, 1982). Literature surveying these changes reveals that, generally, there is regular improvement with age (Cratty, 1979; Espenschade & Eckert, 1980).

There have been some studies that looked at the overall potential of the young child to perform motor tasks in a skillfull manner. Data analyzed by Cooper and Glassow (1963) did show that skillful performance was present in the throwing abilities of young children. Wickstrom (1970) selected six fundamental motor skills (running, throwing, catching, jumping, kicking, and striking) to study using high speed filming. Results indicated that there was progression in the development of motor patterns in young children and that advanced stages of performance approached those of skilled adults. In a study by Flinchum (1971), a comparison was made between children's throwing patterns and the same patterns of a skilled performer. Analysis indicated that the actual performance of the basic pattern was identical. The end results differed due to a strength factor involved, but joint angles, preparatory action, and follow through phases were the same.

The inherent abilities and experiences that learners have prior to instruction have been shown to be related to the academic achievement levels they will attain as a

result of instruction (McDonald & Elias, 1976). Leinhardt (1976) reported a .91 correlation between pre and post academic achievement. Studies of the correlation of pre-post achievement in the psychomotor domain report a much lower score, but these studies looked at ultimate success (product), rather than achievement over a specified period of time (Drowatzky, 1975; Singer, 1975; Trussell, 1965). Henry (1956) reported a .63 to .85 correlation of initial skill and final skill on three motor experiments. The skills included in these experiments were vertical jumping, balancing, and speed of arm movement.

A multitude of studies have shown that there are differences in skill ability with regard to gender. McCaskill and Wellman (1938) made a study of common motor achievements of the pre-school child. Not only did their results reveal a developmental trend in ability to perform certain tasks, but the boys, as a whole, tended to be superior in step and ladder tests, while the girls were superior in hopping and skipping. Guttridge (1939) also reported that girls tended to excel in hopping, skipping, and balance, while boys are superior in jumping and throwing. Physiological differences in regard to body structure and musculature account for some of the differences in abilities between the male and female. It

is also thought that social and cultural influences may affect an individual's ability to perform certain tasks.

Looking at the specific motor task of throwing, Roberton et al., (1979) studied longitudinal changes in horizontal ball velocities of second grade children. The boys' ball velocity increased by five feet per second each year. The girls' velocity increased by three feet per second. Year to year correlations indicated a modest tendency for the children to maintain the same relative performance level across the primary grades.

Cratty (1979) examined the techniques used to throw a ball. He found that the first attempts usually are rigid and underhanded, and that the following three to four years result in a wide variety of throwing patterns evidenced in children as they attempt to perform efficiently.

Espenshade (1980) describes the development of catching where initial attempts consist of arms stiffly extended with minimal, if any, effort made to move to the ball. A sense of timing is gradually developed so that a ball is scooped up against the body by more relaxed arms. Finally, the child develops the ability to anticipate and move to the ball.

In a study of ball catching achievements of pre-school children, Wellman (1937) described three basic

arm positions leading from immature to mature catching ability. These results are corroborated by descriptions presented recently by Espenshade (1980). Cratty (1979) studied the catching abilities of five year old children and found that the average five year old could catch a playground ball that is eight inches in diameter, three or four times out of five attempts.

After studying the catching ability of 27 eight year old boys, Victors (1961) attempted to identify components of the skill and patterns of motor response. The findings showed:

a. The age differences in the frequency of successful performances in catching the ball were not greater than chance.
b. The ball size did not differentiate successful and unsuccessful behavior at these age levels.
c. The components (stance, body alignment, arm position) were different with each level.

Other research directed at examining external influences on the skill of catching and throwing show varying results. Wellman (1938) and Warner (1952) produced data that support the assumption that larger balls are easier to catch. However, some findings suggest that the use of

large balls encourages an immature catching performance (Victors, 1961). Ridenour (1974) found that ball speed and horizontal direction affected the ability of seven year old children to detect the ball path accurately. In this same study, ball size showed no significant effect. Bruce (1966) found that velocity affected catching ability in seven to nine year olds, but not in eleven year old children. He also found that the ball trajectory had no significant effect on the catching success of the seven to eleven year olds. Gallahue's (1968) findings suggest that a lack of contrast between figure and ground, as well as any wall or movement distractions may affect the catching performance of a child.

Kay (1969) suggested three phases to learning a task, like catching, that require anticipation. She stated that it involves being able to perceive the ball and to predict and time the movements to coincide with the ball. Other studies support this notion by reporting that in early stages of learning to catch, the child focuses on the spot where flight is initiated (Stadulis, 1971).

Several studies focusing on the motor skill of jumping suggest developmental trends and describe successful versus unsuccessful jumping patterns. After

biomechanically analyzing successful and non-successful long jumping, Zimmerman (1956) stated that the better jumpers were the ones that efficiently utilized their arms through a greater range of motion. The most difficult type of jump to perform seems to be a jump for distance with a two-footed take off (Espenshade & Eckert, 1980). Data collected from five-year-old children reveal that on the average, the children can long jump a distance of almost three feet, using a two-foot takeoff and landing. Generally, girls' ability to jump for distance is less than that of boys, probably due to less leg strength (Cratty, 1979). A cinematographical study of jumping conducted by Hellebrandt (1961) reported the following conclusions:

a. Jumping is phylogenetic, with growth and maturation providing the mechanisms necessary to perform the jump.
b. Stepping off preceded the ability to jump off with two feet.
c. There is an automatic alignment of weight-bearing limbs upon landing. This provides protection upon impact at landing.
d. Initial performance finds upper extremeties serving as breaks by moving in an opposite direction to the line of motion. As

development occurs, the arms act as stabilizers, and finally are thrust forward to augment momentum.

The review in this section suggests that the best time to study skill acquisition is in the early years. This was kept in mind when the subjects selected for this research project were chosen. One of the most important facts gleaned from the literature is that young children are fully capable of performing fundamental motor skills in a qualitatively efficient manner. Care has been taken to include qualitative measures of learning within this study whenever possible. It is expected that the age differences seen in previous research will hold true in this present study and that the results will indicate that the older subjects perform better, generally, than do the younger subjects.

Summary

This review of literature presented facts, theories, issues, and questions that focus on learning, specifically motor skill learning. The major issue of this project was developed from the application of a stage theory to the study of motor development. Once realizing the content and purpose of the developmental stage theory, questions arise as to the limits of its

use. Originally, the stage theory was meant to be a diagnostic tool for identifying learner abilities. Now, practitioners demand a new challenge from this theory. Can it also be used prescriptively as a master plan for instruction? Should a fundamental movement curriculum specifically promote the learning and performance of each developmental stage along the continuum toward skilled performance? Obviously, research is necessary if we are to resolve this issue. The elements and implications described in the learning and teaching models in the second section of the literature review were developed into a composite model. This model served as a guidepost for this attempt to conduct field research. Inspection of the myriad of data about the learning environment suggests that no one teaching behavior or mode of instruction enhances learning all of the time or for all types of participants.

> "The question for researchers is not Skinner versus Bruner, creativity versus conformity, and so on along the path of opposing pairs; the question is when conformity? When creativity? When individualized instruction? When media? Every person, young or old, has experienced a multiplicity of learning and behaving styles.... Teaching, therefore, cannot be a one

dimensional form of behavior. The richer teacher is the one with the repetoire of behavioral models." (Mosston, 1972, p.5)

Utilizing the knowledge learned from this research review, this project studies the potential prescriptive usage of stage theory in a teaching-learning experiment. Young children, within a natural setting, were given two modes of instruction on three different motor skills. The results presented after the data are analyzed should provide useful insight into stage theory and its use within the instruction of fundamental motor skills.

CHAPTER III

METHODOLOGY

Data produced from a study are only interpretable if the methodological processes and limitations involved in the data collection are clearly explained. All of the activities and characteristics inherent in this project will be presented within this chapter. Specific information will include a list of the research hypotheses to be addressed, a description of the setting, selection and training of the participants, the experimental design and research procedures, and the statistical analyses.

Research Hypotheses

The following research hypotheses were addressed within this study:

H_1: There is no significant difference in the residual gain scores of qualitative and quantitative measures of throwing, catching, and long jumping between subjects instructed with a mature treatment and subjects instructed with a step-wise treatment.

H_2: There is no significant difference in the residual gain scores of qualitative and quantitative measures of throwing, catching, and long jumping between 3-4 year old subjects and 5-6 year old subjects.

General Setting Description

Participants and/or activities may be influenced by the unique characteristics of the surrounding environment. In order to interpret more clearly and accurately the occurrences that took place within this study and thereby to make appropriate conclusions, a brief description of the general setting and location will follow.

The project was conducted in a highly populated, urban neighborhood on the north side of Chicago. The experiment occurred in the natural setting of a school that maintains a policy which welcomes scientific endeavors and provides the flexible schedule necessary to meet the demands for completing research.

A multi-service agency that operates the largest licensed, pre-school, day care program in the State of Illinois was used in this project. In addition to infant and pre-school care, each year the agency's licensed kindergarten program, instructed by Illinois certified

teachers, services approximately two to four capacity-filled classrooms. The center participates in sharing community resources, and the children receive health screening and early intervention programs in academic subjects. These programs are provided by such agencies as St. Joseph Hospital, Chicago Board of Health, Illinois College of Podiatry, DePaul University Health Center, DePaul University Early Childhood Program, and the Chicago Board of Education. The school has no geographic enrollment boundaries and, because of its excellent reputation, many people travel quite far to allow their children to attend the school. Children and families presently utilizing care at the agency are primarily one-parent families of varied socioeconomic and ethnic backgrounds. Almost all of the parents are in need of day care services in order to work or to attend school.

Participants: Selection and Training

Young children were selected as the most appropriate subjects for this project in order to answer the research questions. Because a young child spends so much time participating in fundamental activities while playing, it is during this age period that these skills should be taught and developed. Research findings indicate that teachers make a greater difference in the learning of

younger children than in the learning of older ones, and that younger children are less capable of overcoming the effects of inadequate teaching (Good & Brophy, 1975). Therefore, a clearer picture of the effects of the treatments used in this project would seem more likely if young subjects were involved. Additionally, the population has never had formal school instruction in physical education. This would help to minimize the possible effects that previous professional training might have had on the data collected and would provide an appropriate population with which to test the stated hypotheses.

From the available sample of subjects (N=101), seventy (70) children enrolled in the kindergarten program who were five or six years of age and who were identified by the day care psychologist as not having learning problems participated in this study. Additionally, 31 three and four year old children who had no identified learning problems participated. The entire population included 55% male subjects (N= 52) and 42% female subjects (N= 42). Only data from subjects who attended 95% of the treatment sessions were included in the final analyses, thus eliminating seven subjects. Exact birth date, ethnicity, and socioeconomic level were made available to this author and recorded within the

data set. The subjects came from a wide variety of racial, ethnic, and socioeconomic levels. With regard to ethnicity, 55% of the subjects are Black, 24% are Hispanic, 16% are White, and 4% are Asian. Looking at economic level, the gathered information revealed that 44% of the population are from low income families ($0 - 6,081), 28% are middle ($6,081 - 8,660), and 29% are from high income families ($8,661 +). Subjects were assigned randomly to comparison groups and comparison groups were assigned randomly to treatments. The data produced from studying this mixed sample should permit more generalization of knowledge than if other more homogenously grouped subjects had been chosen.

