A COMPARISON OF SELECTED BASIC GROSS MOTOR SKILLS OF
MODERATELY RETARDED AND NORMAL CHILDREN OF
MIDDLE CHILDHOOD AGE UTILIZING THE OHIO
STATE UNIVERSITY SCALE OF INTRA
GROSS MOTOR ASSESSMENT

DISSERTATION

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

by

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**********

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TO MY BROTHER NEIL
ACKNOWLEDGMENTS

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CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Introduction

History has revealed the neglect and mistreatment of the mentally retarded by civilization upon civilization. Past societies have predominantly viewed mental retardation as a disease or immutable condition, with those afflicted individuals having little human potential. For years, research and humanitarian efforts directed toward solving the problems of the mentally retarded were almost nonexistent.

It has only been since the late 1950's and early 1960's that the plight of the mentally retarded has significantly improved. During this period, a humanistic approach regarding the management of the mentally retarded emerged. Conscientious individuals in education, psychology, medicine and other fields of study began to view mental retardation as a behavioral condition which could be altered with appropriate intervention techniques.

It was also during this period of time, that the Federal Government, State Governments and philanthropic organizations began to concentrate their efforts on the problems of mental retardation. As a result of these
efforts, the attitude toward the mentally retarded changed significantly. Once completely disregarded, a new emerging attitude which considered the mentally retarded as potentially productive members of society who differ from their fellow men only in the extent of their disability evolved.

The philosophic change, during the 1950's and 1960's regarding mental retardation as a behavioral condition, a condition which could be altered, led many investigators to direct their attention to this encompassing problem. As a result of this, answers to many problems and issues focusing on the mentally retarded were brought forth.

Presently, there is still a growing concern for the understanding and the management of the mentally retarded. Although a great deal of time, efforts and monetary resources are being utilized today to search for explanations to debatable issues and questions concerning the mentally retarded, many problems and questions with respect to the mentally retarded lie unanswered.

Many of the unresolved issues and pressing questions which remain to be investigated center around the field of physical education and motor development of the mentally retarded. The physical education profession is in its embryo stages in terms of research on motor development programming for the mentally retarded. Formal recognition of the need for physical education for the retarded was not
made within the physical education profession until 1965. At this time, the American Association for Health, Physical Education and Recreation (AAHPER), in cooperation with the Joseph P. Kennedy, Jr. Foundation established the Project on Recreation and Fitness for the Mentally Retarded to provide assistance and encouragement to schools and agencies in the development of programs of recreation and fitness activities for the mentally retarded.

The Project on Recreation and Fitness for the Mentally Retarded provided for the first time a coordinated effort, a vehicle of communication and a national emphasis in these areas. The formation of this Project, the interest of many professionals and the changing attitude toward mental retardation helped to create and promote the need for more research into physical education and motor development of the retarded.

As a result of these events, a great deal of research into physical education practices and motor development of the retarded was undertaken by professionals in the field during the middle 60's and early 70's. Emanating from this upsurge of research were many answers to unresolved questions and suppositions of the past and solidifications of already known tenets.

As a consequence of this wave of research, two things evolved. One, the importance of physical education and
recreation as an essential activity for mentally retarded individuals was magnified and second, other questions, issues and problems suddenly became more apparent and of great importance to physical educators working with the mentally retarded, i.e., behavioral techniques applied to physical education settings for the mentally retarded.

In 1970, at a Research and Demonstration Conference, sponsored by AAHPER and the National Recreation and Park Association, the continuation of research efforts into program planning for the retarded, leisure education for the retarded, parental services for the retarded and the professional preparation of personnel to work with the mentally retarded were strongly urged (2).

In 1975, the American Alliance of Health, Physical Education and Recreation (1) emphasized the growing need for research into the area of motor development of the moderately mentally retarded child. Additional support for new research was highlighted in a Bureau of Education for the Handicapped Report (36) on the psychomotor development of young handicapped children. This report illuminated numerous gaps in the research literature to date, i.e., motor skill development of the young moderately retarded, and promising extensions of existing research that need to be examined through carefully constructed investigations.
Furthermore, the President's Committee on Mental Retardation (41) has fortified its position relative to mental retardation and has called for a joint effort by all to "manifest knowledge where there is an absence of knowledge and to seek facts so that future directions in the field of mental retardation can be charted" (p. iii).