Permission for the participation of the children in this study was requested from the administrative director of the day care agency. Contact with the director was initiated first by telephone and then by a letter (see Appendix A) that explained the general purpose of the study, guaranteed the anonymity of all participants, and clarified all of the managerial needs of the study. Assurance also was given that the study would cause minimal disruption to the usual program of the school. The director of the school then requested that this author prepare a verbal explanation to be presented to a group meeting of all the day care center teachers

involved. This was an attempt to answer any questions they might have had and to promote their full cooperation. A two-hour meeting was held which resulted in enthusiastic approval of the study from all of the teachers and the director and a request from them for the findings of the study at the completion of the project.

Permission for the participation of each child was requested in a letter that was sent to the parents or guardian (see Appendix B). The letter specified the voluntary nature of this study, guaranteed anonymity of all participants, and clearly outlined what the children would be asked to do. Parents were asked to sign a consent form and to send it back to the school. This form also asked the parents to indicate whether or not their child had ever participated, or was currently participating, in physical education instruction or any other type of movement class. Subjects from the original pool who had received previous instruction (14%) were not included in the data collection.

Physical education or movement classes are not made available to the children through the center, as there is no staff member qualified to deliver such an instructional program. Verified by the form sent to parents, the children used in this experiment never had received formal instruction in fundamental movement prior

to the initiation of this project. The children are given recess several times a day, either outside or in a gymnasium located in the same building as the kindergarten classrooms. Recess activities are limited to free-play using minimal equipment such as balls, ropes, and an outside swing set and slide. Supervision of recess is general in nature and is conducted by volunteer aides from senior citizen groups or by early childhood students from DePaul University. The research treatment given to these subjects in this study was in addition to their regular recess time.

The pre-service teachers assigned to instruct the children in this project were randomly chosen from several male/female undergraduate physical education majors who had participated in two ten-week courses and had successfully completed each set of course requirements (93 % average or better). The random selection was done to avoid any personal biases in the selection process. Both classes were held at DePaul University and were taught by this researcher.

The first course required of the pre-service teachers who participated in the study is a developmental movement class that focuses on the acquisition of gross motor skills in children and on the performance characteristics that reflect stages of development in

each skill. Students in this course are required to learn the developmental stage sequences of ten fundamental motor skills and to demonstrate their understanding by passing a written examination of stage characteristics. Additionally, students must demonstrate their ability to identify skill stages performed by children on video-tape and in live presentations and must be able to do this with a minimum of 90% accuracy. The students' proficiency at identifying actual performances is determined through a practical diagnostic examination where a child's performance is observed. The individual student writes down the stage determined most appropriate and lists three characteristics that validate the stage selection. In addition to the practical diagnostic examination, each student must complete a class project by developing a sequence of movement stages for an individually chosen motor skill.

The second ten-week class required of the pre-service teachers provided opportunities to practice instructing children by using teaching techniques that enhance motor skill learning. Through lectures, discussions, and practical experiences, the pre-service teachers were given instruction on a variety of planning and teaching strategies listed and defined below:

1. Content appropriate activities: Students

could include in their plans only those activities listed on a reference handout (see Appendix C). These activities were taken from motor development texts (Gallahue, 1982; McClenaghan & Gallahue, 1978) and a booklet from Michigan State University (Ulrich et al., 1983) which specifically indicate their appropriateness for teaching particular motor skills.

2. Instructional time: Students were instructed to keep explanations brief (1 to 4 minutes per focus) and not to overload the young children with too many facts at one time. They were to teach one important point about a skill at a time and then allow time for practice of the skill.

3. Maximum participation in practice activities: Good teacher to student ratio (no more than 5 students to 1 teacher) is very important toward enhancing learning. Each child should be provided with sufficient equipment, space, and time to actively practice the movement focus that was highlighted by the teacher. No child

should be allowed to watch for more than a brief moment or to sit out altogether.

4. Modeling Provided: Teachers should take an active part in the activities by performing the tasks in front of the children so that they could observe the movements. Teachers also should engage in the movements with the children throughout the lesson.
5. Task-Specific Feedback: Verbal comments, as well as tactile and visual cues, given to the child should point out specific movements that the child performed or needs to perform as he/she attempts to master a skill activity. This should be done immediately following the subject's performance. (i.e. "You reached forward when you jumped."; "You stepped forward on the opposite foot when you threw.")
6. Positive Reinforcement: Teachers should attempt to be enthusiastic and positive as they give feedback. As much as possible, each task-specific statement should initiate and conclude with some type of verbal praise that motivates further practice. (i.e. "Great job. You used

your hands to catch the ball. You are getting better and better!")

7. Orderly Learning Environment: Through verbal directions from the classroom teachers and the research director, the children were made aware of the fact that they should pay attention to their teachers and attempt to perform the activities. The learning environment should be organized by the teachers to be safe and supportive and the lesson plans should be adhered to within the specific time frame and content. Each lesson should include:
    a. Brief warm-up (3 to 4 minutes),
    b. Instruction (1 to 4 minutes),
    c. Practice activity (5 to 10 minutes),
    d. Repeat "b" and "c," and,
    e. Closure (1 to 2 minutes).

As a further course requirement and in order to provide opportunities to practice these teaching strategies, each student was assigned to teach fundamental motor skills to a small group of children (three to five children) from a local elementary school for eight weeks, two times per week for 30 minutes each

lesson. Students were asked to identify developmental stages of motor skills and to incorporate the pre-listed activities (see Appendix C) that would meet the needs of their assigned children as they learned to move.

Prior to actual teaching, the university instructor evaluated all lesson plans for appropriate content, efficient time allotment, and mention of modeling and other cues to promote learning. Written comments were given to the students about each aspect of the lesson plan and whether or not it structured an orderly learning environment. If revisions were necessary, the plans were submitted for review.

Each supervised teaching lesson involved the use of a checklist to assess the quality of a pre-service teacher's abilities (see Appendix D). After an observation period of 10 to 20 minutes per lesson, each criterion was evaluated by the university instructor using a teaching rating scale of 1 to 5, with 1 representing a poor teaching performance and 5 being superior. After each lesson, the pre-service teacher also completed a written self-evaluation, discussed the assessments with the instructor, and determined means for improvement.

In addition to being evaluated on lesson plans and teaching practices, students successfully completed two

written, objective and essay examinations covering all of the teaching strategies addressed throughout the term. If a student did not successfully complete the tests, they were given an opportunity to study and learn the material and to retake the exam in order to get a better grade.

After finishing both ten-week courses, only those students who successfully completed each set of course requirements and maintained a 93% or better average, as assessed by this author, were randomly selected and assigned to instruct groups of children for this ten-week experimental project. Participation in this study was on a voluntary basis, but it was used by the college students as a means for obtaining clinical hours necessary for their degree.

Each of these pre-service teachers attended two orientation sessions conducted by this author, both lasting approximately two hours. All of the pre-service teachers attended the first meeting, at which time the purpose, time schedules, organizational procedures, and all other aspects of the study were outlined. They also were told to which treatment group they had been randomly assigned. A second orientation meeting was held separately for the set of teachers in each treatment group. This was done to minimize any confusion that

might occur if both treatments were discussed simultaneously. This second meeting detailed specific activities (see Appendix C) that should be taught for each skill lesson. Students participated in the skill activities and were given hints for improving over-all teaching techniques (see Appendix E). These students were informed that all of the teaching sessions would be monitored by the author and another faculty member using a checklist (see Appendix D) to assess appropriate content and method.

This author and one other faculty member in the physical education program at DePaul University served as treatment supervisors. Both individuals have had over fifteen years of teaching experience and each has previously supervised over a dozen student teachers. Both faculty members currently teach methods classes and are much involved in teacher education.

In order to insure supervisor reliability in the task of monitoring the entire treatment, six separate one half hour practice sessions were conducted wherein six different pre-service teachers were observed simultaneously by the two supervisors. Following the same instrument used in the project (see Appendix D) and rating each criterion on a five point scale, a Pearson-product moment correlation of .92 was determined between

the scores of the two supervisors. This correlation verified the high inter-rater reliability of the two supervisors. Two subsequent assessments of the supervisors' reliability were conducted after the second week of the treatment and again after the sixth week of treatment. As in the initial reliability assessment, both supervisors simultaneously observed three-preservice teachers and individually rated their teaching performances. High reliability ($r = .90$; $r = .91$) was established for both reassessments.

Training for the pre- and post-test administration of the subjects involved the author and three hired assistants who otherwise were not involved in the study. A graduate student familiar with operating video-tape equipment filmed the individual performances of each child throwing, catching and jumping. After a practice filming in an effort to determine correct viewing angles, the graduate student did not participate in further training prior to the actual testing of the subjects. The two other assistants helped transport the subjects and also administered and scored the quantitative portion of the test which included measuring the long jump (to the nearest 1/4 inch) and the ball toss (number of successful catches out of twelve attempts). To determine the reliability of the assistants' measuring ability in

the long jump, six practice trials were done on DePaul University track members. Comparing the project assistants' scores to an official NCAA track judge, a correlation of .96 was achieved for measuring ability.

For the ball toss test, the author administered the twelve ball tosses to each subject. Two half-hour rehearsal sessions were conducted where the author practiced underhand tossing in an attempt to produce a moderately arching ball in a direct line with a target. Both assistants were trained to tally the number of successful catches. This was done so they could alternate catching and retrieving balls during the testing. Details of the entire testing procedure are found in the section entitled "Research Procedures."

Three raters were involved in assessing the quality of each subject's skill performances for both pre- and post-testing. One rater was a graduate student who received a bachelor's degree at Michigan State University and successfully completed several motor development classes focusing on skill sequences. This individual taught and supervised in two Michigan State University movement clinics (Remedial Motor and Motor Performance) and assisted in the collection of data for the validation of the stages. The other two raters were senior-level undergraduate students in the physical education program

at DePaul who successfully completed the developmental movement class and achieved a grade of 93% or better on course requirements.

All three raters participated in three one-half hour training sessions conducted by the author where they observed video-taped performances of children, discussed movement characteristics, and practiced rating skill levels. Elementary aged children were video-taped while jumping, throwing, and catching. Their performances were individually assessed by each rater and the author. All of the scores were analyzed using a Pearson-product moment correlation to determine inter-rater reliability. Results yielded an r of .91 to verify the reliability of the raters.

Skills Included in the Study

Incorporated into the treatment of this study was the instruction of three fundamental motor skills, catching, long jumping, and throwing. Because they are popular with children, as evidenced by their inclusion in numerous everyday play activities, it was felt that they would be meaningful to the children involved in this study and, therefore, promote greater motivation to learn. Generally, these skills are considered to be realistic activities in which young children can

participate and achieve efficient and mature levels of performance.

For the skills of catching and long jumping, both qualitative and quantitative measures were collected on each subject. For the skill of throwing, only a qualitative measure was obtained. Space and equipment were unavailable and prevented the testers from measuring distance thrown or velocity of a throw. After a review of the literature, a research decision was made not to include a measure for throwing accuracy. The ability to project an object and accurately hit a target is considered, by many, to be a more difficult task to accomplish for very young children than merely throwing (Keogh, 1965, 1973). Since the focus of this study is fundamental motor skill acquisition dealing with young children, the inclusion of a measure for accuracy was considered inappropriate under the conditions and procedures inherent in this study.

Experimental Design

There are two independent variables, age and treatment, each having two levels. The independent variable of age is composed of level 1, three and four year old subjects, and level 2, five and six year old subjects. The independent variable of treatment is

comprised of level 1, the mature treatment, and level 2, the step-wise treatment. A research design comprised of a pre-test, two treatment groups, and a post-test of an available sample of kindergarten and pre-school children was employed. The subjects were given a pre-test on throwing, catching, and jumping in random order and were randomly assigned to groups which were randomly assigned to treatments. Treatments continued for ten weeks, at which time a post-test on the same skills was given.

Several studies have indicated that some instruction and practice is better than none (Johnson, 1968; Maxey, 1967; Sexton, 1965). Therefore, this study was limited to an investigation to define which of two types of instruction produces greater learning. In essence, one treatment group is a control group for the other treatment, as there was a mature treatment and a non-mature treatment group (the step-wise group).

It has been suggested that research on instructional effects on motor skill learning might yield more information about learning changes if variables were assessed qualitatively (Gallahue, 1982; Roberton, 1977). This study attempted to analyze both qualitative and quantitative types of measures wherever possible. All of the collected data were analyzed using multivariate analysis of individual residual gain scores (Glass & Stanley, 1970).

The strengths of the design include the following:

1. Randomization procedures used to assign subjects to groups and groups to treatments balance out any prior factors (characteristics) of the subjects (race, socioeconomic level, sex, previous experience, nutrition, physiological and psychological maturation.)
2. Randomization procedures used to assign instructors to treatment groups balance any personality, physical, and methodological teacher effects brought to the study by the pre-service teachers.
3. Testing procedures were conducted by trained individuals who were proven to be reliable (r = .96), (r= .91).
4. Testing procedures were done at a slow rate and involved only one child at a time. This helped to avoid technician and subject fatigue.
5. The treatment activity was monitored and observed by trained supervisors throughout the ten week project. The reliability of the supervisors was very high (r = .92; r = .90; r = .91).

6. The treatment presntations were monitored and comparisons produced no significant differences between treatment group instructional behaviors.
7. The study was conducted in a natural school setting. This improved the generalizability of results to other similar natural settings.
8. The children were not told about the purpose of the study, therefore, treatment knowledge (Hawthorne Effect) was avoided.

Independent Variable of Instruction

The treatment focused on improving individual performances of three motor skills; throwing, catching, and long jumping. The two levels of treatment used to instruct the motor skills are referred to as mature instruction (treatment level 1) and step-wise instruction (treatment level 2).

In the mature mode of instruction, the subjects were assigned randomly to groups with no more than five subjects per teacher. Subjects received instruction, cueing, modeling, feedback, reinforcement, and practice activity that were specific only to the most mature stage

of each skill. No matter what level of performance the subjects demonstrated at entry level, they were not given instruction on the rudimentary stages that come prior to mature performance. Subjects already demonstrating mature performance participated in all of the instruction and practice at that level.

One teacher remained with a group for the entire length of the project. Throughout all of the instruction, pre-service teachers followed a lesson format that included modeling the skills several times, cueing, keeping instructions brief (1 to 4 minutes), and planning appropriate activities for practice (3 to 10 minutes on each component focal point). During practice time, teachers gave ongoing, task-specific feedback and encouraged participation as much as possible through positive verbal reinforcement.

Since most mature stages of skills involve several body parts working in harmony, the mature characteristics of each skill were presented using a whole-part-whole teaching technique. The entire skill in its mature form was demonstrated by the teacher several times and was accompanied by verbal cues. Then, a particular bodily action was highlighted (i.e. arm action in throwing) and the subjects were given activities that helped them coordinate that action into an efficient replication of

the movement (i.e. arm circles to emphasize low windup and follow through in a mature throw). This practice activity (3 to 10 minutes) was followed by another brief period of instruction (1 to 4 minutes) in which additional body action was highlighted and then practiced (3 to 10 minutes). Gradually, body actions were practiced in combinations (i.e. trunk rotation with full arm wind-up and follow through). Ultimately, the whole, mature performance was presented and practiced.

In the step-wise mode of instruction (treatment level 2), each stage in the developmental sequence of a skill, from the subject's entry level to a mature performance, was presented. This treatment level deliberately led the subjects from their present skill level through each subsequent stage as they progressed to mature performance. Research reported by Earls (1982) shows that practicing a less advanced pattern will generally hinder motor skill progress. This premise was adhered to and subjects did not practice a skill stage below the one at which they were presently performing.

The preliminary identification of stage level entry behavior for the subjects in the step-wise treatment group was done by the author so that the final raters did not see any video-tapes until the project was finished. In this way, the raters did not know which tapes were

pre-performances and which tapes were post-performances. All of the subjects that performed at a stage 1 in a skill were grouped together for treatment instruction. Likewise, all subjects that performed at stage 2 were grouped together. This grouping was consistent until all of the subjects were appropriately placed with no more than five subjects per one teacher.

Most of the subjects in the step-wise treatment group demonstrated different stages of entry level performance for each individual skill. For example, some of the subjects were at a stage 1 performance in the skill of throwing, but demonstrated a stage 2 in long jumping. In order to group the step-wise subjects, the author identified entry performances of each skill separately and listed them in specific groups. When a particular skill was focused in the daily lesson according to the ten week activity plan, the pre-service teacher assigned to teach that skill stage simply called the names of the subjects on the list who were assigned to that level.

The step-wise subjects progressed at their own rate of learning to a new teaching station and teacher after showing consistent performance at a more mature skill stage. Based on the pre-service teacher's decision, consistency in performance was determined after six repetitions within one lesson of a skill stage which was

more advanced than the one previously mastered. Rotation to a new stage practice group was not done until the next time that skill was taught according to the ten week activity plan (see Table 1). Pre-service teachers reported to the supervisor when they identified a subject that was ready to rotate to the next highest stage group. The supervisor then recorded this subject's name on a list of subjects assigned to the next station. Having one supervisor keep track of subject assignments helped to eliminate possible confusion, as step-wise assignments had to be rewritten almost daily. If a pre-service teacher had no subjects at his/her teaching station, then he/she assisted at another step-wise station. If any step-wise subjects already demonstrated a developmentally mature stage of performance as seen in the pre-test, they were given activities that provided opportunity for skill practice at that level.

The lesson format for the step-wise treatment was the same as that for the mature treatment. Skills were modeled several times by the teacher and accompanied by verbal cues. Instruction was kept brief (1 to 4 minutes for each focus) and practice activities lasted from 3 to 10 minutes. This practice time was followed by another brief skill explanation and then more practice time. This schedule continued until the session was completed.

Table 1

Ten Week Activity Schedule

Week	*Monday or Tuesday	*Wednesday or Thursday
1	throw	catch
2	jump	throw
3	catch	jump
4	throw	catch
5	jump	throw
6	catch	jump
7	throw	catch
8	jump	throw
9	catch	jump
10	review all three skills each day (10 minutes each skill each day)	

*The 5-6 year old subjects had their sessions on Monday and Wednesday, and the 3-4 year old subjects had their sessions on Tuesday and Thursday.

Throughout the one-half hour period, pre-service teachers provided task specific feedback accompanied by positive verbal reinforcement meant to increase interest and effort.

The developmental skill stages in the step-wise treatment level also were presented using the whole-part-whole teaching technique. Depending on what stage level was being taught, the specific charcteristics of that stage were demonstrated wholly several times, even though they were immature skill movements. Then, body actions were broken down (arms, trunk, legs) and explained so that opportunity for practicing that body action was included. Ultimately, the characteristics that made up each stage were performed wholly.

In order to control the instructional content of both treatment levels, a prepared list of teaching activities was used to develop the daily lessons (see Appendix C). Depending on what skill was being taught, pre-service teachers could choose from among the activities listed and present practice activities to the subjects in his/her assigned group. Only these listed activities were considered to be appropriate.

The teaching style used in both treatment levels is referred to by Mosston (1972) as the command style. Basically in this style, the teacher makes all of the

decisions and the student makes none. The subjects in the treatment groups were asked to attempt to perform as directed by the teacher and to use equipment in a similar manner. Because time was a limiting factor, this teaching style was the most efficient one with which to present information and to enhance maximum participation as opposed to learning through guided discovery. Research also shows this style to be most effective in learning skills (Mosston, 1972). In order to give feedback immediately following the skill attempt, the instructor called a subject's name aloud and then gave task-specific information and positive reinforcement. By doing this, it was hoped that all of the treatment group members would gain vicarious reinforcement toward better performance. The teachers made a point of addressing each subject several times during each lesson, in addition to giving mini-demonstrations and explanations to the entire group.

Independent Variable of Age

The subjects in this study were divided into two different chronological age groups. One group of subjects included only pre-schoolers who were three or four years of age. The second group of children was comprised of kindergarten children who ranged in chronological age from five to six years old. By

including two different groups in this study, it may be possible to determine if one treatment is more or less effective for a particular age group of learners.

Dependent Variables

The five dependent variables used in this study were the three qualitative measures and the two quantitative measures of subject performances on the three gross motor skills of throwing, catching, and long jumping. All of the dependent variables were scored numerically.

The qualitative measures of throwing, catching, and long jumping were determined by observing a video-tape of each subject's performance and rating the stage at which he/she performed, based upon total bodily movement. The method of assessing stages and the characteristics used to represent each stage were based upon studies done at Michigan State University (Seefeldt et al., 1982). These stages are based on many years of longitudinal and cross-sectional investigation using large numbers of subjects, and, as such, are highly recognized and accepted within the scientific community. In order to conduct this experiment, it was mandatory that someone maintained a level of expertise with regard to a set of fundamental skill stages. As a doctoral student at Michigan State University, this author successfully

completed several motor development classes and participated in three different movement programs (Early Childhood, Remedial Motor Clinic, and Motor Performance). All of these programs applied Michigan State stage sequences while involving children and pre-service teachers in physical education. This author also participated in the collection of some data that were used to validate and examine the reliability of the skill sequences. Because of these reasons, it was most appropriate that the skill stage sequences from Michigan State University be incorporated into the treatment of this experiment.

Each skill has its own number of developmental stages representative of movement characteristics (see Appendix F). A numerical scale was used which reflected at which stage a subject performed. The largest number in the scale represented the most mature performance possible for that skill, and the smallest number represented the least mature performance. Each subject's video-taped performances were viewed and scored individually by each rater. Every time a subject performed a skill at a Stage 5, he/she received five points. A performance at a Stage 4 level was scored four points, and so forth down to one point for a Stage 1 performance. An average score was determined from the

total number of points a subject received across five trials for each skill and this average was used in the data analysis procedures.

The remaining two dependent variables involved quantitative measures of catching and long jumping. The catching skill was measured by counting the number of successful catches a subject performed in twelve attempts. A successful catch was any ball, not dropped, that was put under control using the hands or arms or that was brought to the chest. The long jumping measure reflected the average recorded jumping distance to the nearest 1/4 inch that a subject performed on three trials. Specific procedures used in the skill testing can be found in the section titled "Research Procedures."

The three qualitative and two quantitative performance measures of the subjects were recorded to reflect entry level performance prior to the initiation of this research project. Exit behavior, as measured by final performances, reflected the subjects' same initial individual characteristics, plus the effects of instruction (treatment). A summary of the numerical scale used to record the dependent variables can be found in Appendix G.