With this thought as a central focus, it is the hope of this writer to contribute in some small way in the effort to reduce the knowledge gap revolving around the motor development of moderately mentally retarded children.

The Problem

Statement of the Problem

The primary purpose of this study was to compare selected basic gross motor skill performances of moderately mentally retarded children and children of normal intelligence through utilization of a criterion referenced assessment tool, the Ohio State University Scale of Intra Gross Motor Assessment (102). More specifically, the investigation attempted to determine if qualitative differences existed between these two groups in the performance of the skills of walking, running, hopping, jumping, throwing, catching, kicking, striking, skipping, ladder climbing and stair climbing. Furthermore, the investigation sought to resolve the following sub-problems:
1. Does the basic gross motor skill performance of moderately mentally retarded children and normal children differ according to their chronological ages?

2. Do similar levels of basic gross motor skill performance exist for both males and females?

Delimitations

The following limitations may have affected the results of this investigation:

1. Only one assessment tool, the Ohio State University Scale of Intra Gross Motor Assessment, was utilized to collect data on the basic gross motor skill performance of the mentally retarded and normal children.

2. The investigation was limited to one hundred and twenty moderately mentally retarded children and one hundred and twenty children of normal intelligence, ranging in chronological age from six to eight years. Through consultation with the County Board of Mental Retardation from which the children participated, the intelligence levels of the moderately mentally retarded children were determined to be between twenty and fifty-five.

3. The moderately mentally retarded children were selected from seven special schools servicing moderately mentally retarded children in the State of Ohio. The children of normal intelligence were selected from the
primary grades of a public elementary school in Upper Arlington, a suburb of Columbus, Ohio. There was no attempt in the selection process to control for socioeconomic variables of either group.

Assumptions

It was assumed that: (1) the Ohio State University Scale of Intra Gross Motor Assessment was a reliable means of gathering data on basic gross motor skill performance, (2) the testing procedures for all children involved in the study were uniform, and (3) a high inter-judge reliability existed for those individuals involved in data collection.

Rationale

Three primary concerns contributed to the significance of this investigation, namely: (1) physical education and its relationship to the adaptive behavior of the retarded, (2) the substantiated absence of information relative to the qualitative nature of the gross motor skill performance of the moderately retarded child, and (3) the need for greater understanding of the motoric behavior of mentally retarded children by physical educators and other personnel involved with motor development programming for the mentally retarded.

In order to more clearly understand the signifi-
cance and scope of this investigation, these three primary concerns will be discussed at length.

Physical Education and Its Relationship to the Adaptive Behavior of the Retarded

As defined by Leland (37), adaptive behavior refers to the ability with which an individual copes with the natural and social demands of his environment. Physical educators can play a significant role in this adapting process at various ages throughout the retarded individual's life. Through the physical education environment, skills facilitating appropriate adaptation by the retarded individual to his/her environment are developed.

With deficits in adaptive behavior becoming the major criterion in the classification for mental retardation, an individual's level of motor functioning or the ability to function in the motoric realm has evolved as a critical factor in determining an individual's level of adaptive behavior.

It is apparent that deficits in the motor development sphere may create problems for an individual in terms of adapting to his or her environment (i.e., mobility, visibility, vocational opportunities). It is also apparent that improvements in an individual's motor development level may enhance that person's adaptation to his/her environment. As evidenced through many physical education
programs, improvements in the area of motor functioning leads to greater mobility and less dependence, improved fitness levels for vocational pursuits, improved opportunities for social interaction, and greater opportunities for leisure and recreational activities in the retarded population. In short, a sound physical education program can lead to reduction of deficits reflected in maturation, learning and social adjustment of the retarded (8, 45), and thus contribute to the overall quality of life of the retarded individual.

If an individual's adaptive behavior is significantly improved, that person's visibility within his environment may be diminished. This reduction in visibility, and improved adaptive behavior may eventually lead to the amelioration of that individual being classified as mentally retarded or lead to a more normalized course of life for the individual.