The raw pre-test and post-test scores obtained on the dependent variables by individual subjects will be

converted into residual gain scores for the purposes of analysis. This is an attempt to measure the amount of learning (change) unrelated to initial performance that took place between pre-testing and post-testing as a result of the treatments. This method of analysis was chosen because authorities (Bereiter, 1963; Glass & Stanley, 1970; Sokol & Rohef, 1981) postulate that merely using difference scores will be negatively related with the pre-test scores upon which they are developed. In effect, this indicates that the performers with the lower pre-test scores will show the greatest amount of gain. Conversely, the difference of scores for those performers who start out at a higher ability level and who do not need to gain as much to reach the desired behavior, will reflect a lesser gain. Using residual gain scores in the analyses, therefore, can alter the possible conclusions derived from a statistical analysis and is an acceptable alternative as an indicator of learning change. A residual gain score measures learning by "fitting a straight regression line to the pre-test and post-test achievement test data and takes into account the variation from the regression line (errors of estimate) measured along the post-test axis" (Glass & Stanley, 1979, p. 182). This method of analysis controls for the depressor effect caused by merely using pre-post

difference measures and provides appropriate measures of the dependent variables.

Pilot Study

A pilot study was conducted in an attempt to verify the feasibility of the proposed project and to identify any methodological problems.

Eight kindergarten children were pre-tested on the three skills using video tape to record the quality of their performances. Additionally, quantitative measures were obtained for distance jumped and number of successful catches out of twelve attempts. The testing procedures used in the pilot study provided information about the time needed to do the pre-test and post-test, what equipment and staff was necessary, and the organization of the record keeping instruments.

The experimenter and one assistant presented the two treatments twice a week for four weeks. The step-wise treatment was originally going to be conducted exactly as the mature treatment was handled, with all of the children assigned to one pre-service teacher throughout the experiment. As a result of this pilot study, it was determined that providing individual skill stage instruction to a group of subjects who perform at different skill levels was tremendously difficult and the children were deprived of instructional time. It

required the teacher in the step-wise treatment group to simultaneously present as many as four different skill activities to meet individual needs within the one thirty minute session. This seemed to bias the treatment presentation in favor of the mature group whose pre-service teacher could present one activity to the entire group, regardless of their skill stage. Since the main focus of this project was to identify the effects of instructional techniques rather than classroom management techniques, it was decided that the step-wise group would be divided into stations according to their stage of performance as determined from the pre-test. A teacher provided the appropriate instruction at each station. When a child showed some consistency in performance (six times or more in one class period), he/she then would rotate to another station where the next skill stage would be addressed. This rotation did not take place until the next teaching session in order to eliminate as much distraction and loss of teaching and practice time as possible during the lesson.

Special attention was given to the placement of more than one teaching station in the gymnasium in order to avoid distractions which could affect a subject's response and attention to the treatment. A sufficient

amount of space between stations (20' to 30') was available and used, as well as a few portable partitions. Throughout the pilot study, the location of each teaching station did not prove to hamper any instruction or student activities which took place.

Testing Procedures

1. Each subject was asked to "throw the ball as hard as you can." The ball was a small 4 inch nerf ball and the subject threw the ball 5 times.
2. Next, the subject was asked to "catch the ball." A 6" fleece ball was thrown with a moderate arc from a distance of six to seven feet away. The parabolic path of the ball never reached a peak height of more than one foot above the subject's eyes. All of the balls were thrown in a direct line with the subject unless he/she demonstrated the ability to catch the ball easily using only the hands. It was assumed that a child who could not catch a ball thrown directly to them would have even more difficulty catching a ball that required them to move. Those subjects who successfully caught the first three balls with hands only were given an opportunity to catch a ball that was thrown one foot to the right or left of the subject in an attempt to see if the

subject would move in response to the path of the ball. This was done to determine if they were at a higher stage of skill development. No warning was given to the subject as to which side the ball would be thrown. All of the balls were thrown by the same trained test administrator. A minimum of five attempts at catching were performed by each subject.

3. Finally, the subject was asked to "jump as far as you can over the line." The masking tape line was 1" wide and 4' long. The experimenter stood in front of the subject with arms out-stretched in an attempt to motivate the subject to jump forward. Each subject was given three opportunities to jump.

The qualitative pre-test and post-test assessments each took approximately fifteen minutes per subject and were administered in the controlled environment of a gymnasium or multipurpose room located at the day care agency. The experimenter administered the tests to all of the subjects. Only the experimenter and one assistant operating the video equipment were present during the testing procedures. Another assistant was used to guide the subjects to and from the testing site.

The quantitative collection of pre-test and post-test data involved catching and long jumping only. No quantitative measure was obtained for the skill of

throwing, as some of the pre-testing took place in a multipurpose room which did not have sufficient space to permit throws for distance. All quantitative measures were collected by this author and two assistants and each session took approximately ten minutes per subject. The verbal directions given to the subjects and the procedures used to collect the quantitative information were identical to those used to collect the qualitative data.

Treatment Procedures

Treatment sessions were thirty minutes long and occurred twice a week for a ten week period. This schedule allowed three and one half weeks of instruction per skill. Each individual skill was taught for six 30 minute periods. In addition, 20 minutes of review was spent the last week of the treatment on each skill for a total instructional exposure of 200 minutes per skill (see Table 1).

For the older subjects, four pre-service teachers were involved in presenting the mature treatment, and four pre-service teachers were assigned to present the step-wise treatment. They were randomly assigned to present the treatments to subject groups totaling no more than five children per teacher.

For the younger subjects, three pre-service teachers were involved in presenting the mature treatment and three additional pre-service teachers presented the step-wise treatment. These teachers also were randomly assigned to subject groups totaling no more than five children each. Fewer teachers were needed for the younger age group than for the older age group as there were fewer subjects involved and only a few of the subjects demonstrated entry level performances reflecting consistent, mature skill levels.

The possible effect that the time of day may have had on the treatment was controlled by rotating the time at which the groups received instruction every week. All of the one-half hour sessions took place between nine o'clock a.m. and noon each day. The instruction times were as follows:

9:00 to 9:30	session one
9:45 to 10:15	session two
10:30 to 11:00	session three

Day care teachers transported the children to and from each session. All of the five and six year olds received treatment in the controlled environment of a large gymnasium, while the three and four year olds participated in a multipurpose room that had a wall divider to separate teaching stations. Both the

gymnasium and the multipurpose room were free from distractions and intruders during the sessions. The subjects' familiarity with both locations served to enhance their feelings of security while participating in the activities of this project. Treatment groups were widely separated (20' to 30' apart) at designated teaching stations in the gymnasium and in the multipurpose room and closely supervised so that distractions were kept to a minimum and contamination of treatment effects was avoided.

Monitoring Procedures

Two trained, reliable supervisors were present during each instructional treatment session. In order to assure that the appropriate treatment was taking place, each supervisor observed a pre-service teacher for five minutes and then rotated to another assigned teacher until all of the teachers to whom she was randomly assigned were observed. Then, the rotation began again. This system permitted each supervisor to observe each teacher several times during each session. A monitoring instrument was used by each supervisor which helped the supervisors focus on the most important aspects of the treatment (see Appendix D).

The criteria used to monitor the quality of the

treatment presentation were based on research that has analyzed the factors that enhance overall learning: appropriate content, succinct instruction followed by maximum participation in practice activities, use of cueing and modeling, task-specific feedback immediately following a performance, and an orderly learning environment. Each of the listed criteria on the instrument was thoroughly presented to and practiced by the pre-service teachers prior to this study during their prerequisite courses and follow up training. The supervisors' perceptions of these criteria were discussed during training and their ability to assess the quality of teaching was proved to be reliable.

The monitoring instrument required the supervisors to check if the activity was occurring and then to rate the quality of the teaching performance. A five point scale was used in which five points represented superior teaching, four points was excellent, three points was good, two points was fair, and one point indicated poor teaching ability. If a problem was noticed, the supervisor would immediately approach the pre-service teacher and resolve the situation. If a teacher consistently showed problems by scoring ones and twos on any criterion, the data from subjects who were taught by that teacher were not used in the final treatment

analyses. An average score for each criterion was computed for each teacher. The mean scores of teachers in the same treatment group were then averaged together for each separate criterion and compared to the average scores of teachers in the other treatment group to see if there were any apparant differences in teaching behaviors between treatment groups. All of the monitoring data were analyzed descriptively to report the effectiveness of the pre-service teachers' abilities. These data are repoted in Chapter IV.

Scoring Procedures

After all of the skill performances (pre and post) of the subjects were recorded on video tape, these video tapes were divided into three separate tapes and duplicated, each recording one-third of the subjects. In order to eliminate rater fatigue that could occur while attempting to rate a large number of subjects, a schedule was developed for viewing available tapes and taking time breaks between the viewing of each tape:

	Day One	Day Two	Day Three
Rater One	Tape 1	2	3
Rater Two	Tape 2	3	1
Rater Three	Tape 3	1	2

The video machine was turned off after the

completion of all trials for each individual skill so that the rater could rate each trial and average the scores across all trials of the skill before going on to the next skill (see Appendix H for a copy of the scoring sheet). A ten minute break was taken between every fifth performer. The skills were viewed with catching being rated first, then throwing, and finally long jumping. A numerical scale was used that reflected the stage at which a subject performed (see Appendix F). A copy of the scoring sheet is presented in Appendix H.

Statistical Analyses

To facilitate the analyses of the data resulting from this study, and therefore, to produce some answers to the hypothesized questions, the age and treatment groups were coded numerically:

Group 1 = 3 & 4 year olds in the mature treatment

Group 2 = 3 & 4 year olds in the step-wise treatment

Group 3 = 5 & 6 year olds in the mature treatment

Group 4 = 5 & 6 year olds in the step-wise treatment

Data were collected for each of these groups and then results were compared to other groups within the study. Each comparison was tested for significance ($p \leq .05$).

Pre-test and post-test means and standard deviations

for the dependent variables were recorded. Also, residual gain scores are reported as they form the basis for subsequent analysis.

Multivariate analysis of residual gain scores of individual subjects on the five dependent variables was used to test the hypothesized statements. This statistical process allows an investigation of an overall effect by taking into account the simultaneous influence of the dependent variables on the subjects (Volicer, 1984). A Wilk's Lambda was used to report the results of the multivariate analysis. When the lambda test produced a rejection of the null hypothesis, discriminate function analysis was applied to the data to determine which elements contributed most to the discrimination between the groups. Discriminate function is considered to be an appropriate follow-up test to multivariate analysis because of the related measures involved (Huberty, 1975; Tatsuoka, 1971).

Overall, generalizations were drawn that discuss the main effects of treatment and age group. Additionally, the interaction of treatment with age group was considered in order to see if the effect of one of these independent variables varies across the categories of the other independent variable.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of this study was to determine if one type of instruction facilitated motor skill learning more than another. The research design was begun with a total of one hundred and one subjects who were divided randomly into treatment groups. Data from seven subjects were eliminated due to their excessive absence from the treatment, although these subjects continued to participate in the treatment activities until the end of the project. Thus, the results are reported on a reduced sample of 94 children.

Initially within this chapter, sample size will be presented according to treatment group. Next, descriptive results on pre-test and post-test data, residual gain scores on the dependent variables, and scores obtained on the monitored instructional behaviors are presented. Then, each research question and hypotheses will be stated, followed by the results of the Manova analysis. Discussion of the results accompanies each question being addressed.

Sample Size According to Treatment and Age Group

The sample size according to treatment and age is presented in Table 2. More five and six year old subjects were involved in the study than were three and four year old subjects. This was based purely on the availability of the subjects. Each 3-4 year old treatment group had 14 subjects, while the 5-6 year old mature treatment group had 31 subjects and the 5-6 year old step-wise group had 35 subject.