Substantiated Need for Information Concerning the Moderately Mentally Retarded

Having reviewed the literature on motor development of the mentally retarded, a number of impressions emerge. First, there seems to be a complete absence of investigations on the psychomotor development of the young moderately mentally retarded child (preschool and primary
level children). This impression is supported by a report from the Bureau of Education for the Handicapped on the psychomotor development of young handicapped children (Vasquez Associates, 1975). The importance of understanding the motor development of this group of children cannot be overlooked. It is often said that the early years are most formative and important in an individual's life. The growing number of early education, infant education and preschool programs bear witness to this fact. As indicated earlier, an individual's motor development level has many important implications, but without a clear picture of motoric development and potential, difficulties will arise in goal setting and program planning for this group of children.

Second, little information pertaining to gross motor skill development of mentally retarded youngsters can be found in the literature. Investigators have often looked at items labeled motor proficiency, motor ability, physical fitness, physical development and physical efficiency of the mentally retarded (primarily the EMR) and hypothesized that they were observing some aspect of gross motor skill performance. However, in most instances, little emphasis was placed on examining the sequential development of skills such as walking, running, jumping, throwing, catching, hopping, etc., with a moderately mentally retarded population or, in fact, any developmentally delayed population.
Wickstrom (51) points out the importance of developing these basic motor skills as prerequisites for higher ordered motor skills and recreational activities to emerge. Little information exists as to when, how and to what extent these skills develop in a moderately retarded population. It is time the motoric behavior of this population be more thoroughly investigated.

Third, the quality of motor skill development is often overlooked by investigators. In most instances, investigators examine a performance time, a weight, a power equivalent or fitness score without truly examining the qualitatively of a performance. The end point, the final score, seems to be all that is measured and relevant. Unfortunately, with this type of approach, the mentally retarded child or any other handicapped child usually fairs poorly. This has certainly resulted in problems when attempting to identify motoric behaviors that need to be improved and needs that have to be met.

In terms of normative tests or tests as a whole, again, the quality of the individual's performance is often overlooked. The individual is evaluated against a certain norm or score and either passes or fails. With the moderately mentally retarded child, normative testing results in a cluster of failures. This type of testing does not promote appropriate assessment and subsequent
programming. It is evident that the qualitatively of
the mentally retarded child's performance, not the passing
or failing grades, needs to be examined to more effec-
tively provide developmental programs to foster behavioral
change and provide beneficial results.

Need on the Part of the Practitioners

With the passage of Public Law 94-142 ("Education
for All Handicapped Children Act of 1975"), and other
legislation of a similar nature, i.e., State Law 455-Ohio
and their resulting implications, a new era of education
is about to be born. Public Law 94-142 mandates quality
education for all handicapped children, ages three to
twenty-one. Its central feature is an individualized
educational plan for each person regardless of functional
level. The term "individualized educational program"
means a written statement for each handicapped child of
specially designed instruction to meet the unique needs
of handicapped children.

Implicit in Public Law 94-142, and other legisla-
tion of similar nature, is educational accountability by
those involved, i.e., physical educators, for the
educational progress of handicapped children. Public Law
94-142 describes a process of implementation which enables
objective monitoring and evaluation of delivery of serv-
ices to handicapped children.
Personnel involved in physical education and motor development for handicapped children need to have a thorough knowledge of the motor development of handicapped children to successfully comply with current legislation and demands of future legislation. It is essential that educators have the ability to identify where children are in a developmental sequence and where they should be, so that appropriate programs can be developed and implemented.

Hopefully, information acquired from this investigation will provide personnel involved in motor development of moderately retarded children an in-depth knowledge as to the gross motor behaviors of this particular group. Certainly, this could facilitate the assessment, planning and implementation processes of motor development programming for the moderately retarded child. By doing this, physical educators and other personnel involved in motor development programming would be aided in the task of complying with present and future federal and state legislative mandates on education for handicapped children.

**Definitions**

The following terms used in this study are clarified at this time:
1. **Mental Retardation** - refers to significantly subaverage general intellectual functioning existing concurrently with deficits in adaptive behavior, and manifested during the developmental period (28).

2. **Moderately Retarded** - a term used to describe the degree of mental retardation when intelligence testing scores range between 3 and 4 standard deviations below the norm (36 to 51 on the Stanford-Binet and 40-54 on the Wechsler Scales). Many trainable individuals function at this level; such persons usually can learn self help, communication, social and simple occupational skills but only limited academic or vocational skills (28).