Means and Standard Deviations for Pre-Test and Post-Test Data

In an effort to clearly describe the subjects used in this study and to determine at which ability level they performed prior to the application of the treatments, the means and standard deviations for the qualitative and quantitative pre-test scores on throwing, catching, and long jumping for both treatment groups and ages were recorded (see Table 3). These pre-test scores indicated that within each age group, on the average, the process of randomized assignment of subjects has yielded skill levels that are comparable. The younger subjects scored lower than the older subjects on all measures except for catch quantity, where the 3-4 year old mature treatment group caught more balls (average = 9.43) than

Table 2

Sample Size by Treatment Group and Age Group

Age and Treatment	Number of Subjects
3-4 year old:	
Mature	14
Step-wise	14
5-6 year old:	
Mature	31
Step-wise	35

Table 3

Means ($\bar{X}$) and Standard Deviations (SD) of Pre-test Stage Scores for 3-4 and 5-6 Year Old Subjects

Variable	$\bar{X}$	SD
Throw Quality		
Mature Treatment: 3-4	2.00	1.12
Step-wise Treatment: 3-4	2.11	1.04
Mature Treatment: 5-6	3.03	1.07
Step-wise Treatment: 5-6	2.69	1.23
Catch Quality		
Mature Treatment: 3-4	2.61	0.63
Step-wise Treatment: 3-4	2.46	0.79
Mature Treatment: 5-6	3.31	0.74
Step-wise Treatment: 5-6	3.13	0.79
Jump Quality		
Mature Treatment: 3-4	1.64	0.69
Step-wise Treatment: 3-4	1.42	0.73
Mature Treatment: 5-6	1.75	0.62
Step-wise Treatment: 5-6	1.81	0.65
Catch Quantity		
Mature Treatment: 3-4	9.43	0.94
Step-wise Treatment: 3-4	8.86	1.56
Mature Treatment: 5-6	9.39	2.25
Step-wise Treatment: 5-6	9.63	2.10
Jump Quantity		
Mature Treatment: 3-4	23.69	7.84
Step-wise Treatment: 3-4	23.77	5.27
Mature Treatment: 5-6	41.90	6.87
Step-wise Treatment: 5-6	39.68	6.72

Note: A. Qualitative mean scores represented the average stage of performance within the developmental sequence of stages for the specific skills. The possible qualitative skill score for throw and catch was 1 to 5; for the jump, the possible score was 1 to 4.
B. The unit of measurement used for jumping was distance jumped in inches. For catching, the score was based on the number of successful catches out of 12 attempts.

did the 5-6 year old mature treatment group (9.39).

The means and standard deviations reported in Table 4 include the pre-test and post-test data. An examination of these scores indicates that there was improvement in the scores at the end of the treatment period as compared to the pre-test data. This result was anticipated due to the information gleaned from the review of literature which suggests that instruction does make a positive contribution toward learning (Brophy, 1980; Werner, 1974; Reidinger, 1973; Masche, 1969; Dusenberry, 1952). For the post-test scores, both treatment groups within the same age category were rated at similar qualitative stages of performance and at similiar quantitative levels of performance. Generally, the older children outperformed the younger children. Literature focusing on age-related abilities seems to support the likelihood of these results (Wickstrom, 1983; Cratty, 1979; Gallahue, 1976).

Residual Gain Scores

Cell means and standard deviations of the residual gain scores for each dependent variable for both 3-4 year old treatment groups are shown on Table 5. With the exception of the mean residual score for throw quality of the step-wise group (0.319), all the actual post-test

Table 4

Means ($\bar{X}$) and Standard Deviations (SD) of Pre-Test and Post-Test Stage Scores for 3-4 and 5-6 Year Old Subjects

Variable	Pre-Test $\bar{X}$	Pre-Test SD	Post-Test $\bar{X}$	Post-Test SD
Throw Quality				
Mature 3-4	2.00	1.12	2.10	1.20
Step-wise 3-4	2.11	1.04	2.40	1.10
Mature 5-6	3.03	1.07	3.60	0.90
Step-wise 5-6	2.69	1.23	3.30	1.20
Catch Quality				
Mature 3-4	2.61	0.63	3.10	0.57
Step-wise 3-4	2.46	0.79	2.90	0.45
Mature 5-6	3.31	0.74	3.80	0.67
Step-wise 5-6	3.13	0.79	3.60	0.71
Jump Quality				
Mature 3-4	1.64	0.69	1.90	0.43
Step-wise 3-4	1.42	0.73	1.90	0.69
Mature 5-6	1.75	0.62	2.30	0.81
Step-wise 5-6	1.81	0.65	2.30	0.61
Catch Quantity				
Mature 3-4	9.43	0.94	10.00	0.82
Step-wise 3-4	8.86	1.56	10.00	1.30
Mature 5-6	9.39	2.25	11.00	1.50
Step-wise 5-6	9.63	2.10	10.00	1.70
Jump Quantity				
Mature 3-4	23.69	7.84	24.60	8.20
Step-wise 3-4	23.77	5.27	25.20	4.10
Mature 5-6	41.90	6.87	42.40	6.10
Step-wise 5-6	39.68	6.72	42.50	6.40

Note: Qualitative mean scores represented the average stage of performance within the developmental sequence of stages for the specific skills. The possible qualitative skill score for throw and catch was 1 to 5; for the jump, the possible score was 1 to 4.

The unit of measurement used for quantitative mean scores in jumping was distance jumped in inches. For catching, the quantitative mean score is based on the number of successful catches out of 12 attempts.

Table 5

Means and Standard Deviations of Residual Gain Scores for 3-4 Year Old Subjects

Variable	Means	Standard Deviations
Throw Quality		
Mature	*-0.574	0.772
Step-wise	0.319	1.064
Catch Quality		
Mature	-0.194	0.556
Step-wise	-0.315	0.520
Jump Quality		
Mature	-0.238	0.354
Step-wise	-0.198	0.523
Catch Quantity		
Mature	-0.352	0.712
Step-wise	-0.236	1.091
Jump Quantity		
Mature	-0.702	1.846
Step-wise	-1.142	2.552

*The negative sign indicates that the actual post scores of these subjects were less than the predicted post scores using residual gain scores in the computation.

N = 14 subjects per treatment group

values of the 3-4 year old treatment groups were less than the estimated post-test values using residual gain scores in the computation. The measure for jumping quantity showed the greatest variability of scores for both 3-4 year old treatment groups (standard deviation = 1.846 for the mature group; standard deviation = 2.552 for the step-wise group). With the exception of the post measure for catching quality and jumping quantity, the actual post scores of the 3-4 year old step-wise subjects were closer to the estimated scores than the actual scores of the mature subjects (smaller mean residual gain scores for the step-wise group).

For the 5-6 year old subjects (see Table 6), on the other hand, the actual post-test scores for the mature and step-wise treatment groups were greater (positive mean residual scores) than the estimated post-test scores for every measure except for catch quantity in the step-wise group (-0.004), and jump quantity in the mature group (-0.489). With the exception of the step-wise post-test mean score for jump quantity (1.603), all post-test mean scores for the 5-6 year old mature treatment group were higher than the scores of the 5-6 year old step-wise group.

Summarizing the residual data (see Tables 5 & 6), the estimated trend that is indicated is that the

Table 6

Means and Standard Deviations of Residual Gain Scores for 5-6 Year Old Subjects

Variable	Means	Standard Deviations
Throw Quality		
Mature	0.246	0.816
Step-wise	0.140	1.006
Catch Quality		
Mature	0.167	0.662
Step-wise	0.057	0.624
Jump Quality		
Mature	0.124	0.689
Step-wise	0.065	0.602
Catch Quantity		
Mature	0.281	1.431
Step-wise	*-0.004	1.557
Jump Quantity		
Mature	*-0.489	3.862
Step-wise	1.603	4.531

*The negative sign indicates that the actual post scores of these subjects were less than the predicted post scores using residual gain scores in the computation.

Mature Treatment Group N = 31

Step-wise Treatment Group N = 35

treatments seem to have a more positive effect on a particular age group. The 3-4 year old subjects in the step-wise group, generally, produced better gain scores in three of the five measures than did the 3-4 year old subjects in the mature treatment. This is not a strong indication, but does show a slight tendency. For the 5-6 year old subjects, the gain scores of the mature group, generally, were better in four of the five measures than the scores of subjects in the step-wise group. This is a much stronger indication.

Although the span of time that exists between a child 3 or 4 years old and a child 5 or 6 years old is relatively small, many experiences and much growth and development occur during these few years (Krogman, 1980; Keogh, 1985; Ziachkowsky, 1980). Evidence exists that the memory functions of encoding, rehearsal, and organization are less effectively used in young children than in older children (Thomas, 1984). Learning can depend on the ability of the child to attend selectively to stimuli (Keogh, 1985; Gallahue, 1980; Leithwood, 1971; Cratty, 1979). If there are too many things for the child to comprehend and ultimately respond to, the attentional capacity of the learner may be overloaded. Since the mature treatment in the current study incorporates demonstrations of the most advanced form of

a skill, and requires the subjects to practice moving their body parts using efficient, complex patterns, there may be too many skill components for the immature, preschool child to address and simultaneously combine. Also, the maturational level of 3-4 year old subjects may not be developed enough to enable them to perceive all of the stimuli that are presented during the mature treatment session (Keogh, 1985; Cratty et al., 1973). Due to a lack of body awareness, minimal experience at intergrating body movements, and/or an underdeveloped kinesthetic sense, the child may be able to focus only on one or two aspects of a skill (Birch & Lefford, 1963; Connolly & Jones, 1970; Lazlo & Bairstow, 1980). These developmental or maturational effects may lead to the suggestion that the step-wise treatment is a more appropriate curricular approach to instructing very young children. Since this teaching approach begins with a child's current level of performance and gradually progresses toward advanced movement, the step-wise treatment establishes more realistic goals at smaller increments and, therefore, may enable the lesser developed child to achieve more success.

The presence of the abilities to selectively attend to stimuli, to coordinate body limbs, and to be aware of body parts may have allowed the 5-6 year old subjects in the mature treatment group to progress more than the 5-6

year old subjects in the step-wise treatment group. The mature treatment provided the environment and the opportunity to practice performing skills at a more mature skill stage, while the step-wise treatment kept the learners on a stage-by-stage schedule. Those 5-6 year old subjects who were maturationally ready were able to progress more when given the mature treatment as indicated by the residual gain scores of the 5-6 year old mature group.

Ratings of Instructional Behaviors of Teachers Administering Treatments

In order to ensure appropriate treatment presentation, the instructional behaviors of the teachers administering the treatments were monitored and rated. Twenty monitoring instruments were completed for each teacher over the ten week period, and no teacher's data were eliminated from the final analysis due to ineffective administration of the treatment (a score of less than 4 on a criterion). Each individual teacher's scores on each criterion were averaged, and then an average score was computed for each treatment group on each of the teaching behaviors. The mean scores recorded in Table 7 for the 3-4 year old treatment groups and the mean scores recorded in Table 8 for the 5-6 year old treatment groups indicate that, on the average, all of

Table 7

Means ($\bar{X}$) and Standard Deviations (SD) of Rated Instructional Behaviors for 3-4 Year Old Treatment Group Instructors

Rated Teaching Behaviors	Mature Treatment		Step-wise Treatment	
	$\bar{X}$	SD	$\bar{X}$	SD
1. Content Appropriate	4.3	.45	4.5	.20
2. Brief Instruction Focus	4.4	.10	4.4	.07
3. Maximum Participation	4.8	0	4.8	.16
4. Modeling	4.4	.10	4.6	.35
5. Task Specific Feedback	4.4	.45	4.3	.45
6. Positive Reinforcement	4.8	.16	4.7	0
7. Orderly Learning Environment	4.3	.35	4.6	.45

N = 3 teachers per treatment group
Rating range = 1 representing poor, 2 representing fair, 3 representing good, 4 representing very good, and 5 representing excellent.

Table 8

Means ($\bar{X}$) and Standard Deviations (SD) of Rated Instructional Behaviors for 5-6 Year Old Treatment Group Instructors

Rated Teaching Behaviors	Mature Treatment		Step-wise Treatment	
	$\bar{X}$	SD	$\bar{X}$	SD
1. Content Appropriate	4.5	.25	4.5	.41
2. Brief Instruction Focus	4.6	.25	4.3	.28
3. Maximum Participation	4.2	.26	4.4	.26
4. Modeling	4.3	.24	4.6	.24
5. Task Specific Feedback	4.6	.42	4.4	.45
6. Positive Reinforcement	4.7	.55	4.5	.45
7. Orderly Learning Environment	4.6	.50	4.4	.49

N = 4 teachers per treatment group
Rating range = 1 representing poor, 2 representing fair, 3 representing good, 4 representing very good, and 5 representing excellent.

the teachers in each of the treatment groups received teacher behavior criteria ratings ranging from 4.2 to 4.8. Since the criteria rating scale went from a lower limit of 1 to a higher limit of 5, these scores can be considered relatively high ratings. The relatively high ratings earned by the novice teachers involved in this study gives some credibility to the teacher education program in which they were trained. The effectiveness that these pre-service teachers demonstrated gives support to the idea that teachers can be taught successfully to perform instructional activities that seem to promote learning.

A t-test of the difference between treatment group means was applied to the instructional behavior mean scores. Results from the analysis indicated that there was no significant difference (see Table 9) between the instructional behaviors presented in the mature treatment and those presented in the step-wise treatment.

Results of Multivariate Analyses

Using the Statistical Analysis System (SAS) computer package, multivariate analysis (MANOVA) was applied in a 2 x 2 (treatment x age) analysis. The data collected on the residual gain scores of throwing quality, catching quality, long jumping quality, catching quantity, and long jumping quantity were used as the dependent variables to test the hypotheses.

Table 9

Results of a t-test Comparing Treatment Group Mean Scores of Instructional Behavior

	Mature Treatment	Step-wise Treatment	t	DF
N	14	14	-.110	26
Mean	4.493	4.500		
SD	.193	.147		

probability = .91 (one tail)

probability = .999 (two tailed)

The first research question addresses whether or not there is a significant difference in the residual gain scores on the dependent variables between those taught by the mature treatment and those taught by the step-wise treatment.

H_1: There is no significant difference in the residual gain scores of qualitative and quantitative measures of throwing, catching, and long jumping between subjects instructed with a mature treatment and subjects instructed with a step-wise treatment.

The results of the multivariate analysis (see Table 10) indicate that there is no statistically significant interaction effect between treatment and age group ($F = 1.13$, $p \leq 0.3521$). An investigation of the main effects, therefore, is appropriate as a follow-up. A multivariate analysis of the main effect of treatment indicates that there is no significant difference between the two treatment groups ($F = 1.15$, $p \leq .3381$). The null hypotheses, therefore, is accepted.

Quantitative measures have been used often as indicators of change. An instructional emphasis placed on both quantity and quality of performance in this study was based on more current research that suggests that

Table 10

Multivariate Anaylsis of the Effects of Treatment by Age Group, Treatment, and Age Group

Effect	df	Multivariate F	p
Treatment x Age Group	5/87	1.13	0.3521
Age Group	5/88	3.73	0.0041*
Treatment	5/88	1.15	0.3381

*Significant at the .05 level

Dependent Variables: Three Qualitative Measures: Throw, Catch, Long Jump

Two Quantitative Measures: Catch, Long Jump

merely using quantitative measures to determine skill ability (ie. distance jumped) may not be a perspective sensitive enough to reflect all of the mechanics necessary to perform a skill and, therefore, identify skill improvement or learning change. The inclusion of a qualitative factor in this study may have influenced the results that were obtained. It is possible that permanent qualitative change needs more time to develop than does the quantitatively measured end-product of a performance. The musculature needed to control the force involved in fundamental skill performance may readily show improvement, just from maturation and participation in practice activities. Conversely, the kinesthetic awareness and coordination of several body parts that are involved in a skill may take much longer to develop and to be evident as improved qualitative performance. Future research endeavors might lengthen the treatment period or look at the data in a longitudinal manner in order to allow more time for effects to become apparant.

In an investigation of the overarm throw, Hrkal (1977) compared two treatments very much like the treatments in this current study. A group of 38 subjects who ranged in age from 37 to 65 months was used in this study. Skill stages were applied to instruction (treatment) within two experimental groups. One

treatment group received a mature stage V instruction like the mature treatment in this study, and the other group in the Hrkal study was taught stage by stage, like the step-wise treatment in this study. A total of 240 minutes of instruction (treatment) was administered. Hrkal documented the amount of time (number of sessions) each subject took to move from one stage to another and compared treatment groups on this basis. A greater amount of skill variance was noted from the mature group during the on-going process of the treatment. Some of the subjects in this group skipped preliminary stages of instruction and attained a near advanced ability stage after only one session.

One rationale for the Hrkal results suggests that if children are exposed to mature performance instruction and modeling, those who are maturationally able will advance at a faster pace than those who are not. Since no advanced skill performance was included in the stage-by-stage treatment until the third session, variability of scores was less. The children in this group that might have advanced more quickly were prohibited from doing so by being kept on a stage-by-stage schedule.

Although the documentation done in the Hrkal study shows that there were different on-going process effects between treatment groups, the analysis of the subjects'

final levels of performance produced findings similar to the current study. There were no significant differences in the skill performances between the two treatment groups.

The second research question asks whether there is a difference in the gain scores on the dependent variables between 3-4 year old subjects and 5-6 year old subjects.

H_2: There is no significant difference in the residual gain scores of qualitative and quantitative measures of throwing, catching, and long jumping between 3-4 year old subjects and 5-6 year old subjects.

This null hypothesis is rejected based on the multivariate analysis (see Table 10) which shows a significant difference between age groups ($F = 3.73$, $p \leq .0041$).

A follow-up discriminate analysis was employed to the data to determine what factors contributed most to the classification of age groups (Klecka, 1980). In the step-wise approach that was used, the effects of the five variables were combined and looked at simultaneously to determine if this unique combination had a significant effect on age group determination (see Table 11).

Table 11

Discriminate Function: Combined Effects of All of the Variables and Their Significant Contributions to Age Group Discrimination

Variable	F	p
Residual Gain Jump Quality	5.480	0.021*
Residual Gain Throw Quality	9.465	0.003*
Residual Gain Catch Quality	6.963	0.009*
Residual Gain Catch Quantity	1.945	0.167
Residual Gain Jump Quantity	5.592	0.020*

* Significant at the .05 level

Results indicated that four of the five variables, when combined, were significant contributors to age group discrimination. The variable that contributed most to the discrimination was throw quality ($\underline{F}$ = 9.465, $p \leq 0.003$). Catch quality was the next most significant contributor ($\underline{F}$ = 6.963, $p \leq 0.009$), followed by jump quantity ($\underline{F}$ = 5.592, $p \leq 0.020$), and jump quality ($\underline{F}$ = 5.480, $p \leq 0.021$). The only variable that did not significantly contribute to the age group discrimination was catch quantity ($\underline{F}$ - 1.945, $p \leq 0.167$).

The next step in completing the discriminate function analysis is to remove, from the group combination, the most significant contributor. In this case, the effects of throw quality were eliminated. This new combination of four variables was examined to determine which ones still had significant effects on the age group determination (see Table 12). Jump quantity was the only remaining variable to have a significant effect ($\underline{F}$ = 4.483, $p \leq 0.037$). Consequently, the result of this analyses indicated that knowledge of scores on throwing quality ($\underline{F}$ = 9.465, $p \leq 0.003$) and scores on jumping quantity ($\underline{F}$ = 4.483, $p \leq 0.037$) allow for a significantly better than chance classification into perceived age groups (see Table 13).

Table 12

Step 2 of Stepwise Discriminate Function: Combined Effects of All of the Variables Except Throw Quality

Variable	F	p
Residual Gain Jump Quality	3.035	0.085
Residual Gain Catch Quality	2.366	0.128
Residual Gain Catch Quantity	1.654	0.202
Residual Gain Jump Quantity	4.483	0.037*

*Significant at the .05 level

Table 13

Discriminate Function Analysis Results for Age Group: Two Variables That Contributed Significantly To Discrimination Between Groups

Step Number	Variable Entered	F - to Enter	p
Step 1	Residual Gain Throw Quality	9.465	0.003*
Step 2	Residual Gain Jump Quantity	4.483	0.037*

*Significant at the .05 level

It was hypothesized and verified through the MANOVA (see Table 10) that the data from this study would yield significant differences between age group performances with the older children doing better. There is a wealth of cross sectional and longitudinal data available that substantiate the conclusion that skill level generally improves with age (Keogh, 1985; Wickstrom, 1983; Morris et al., 1982; Roberton et al., 1979; Connelly, 1968; Malina, 1968; Fleishman, 1964; Bayley, 1935). The developmental process combines experience with biological, affective, and cognitive maturation and results in a readiness to learn and perform (Seefeldt, 1975). As children develop, they become more aware of their bodies and their environment, increase their repetoire of abilities, and perform in a more efficient, consistent, and effective manner.

Throwing quality and distance jumped were the two factors that contributed most to the discrimination between age groups as indicated by the discriminate function analysis (see Table 13). Generally, the probability exists that the older child has had more time to practice moving than the younger child by the very nature of his/her age. Therefore, the older child may be able to coordinate the bodily movements necessary to perform a throw with more efficient qualitative results.

For a skill like jumping that requires force production, limb length and musculature influence a child's ability to perform such a skill. Research indicates that the two-footed jump for distance is the most difficult type of jump to perform (Espenshade & Eckert, 1980), and a certain degree of leg strength is necessary to exert sufficient force to lift the body off the ground. With regard to the developing child, gains in height and weight progress at a uniform rate. The proportion of muscle tissue remains constant at 25% until the fifth year, when 75% of the gain in weight is attributed to muscle tissue (Espenshade & Eckert, 1980). This increase in muscle tissue allows the older child to produce a higher level of muscular effort than the younger child. Finally, a degree of balance and neuromuscular control is necessary to perform a long jump, as the performer must maintain in-flight and landing equilibrium and body control. Again, research verifies the more advanced abilities of a 5-6 year old over a 3-4 year old (Cratty, 1979).

In the final discriminate analysis, the two other qualitative measures (catch and jump) were not significant. Although the older children did perform better than the younger children in these skills, the difference between age group performances was not enough

to be significant. Quite possibly, as indicated earlier, qualitative change takes longer to become apparant and, therefore, these skill measures did not contribute to the age group discrimination.

The measure for catching quantity showed the least amount of contribution for the classification of age group (see Table 11) and was the only measure that was not significant ($\underline{F} = 1.945$, $p \leq 0.167$). One possible reason for this result might be the short distance from which the subjects were asked to catch the thrown balls (6 to 7 feet), as well as the soft toss of the ball following a low arc and direct path. The distance may have been too short and, therefore, too easy for both age groups. According to Cratty (1970), the average 5 year old can catch a ball that is bounced from a distance of 15 feet away. An increase in the distance between the thrower and the catcher should be included in future research and a comparison made of performance levels measured from a variety of distances.