3. **Trainable Mentally Retarded** - is a term used interchangeably with moderately retarded.

4. **Motoric Behavior** - in this investigation, the characteristic large muscle movements seen in the sequential development of the basic motor skills of walking, running, jumping, hopping, skipping, catching, throwing, striking, kicking, stair climbing and ladder climbing.

5. **Adaptive Behavior** - the manner in which an individual copes with the natural and social demands of his environment (37).

6. **Criterion Referenced Test** - a test which is constructed to yield measurements that are directly interpretable in terms of a specified domain of instructionally relevant tasks or behaviors (27).
7. **Middle Childhood Age** - for descriptive purposes in this investigation, the growth and development period from six through eight years of age.

8. **County Programs** - those community programs administered by the Local 169 boards and which provide training and educational experiences for the moderately retarded population.
CHAPTER II

SURVEY OF RELATED LITERATURE

Introduction

In this chapter, an attempt was made to review and synthesize pertinent literature regarding motor development, motor characteristics, and/or physical abilities of mentally retarded children. Hopefully, from this process, the reader might acquire a descriptive base as to what currently is known relative to these variables in this population.

The chapter has been divided into three sections for the convenience of the reader. The first of these sections examines literature on the motor abilities of educable mentally retarded children and the second section is devoted to literature on the motor abilities of moderately mentally retarded children. In the third section, a summary of the results of the reviewed literature is presented.

Studies Related to the Motor Performance of Educable Mentally Retarded Children

In one of the first notable attempts to distinguish differences in motor performance between mentally retarded and normal children, Howe (68) selected forty-three normal children of similar chronological age (CA 6 to 12), sex,
and socioeconomic background and examined them on a battery of eleven test items. Testing items included the Sargent jump, balancing on one foot, tracing speed, tapping speed, dotting speed, grip strength, zig-zag speed, 50 yard run, squat thrust, ball throw for accuracy at fifteen feet, and paper and pencil maze test. Results of the data analysis yielded significant differences between the mentally retarded and normal children. Normal males were significantly superior on all eleven motor tasks while normal females were significantly superior on nine of the eleven items. Although significance was not attained by the normal females on the items of grip strength and ball throwing, their scores did reflect a higher degree of performance. The item of balancing on one foot for one minute produced the most dramatic differences. On this item, only two of the retarded children attained the maximum score. Results also indicated a good deal of variability and overlap between achievements of normal and retarded children.

In a landmark study, Francis and Rarick (66) compared selected aspects of the gross motor abilities of mentally retarded children and normal children. Two hundred and eighty-four mentally retarded children ranging in age from nine to fourteen and in IQ from 64 to 70 were selected from special classes in the Madison and Milwaukee public school system. The subjects were
administered a battery of twelve gross motor skill tests which reflected their static strength, running speed, power or dynamic strength, balance and agility.

Results by Francis and Rarick (66) showed that mentally retarded youngsters were two to four years behind their normal counterparts in all motor activities tested. Age and sex trends for mentally retarded subjects followed similar patterns as those in normal children, but at a lower level for each age. Discrepancies between mentally retarded and normal children tended to increase at each successive age level. With complex skills, the differences in performance between the mentally retarded and normal children increased even more so with advanced age. Results further demonstrated a low positive relationship between intelligence as measured by standard intelligence tests and most of the performance scores recorded for the retarded children.

Research designed to determine if educable mentally retarded males differed from a group of normal males of comparable chronological age and a group of normal males of comparable mental age on measures of physical fitness from the AAHPER Youth Fitness Test was conducted by Sengstock (79). Thirty educable mentally retarded males were selected from public school settings and compared with thirty normal males of similar chronological age (CA 120 months to 180 months) and thirty younger normal
males with similar mental ages (72 months to 144 months). Statistical analysis produced results which indicated that the fitness scores of the EMR males were inferior to that of the normal group with comparable chronological ages for all items tested. Fitness scores of the educable mentally retarded males, when compared to the younger males of similar mental age were found to be significantly superior on all fitness measures except situps where the normal males surpassed the educable mentally retarded males.