In summarizing the results obtained from this research endeavor, the descriptive data indicates that both of the treatments, involving skill stages, were successful at promoting learning in young children. Further, the pre-service teachers who presented the treatments, successfully performed the instructional

behaviors they were trained to do in order to enhance learning. Although slight, a trend is evident that suggests that the treatments have a more positive affect on a particular age group.

The inferential analyses of the data do not reveal any significant differences in the interactive effects of treatment with age. Similarly, there were no significant differences in treatment effects. The analyses of the effect of age was proven to be significant and the review of literature supports this finding. Examination of the stepwise discriminate function analyses clearly indicates that throwing quality and jumping quantity were the two most powerful discriminators between age groups.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A summary of the underlying purposes of this study will be presented initially within this chapter with a brief description of the procedures that were implemented. The next sections will provide an overview of the findings from the descriptive analysis of the data and the results of the inferential analyses specific to each research hypothesis. Conclusions will be stated and suggestions for future research endeavors will bring this chapter to a close.

While concerning itself with the comparative effects of two instructional approaches to the acquisition of fundamental motor skill, as well as with specific age group differences, this study applied a stage theory approach to analyzing movement. Sequenced, bodily movement characteristics made up the skill stages which were incorporated in the treatment presentation, as well as in the pre-post assessment of change in ability level. The combination of these qualitative stages with quantitative measures were analyzed to measure the treatment effects on the dependent variables.

One instructional approach, the mature treatment, presented instruction of only the most efficient movement patterns in the stage continuum involved in performing the skills. This was done regardless of the subject's current skill level. The other approach, the step-wise treatment, taught the preliminary stages of a skill prior to its mature performance. This step-wise instruction began with the subject's current level of ability, and continued toward mature performance at the subject's own rate of learning. Both treatments were administered for 30 minutes twice a week for a period of ten weeks.

Throughout the treatment period, the trained teachers who were involved in presenting the instructional activities were monitored by trained supervisors who were tested and proven reliable. The monitoring was done to insure that the treatments were conducted appropriately.

Pre and post measures were taken on the five dependent variables. Qualitative measures of throw, catch, and long jump were obtained from video-taped performances which were rated in terms of their developmental stage. The quantitative measures of catching and long jumping involved counting the number of successful catches out of twelve attempts and measuring distance jumped to the nearest 1/4 inch, respectfully.

Residual gain scores were computed for each subject's scores, and then averaged to reflect treatment group means. Multivariate (MANOVA) analyses were applied to determine if any significant differences in learning gains existed between treatment groups and between age groups.

The descriptive data collected herein did indicate that the utilization of skill stages in the development of an instructional plan (treatment) did promote learning. An examination of pre-test and post-test data (see Table 4), as well as the trend seen in the residual gain score data (see Tables 5 & 6), suggest positive change in skill performance. This information warrants further application of the stage approach to research on instructional effects.

The multivariate analysis of the residual gain scores obtained on the dependent variables (see Table 10) indicated non-significant differences between the interactive effects of treatment with age group ($\underline{F}$ = 1.13, $p \leq .352$), and the main effects of the two treatments ($\underline{F}$ = 1.15, $p \leq .338$). The MANOVA examination of age group did show significant differences between groups ($\underline{F}$ = 3.73, $p \leq .004$) (see Table 10). Step-wise discriminate function analyses revealed that scores on throwing quality ($\underline{F}$ = 9.465, $p \leq .003$), and scores on

jumping quantity ($F = 4.483$, $p \leq .037$) contributed most to the age group classification (see Table 13).

The following conclusions are made based on the findings, limitations, and scope of this investigation:

a. Both instructional approaches (mature and stepwise) similarly affect motor skill learning, based on the non-significant difference in their effects suggested from the MANOVA analyses (see Table 10).

b. Differences in skill level are, generally, apparent between children 3-4 years old and children 5-6 years old, with the older children, generally, outperforming the younger children. This is evident from the means and standard deviations reported in the descriptive section of this study and the multivariate analyses of age group differences.

c. There are significant differences in the ability to throw in terms of quality, and the ability to jump for distance between 3-4 year old children and 5-6 year old children. This is apparant from the discriminate function analysis applied to the data (see Tables 11, 12, 13).

More investigation which compares the effects of these same curricular approaches is necessary. The recommendations expressed here are meant to facilitate research related to this topic.

The first recommendation this author poses is meant to address the use of qualitative and quantitative measures of motor skill learning. It is suggested that skill performance be viewed in a manner that allows simultaneous measurement of quality and quantity. To do this would require video-taping equipment and assistance. Obviously, this recommendation is not practical for an individual physical educator in a typical school setting, but it could easily be accomplished within the design of a research project. If simultaneous viewing is not possible, then separate sessions could be planned which would still allow the inclusion of both types of measures. Results of investigations of this type could clarify issues about the relationship of skill measures, skill acquisition, and the development of prescriptive curricula.

Since the concept of age can be defined chronologically and maturationally, it is suggested that future research include specific assessments of both indices of age. With the addition of information about the maturational level of the subjects, treatment effects may be more discernable. It is also suggested that other age groups be compared with regard to treatment effects.

To reiterate the suggestion made in an earlier section, if qualitative and quantitative skill

improvement are to be assessed, the administration of the treatment should be lengthened by conducting longitudinal studies. Some forms of change may take longer to become evident. Periodic assessments of performance levels over a span of several years may be the only way to verify if these changes do occur. A study could teach to skill mastery and use time taken to get to mastery as the dependent variable.

In order to allow more finite qualitative changes to be identified, it is recommended that future research employ a different point system than the one used within this study. Rather than only using whole numbers to evaluate skill level, transitional periods could be indicated by using half numbers (i.e. 1.5). This will allow change to be noted more precisely.

Although the mechanics of applying a monitoring system throughout a research project seem tedious and requires additional assistance, the process gives additional assurance to the researcher when conclusions are reported. Checking the reliability of the monitoring supervisors periodically throughout the project will help to verify that the treatments were implemented as designed.

In conclusion, a final recommendation gleaned from the results of this study, and the review of literature

that preceded it, addresses skill assessment. Many test components that are administered to assess motor skill ability and fitness use quantitative standards as their base. Only recently have researchers presented assessment instruments that focus on qualitative characteristics of performance (Ulrich, 1985; Haubenstricker et al., 1981; McClenaghan & Gallahue, 1978; McClenaghan, 1976; Seefeldt & Haubenstricker, 1976). Training sessions are needed for the physical educators whose task it is to assess the qualitative skill ability of school children. An instrument should be developed that incorporates measures of both quality and quantity and contains a formula for totaling these measures into a complete ability profile which is useable in addressing the needs of the learner.

APPENDIX A

Letter To Agency

APPENDIX A

LETTER TO AGENCY

Dear Teachers and Administrators:

The subject of how children learn and what teaching methods enhance learning is a research endeavor of many educators. Through my work as a doctoral student and my previous fourteen years of teaching physical education, health and language arts at the elementary level, I have developed a particular interest in studying growth and motor development and their effects on cognitive, social and psychological aspects of learning in children. Investigating motor skill acquisition in youth can provide valuable information for elementary and physical education teachers, and can guide institutions such as DePaul University's School of Education in planning better curriculum for teacher education.

I am most appreciative that you are willing to allow a study to be conducted within your facility. Data will be collected through observation of the children's motor abilities; namely, throwing, catching and jumping. The children will be observed in April and again ten weeks later. During the interim, physical education students from DePaul University, who have undergone special training, will teach the children approximately twice a week for a thirty minute lesson.

You can be assured that all of the information collected during the course of this study will be kept strictly confidential and the identity of the children, teachers and school will remain anonymous. The general findings obtained through analysis of the data will be sent to all interested parties, including parents, teachers and school administrators.

Again, may I thank you! Your participation in this project allows research to be conducted within a realistic setting that can give greater insight into how learning takes place. If you have any questions, do not hesitate to call me at 341-8124.

Sincerely,

Kathryn C. Wiggins
Instructor, Physical Education

APPENDIX B

Letter To Parents and Consent Form

APPENDIX B

LETTER TO PARENTS AND CONSENT FORM

Dear Parent(s) or Guardian:

The subject of how children learn and what teaching methods enhance learning is a research endeavor of many educators. Through my work as a doctoral student and my fourteen years of teaching at the elementary level, I have developed a particular interest in studying growth and motor development and their effects on cognitive, social and psychological aspects of learning in children. Movement is an important part of a child's daily activities and investigating exactly how children learn to move and control their bodies can provide valuable information for the elementary and physical education professions. It can also guide institutions such as DePaul University's School of Education in planning better programs in teacher education.

We are planning a research project involving the DePaul Day Care Center. Data collection procedures for this study include the observation of children's motor abilities; namely, throwing, catching, and jumping. The children will be observed at the end of April and again ten weeks later. During the interim, physical education students from DePaul University, who have undergone special training, will teach the children approximately twice a week for a thirty minute lesson. The lessons will be directed at improving motor abilities through specific instruction and creative activities and games.

You can be assured that all of the information collected during the course of this study will be kept strictly confidential and the identity of the children, teachers and school will remain anonymous. Individuals will be free to discontinue participation in this project at any time during the course of this study. After the study has been completed, information concerning its findings will be sent to all interested parties including parents, teachers and school administrators.

The purpose and procedures of this study have already been explained to your child's teacher and school administrator, and each of them has agreed to participate in

this project. However, the approval of all parents/guardians is also needed. This letter constitutes a request for your permission to allow your child to participate in this study. Once again, be assured that all information collected will be totally confidential and your child's name will be replaced with a subject number as soon as the information is collected. If you do approve of the purposes of this study and will allow your child to participate, then please complete the attached form and return it to the address listed at the bottom on this letter or have your child return it, the form, to his or her teacher. If you have any questions concerning this project, you can call or write me at the address listed below.

Your permission will be greatly appreciated as it will allow research to be conducted within a realistic setting. It is only through studies such as these that more knowledge concerning how children learn can be gained.

Sincerely,

Kathryn C. Wiggins
School of Education
Physical Education Program

KCW:ljm

APPENDIX B

LETTER TO PARENTS AND CONSENT FORM
(continued)

PARENTAL CONSENT FORM

1. I have read the information contained in the accompanying letter concerning the proposed project which is being conducted with children attending the DePaul Day Care Center and I will give permission to allow my child, to participate as a volunteer in the study conducted by Kathryn Wiggins.

2. I understand that I am free to withdraw my consent and discontinue my child's participate at any time.

3. I understand that the results of the study will be treated in strict confidence and that my child's identity will remain anonymous. Within these restrictions, results of the study will be made available to me.

4. I understand that my child's participation in the study does not guarantee any beneficial results to him/her or me.

5. I understand that I can receive additional explanation of the study, at my request, after my child's participation is completed.

SIGNED

DATE

Please list any physical education or movement programs in which your child has or is currently participating:

APPENDIX C

Activity List for Throwing, Catching, and Long Jumping

APPENDIX C

ACTIVITY LIST FOR THROWING, CATCHING, AND LONG JUMPING

THROW

NOTE: Throwing and catching skills require different sized balls for young, unskilled performers, for throwing:

a. objects should be small enough to be gripped easily with one hand such as a tennis ball, bean bag or yarn ball.
b. encouragement to throw hard/far is more conductive to optimal performance than throwing for accuracy in early learning.
c. targets used should be large, colorful and numerous to provide much success.