Brace (92) investigated various physical fitness parameters in sixty-five mentally retarded boys with a mean age of thirteen years six months and a mean IQ of 60 from a Texas State institution relative to national age norms for boys of the same chronological age. Using the AAHPER Youth Fitness Test, Brace reported that the mentally retarded boys scored on the average substantially below the national age norms with 80.6 percent of the scores falling below the median of the national scores.

In a related study, Stein (82) utilized the AAHPER Youth Fitness Test to evaluate twenty-four regular class educable mentally retarded males ranging in age from thirteen to sixteen years. When compared with Brace's (92) institutionalized group, Stein indicated that the educable mentally retarded children from the regular
class setting were significantly superior relative to physical fitness. Results further showed that the fitness scores of the retarded children from the regular class setting did not differ significantly from published normative data.

Evidence generated from this study conclusively indicated that physical fitness of children in residential settings and those attending public school special education classes cannot be equated nor generalizations made from one to another.

Malpass (93) conducted an investigation to ascertain whether groups of institutionalized and non-institutionalized mentally retarded boys and girls differed in motor proficiency measures and whether motor ability of these retarded children was distinguishable from that of normal children. Fifty-two institutionalized retardates, with a mean chronological age of eleven years, eleven months, and a mean IQ of 62.8, fifty-six non-institutionalized retardates with a mean chronological age of eleven years eight months and a mean IQ of 67.8 and seventy-one normal children with a mean chronological age of eleven years eight months were selected and assessed with the Lincoln Oseretsky Motor Development Scale. Analysis of the data revealed no differences in motor performance between institutionalized and non-institutionalized retarded
groups. Results further indicated no significant differences in motor proficiency between mentally retarded males and females. Highly significant differences, though, were noted between the performances of normal and retarded groups.

Byrd (74) in a study some years later, compared the motor performances of eight hundred and twenty-seven normal and mentally retarded children from intermediate grades of public elementary schools in Austin, Texas, with thirty retarded children from Austin State School. Data was gathered utilizing ten selected items from the Brace Motor Ability Test, the standing broad jump and the 25 yard dash. Results showed that normal children were superior in all measures of motor ability when compared to retarded children from public elementary schools and from the Austin State School. Results further indicated that the retarded children from the state institution were less proficient motorically than the mentally retarded children in the public school setting.

Performance of institutionalized mentally retarded adolescent males was compared with standardized norms for two motor tasks requiring different degrees of insight and ability in a study undertaken by Fait and Kupferer (64). Forty-one subjects with a mean IQ of 60 and a mean age of 15.8 were tested in the vertical jump and the
squat thrust. Results revealed comparable performance levels between the retardates and normals in the vertical jump (simple task), but significantly lower performance levels between the retardates in the squat thrust (complex task). According to the investigation, the differences in performance were influenced more by the complexity of movements (intellectual loading) of the squat thrust than to basic differences in motor ability.

In a study of thirty mildly retarded females (IQ 45 to 69, mean chronological age of eleven years nine months), Fallers (96) found that none of the subjects attained a rating of normal on the Lincoln-Oseretsky Scale. Results depicted sixty percent as motor idiots, seventeen percent as having marked motor retardation, and thirteen percent as having moderate motor retardation. Results seemingly pointed toward the relationship between motor and measured intellectual values since females in the lower IQ specimen of the IQ range, 45 to 53, accounted for the majority of the motor idiots while the upper IQ range, 61 to 69, had the greatest variability in scores and the fewest in the marked motor retardation category.

In a related study, Sloan (80) attempted to distinguish differences in motor proficiency between a group of educable mentally retarded children and a group of normal children. Two groups of ten year old students,
twenty educable mentally retarded children with IQ's ranging from 45 to 70 and twenty normal children with IQ's ranging from 90 to 110 were selected and given the Lincoln-Oseretsky Test of Motor Proficiency. Within the scope of this study, results indicated that mentally retarded children were significantly inferior to children of normal intelligence in motor proficiency. No sex differences were evident from data analysis. The mentally retarded children as a group performed best on synkinesia and poorest in simultaneous movements when six subtests were compared. This finding further substantiated the belief expressed earlier by Fait and Kupferer (64) that the degree of difficulty varies directly with task complexity.