1. Throw balls high into the air (up and over shoulder).

2. Have child sit on bench and throw (to inhibit throwing underhand).

3. Drape old bed sheet between volleyball standards (or any relatively tall objects such as a chair, piano, or balance beam) for child to throw over.

4. Place a lot of large targets at varying heights on wall to encourage throwing. Have some as low as their body height.

5. Play "Clean Up Your Own Backyard" - form two groups, one on each side of the room, with divider such as balance beam or low table. Give each group numerous yarn balls, foam shapes, etc. to throw into the other group's backyard. Balls continue to be thrown back and forth.

6. With feet in forward stride position rock back and forth transferring weight (may pretend to be on a boat rocking with the waves). May add verbal cues such as "rock, step and throw."

7. Place a rope on floor in front of child and ask child to step over the line and throw (could use masking tape line, etc.).

8. Step onto (or off) carpet square or base and throw into (or out of) hoola hoop.

9. Place footprints on floor to encourage correct step.

10. Stand on edge of gym mat, step off onto floor and throw.

11. Place elastic band with bells on it around ankle of contralateral foot so a correct step and throw will "ring the bells."

12. Place sticker on shoe or scarf around ankle of contralateral foot.

13. Remind child to use both sides of body; throw with hand on one side, step with foot on the other.

14. Use hand held crepe-paper streamers while child practices arm circles emphasizing low wind-up and full extension of arm.

15. Stand behind child and hold throwing object. Child must reach behind to get object to throw.

16. Develop verbal cues that rhytmically coincide with throwing pattern. i.e. "Step and Throw."

CATCH

Helpful hints for working with catching:

a. use large, soft, colorful balls such as beachballs, nerf balls, light plastic balls.
b. objects such as stuffed animals, foam shapes, semi-deflated balls are helpful.
c. difficulty in catching increases as speed of ball tossed increases and as size of ball decreases.
d. check ability of child to grasp with hands as well as hand-eye coordination by spending time practicing picking-up and squeezing objects of different textures and shapes (i.e., foam, yarn, rubber, square, round).

1. Hang a ball or other attractive object on a rope for child to move to and catch.

2. Roll ball across floor to child to "catch."

3. Partners sit across from each other on floor and roll back and forth.

4. As a group, form a circle and play ball chase - pass several differently sized balls around from person to person, starting one ahead of the other; cat chases the mouse, farmer chases the rabbit, etc.

5. Place ball on an incline so it can roll down a path and directly into child's arms.

6. Roll ball across table top to child.

7. Toss balloon to child to reach for and hit, or grasp.

8. Manually assist child who does not move until the ball or balloon contacts arms, i.e., stand behind child and manipulate arms.

9. Encourage child to keep elbows close and just in front of body to catch.

10. Assist child in using arms and chest to catch by tossing cylindrically shaped objects such as a nerf shape or pillow.

11. Have child drop ball to self, catching after it bounces once.

12. Ask child to toss ball lightly to self (toss it up and catch it).

13. Bounce large ball to child.

14. Suspend ball on a rope and swing it toward child who reaches for it with hands only.

15. Swing suspended ball to child's right or left side so child must move to catch it.

JUMP
(horizontal)

1. In a circle holding hands all rock back and forth on heels and toes trying to roll onto tip toes.

2. In a circle, flex and extend knees rhythmically, rising higher and higher onto toes until feet leave the floor.

3. Without actually jumping, practice preparatory leg movements (rhymical flexion and extension) then add arm movement.
   -may add teacher led drum beat or clap to help children feel rhytmical pattern.

4. Play "Jack in the Box" - pretend to be kangaroos or popcorn popping.

5. Do bouncing action (rhythmical flexion/extension). If legs on trampoline and with support from an adult try to push up off the tramp bed.

6. Play "Pop Goes the Weasel" - sing the song moving in a circle and bending low. On the 1st few words have children stop, drop arms down and backward with elbows flexed and on word "pop" they swing arms forward and upward while extending the legs and hips to jump.

7. Jump in place, as high as possible.

8. Jump from a step onto floor (working toward two footed landing), place a piece of noisy material such as a securely fastened flat pie plate on floor where child is expected to land; instruct child to listen for sounds produced by feet.

9. Jump from one level to another - down or up, from mats to floor, various stairs to steps to mats, bench to floor.

10. Jump many small jumps, horizontally or vertically.

11. Jump over objects:
    a. single objects - foam shapes, animal pictures, wooden sticks, rope, lines.

b. let child put any number of items in a row to decide how great a challenge to try jumping over.
c. place two ropes on floor parallel to each other to jump, gradually moving them farther apart after each jump (pretend ropes form a river or moat).
d. place two ropes on floor so child can choose challenge.
e. place a series of colored lines on floor so that child can self test for distance.

APPENDIX D

Monitoring Sheet for Treatment Administration

APPENDIX D

MONITORING SHEET FOR TREATMENT ADMINISTRATION

Pre-Service Teacher: Date:

Treatment Group: Skill:

Supervisor:

Criteria	Present	Rating	Comments
1. CONTENT APPROPRIATE: Only listed activities are incorporated into lesson.			
2. INSTRUCTIONAL TIME BRIEF: 1 to 4 minutes and only one focus at a time.			
3. MAXIMUM PARTICIPATION: No more than 5 subjects and all are involved.			
4. MODELING PROVIDED: Teachers are actively engaged in demonstrating.			
5. TASK-SPECIFIC FEEDBACK: Verbal comments point out specific things to do to improve.			
6. POSITIVE REINFORCEMENT: Teacher is enthusiastic and provides positive verbal comments (praise).			
7. LEARNING ENVIRONMENT ORDERLY: Warm-up (3 - 4 minutes); Instruction (1 - 4 minutes); Practice (3 - 10 minutes); Closure (1 - 2 minutes).			

Rating Summary
5=Superior 4=Excellent 3=Good 2=Fair 1=Poor

APPENDIX E

Teaching Hints

APPENDIX E

TEACHING HINTS

General Teaching Hints

1. Be friendly to your student(s). It is necessary to develop rapport with your student and to instill a feeling of trust and acceptance.

2. Be enthusiasitc! Enthusiasm is contagious and will often serve as a strong motivating force for your student.

3. Be firm and consistent. At times the student will test your intentions by refusing to participate in the planned activities or by engaging in activities of their own choice. Firmness and consistency can reduce undesirable behavior on the part of the student.

4. Strive to remain objective in your assessments. Try to obtain factual information, either quantitative or qualitative in nature. This will enable you to determine whether or not progress has been made.

5. Exercise patience. Gains for some students come slowly and it is not difficult for either student or instructor (or both) to become frustrated with the apparent lack of progress in the remediation of gross motor problems. However, loss of patience seldom yields positive results.

6. Attempt to be creative in your approach. Select model activities or use equipment in new ways to reduce boredom and to enhance motivation. Such creativity must, however, be purposeful and not introduced for its own sake.

7. Keep instructions brief, clear and appropriate to the capacities of the student. Lack of adequate performance may be due to inadequate directions. Maintain eye-to-eye contact whenever possible to detect facial signs indicating confusion.

8. Plan for success. Successful experiences are necessary for progress to occur. Tasks must be presented so that enough success is experienced to encourage continued participation. Failure will lead to frustration and avoidance of the activities which are most needed.

9. Provide for the safety of the child. Do not force children to participate in an activity which is potentially dangerous. Attempt to set up your activities so that there will be minimal interference with those of other students in the area.

10. It may be helpful to allow the student to choose an activity to practice periodically. The student may also be involved in setting the goals for which he/she will strive by the end of the term. These practices may serve to maintain interest and to motivate the student.

11. Observe the behavior of the student carefully. Loss of attention may require a change in activity or a new approach to the task.

12. Overplan! If a planned activity does not work, try a different approach with your child that will still focus upon the objective you have identified.

13. As an instructor in the gym your main objective is to alter the child's motor behavior in a positive manner. Class time, therefore, should NOT be considered merely a free-play experience.

14. Enjoy yourself. Although teaching is a challenging activity, it is also very rewarding. If the experience becomes completely frustrating, ask your supervisor for suggestions.

APPENDIX F

Qualitative Stage Breakdown for Throwing, Catching, and Long Jumping

APPENDIX F

QUALITATIVE STAGE BREAKDOWN FOR THROWING, CATCHING AND LONG JUMPING

Dependent Variable One: Throwing Quality

Stage One:	"Chop" throw, feet stationary, no spinal rotation.
Stage Two:	"Sling" throw, block rotation of body.
Stage Three:	Ipsilateral step, high wind-up, little spinal rotation.
Stage Four:	Contralateral step, high wind-up, little spinal rotation.
Stage Five:	Contralateral step, low wind-up, segmented body rotation.
Numerical Scale:	1 - 2 - 3 - 4 - 5 (immature) (mature)

Dependent Variable Two: Catching Quality

Stage One:	Delayed arm action, arms straight in front untill ball contact, then scooping action to chest, feet stationary.
Stage Two:	Arms encircle as ball approached, ball is "hugged" to chest, feet stationary.
Stage Three:	"To chest" catch, arms scoop under the ball to trap it to chest, single step may be used to approach ball.
Stage Four:	Catch with hands only, feet stationary or limited to one step.
Stage Five:	Catch with hands only while body moves through space to meet the ball.
Numerical Scale:	1 - 2 - 3 - 4 - 5 (immature) (mature)

Dependent Variable Three:	Long Jumping Quality
Stage One:	Arms act as "brakes," large vertical component legs not extended.
Stage Two:	Arms act as "wings," vertical component still great, legs near full extension.
Stage Three:	Arms more forward on takeoff, hands to head height, takeoff angle still above 45 degrees, legs often fully extended.
Stage Four:	Complete arm and leg extension at takeoff, takeoff near 45 degree angle, thighs parallel to surface when feet contact for landing.
Numerical Scale:	1 - 2 - 3 - 4 - 5 (immature) (mature)

APPENDIX G

Summary of Numerical Scale for Qualitative and Quantitative Ratings of Throwing, Catching, and Long Jumping

APPENDIX G

SUMMARY OF NUMERICAL SCALE FOR QUALITATIVE AND QUANTITATIVE RATINGS OF THROWING, CATCHING, AND LONG JUMPING

Dependent Variable One: Throwing Quality

Numerical Scale: 1 - 2 - 3 - 4 - 5
(immature) (mature)

Dependent Variable Two: Catching Quality

Numerical Scale: 1 - 2 - 3 - 4 - 5
(immature) (mature)

Dependent Variable Three: Long Jumping Quality

Numerical Scale: 1 - 2 - 3 - 4 - 5
(immature) (mature)

Dependent Variable Four: Catching Quantity

Numerical Scale: 1.....12

Dependent Variable Five: Long Jumping Quantity

Numerical Scale: Average distance to the nearest ½ inch.

APPENDIX H

Raters Checklist for Qualitative Assessment of Throwing, Catching, and Long Jumping

APPENDIX H

RATERS CHECKLIST FOR QUALITATIVE ASSESSMENT OF THROWING, CATCHING AND LONG JUMPING

Examiner:

Date: Tape #: Pretest or Posttest

PERFORMER #

	Throw	Catch	Jump
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
Average:	_____	_____	_____

PERFORMER #

	Throw	Catch	Jump
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
Average:	_____	_____	_____

PERFORMER #

	Throw	Catch	Jump
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
Average:	_____	_____	_____

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