Langan (101) in a more recent study assessed ninety-six educable mentally retarded children between the ages of seven years six months and ten years five months with the Lincoln-Oseretsky Scale and compared their performance to existing normative data. Findings indicated significant differences between motor proficiency scores of eight, nine and ten year old retarded children. Motor proficiency was also found to be related to chronological age in a linear fashion, thus indicating it is developmental in nature. Results further revealed the significant superiority of the normal children for both sexes at all age levels in all measures of motor proficiency.
The developmental curve of the retarded population was similar to that of the normals, but at a lower level. Results also suggested that with increasing chronological age, the gap in motor proficiency between normals and retardates widened. The author concluded that the motor proficiency levels obtained by the retardates approximate those one would expect if their mental age was substituted for their chronological age.

A similar study comparing educable mentally retarded children and normal children on aspects of the Lincoln-Oseretsky Scale was designed by Hollingsworth (99). Ninety subjects were selected from special and regular third, fourth and fifth grade schools in a Georgia School System. Results indicated that when compared on the basis of chronological age, educable mentally retarded children were significantly below their intellectually normal peers in motor performance at ages eight, nine and ten. When compared on the basis of mental age, results indicated that the retarded children were significantly superior to their intellectually normal peers.

A study designed to determine differences in motor proficiency between a group of highly intellectually functioning educable mentally retarded children and a group of low intellectually functioning educable mentally retarded children was conducted by Dawson (61). One
thousand three hundred educable mentally retarded children from elementary schools within the State of Missouri were assessed with the Missouri Perceptual Motor-Motor Performance Test Battery. Results from data analysis suggested that among elementary school children, higher IQ children perform better than lower IQ children on perceptual motor and motor performance items.

Auxter (55) compared intellectually typical boys and educable mentally retarded boys on selected aspects of flexibility and strength. Data were obtained from ninety-one educable mentally retarded boys with an intelligence range from fifty to seventy-nine and thirty-one typical boys whose chronological age ranged from nine to eleven. The Stoelting adjustable dynamometer was used to test grip strength and the vertical jump test was administered to measure jump and reach height. Flexibility measures as described by Leighton were given to measure aspects of trunk flexion and extension and ankle flexion and extension. Results supported the significant superiority of the intellectual typical group on tests of grip strength, vertical jump and ankle flexion. Significant differences were not revealed between the typical youngsters and the retarded youngsters on measures of trunk flexion and extension.
A study by Keogh and Oliver (70) was designed to observe the motor performance of seventeen severely awkward educationally subnormal boys ranging in age from nine to ten and in IQ from 51 to 73. The subjects demonstrated physical skills involved in the performance of beam balance, beam walk, fifty foot hop, alternate foot hopping, standing broad jump and simultaneous foot finger tapping. Observation of the subjects' performances revealed slowness and deliberateness when moving, lack of control of force and speed and inability to perform with one side of the body. Performance difficulties were seemingly related to the tests themselves and the problems of initial learning rather than to the physical characteristics of the subjects.

Adrian and Auxter (86) examined the running patterns of educable mentally retarded boys to identify developmental trends and to compare findings with similar data obtained from normal children. Forty-six subjects with a chronological age range between eight and twelve were chosen and placed into five age groups. Each subject was filmed while running a thirty yard distance. Prior to filming, reference markings were placed on the limbs of each subject so that limb movements could be easily identified. Analysis of the subjects' running performance with respect to speed, percentage of time in flight, stride length, contact time, foot position at landing, angle of
swinging thigh, arm position and landing were computed and compared with data on normal boys. Results revealed that the running speed of mentally retarded boys was slower than that of normal boys. Results further indicated that the performance of the retarded boys differed from the normal population in all measures identified. Few differences were reported in the performance of the mentally retarded boys in different age groupings.

The most comprehensive study dealing with the status of physical fitness and motor performance of mentally retarded children was conducted by Rarick, Widdop and Broadhead (78). A national sample of four thousand, two hundred thirty-five educable mentally retarded boys and girls ranging from age eight to eighteen and in IQ from 50 to 80 were tested with a modified version of the AAHPER Youth Fitness Test.

Results compared favorably with the previously cited research of Francis and Rarick (66), Howe (68), and Sengstock (79) in revealing that educable mentally retarded boys and girls at each age level were substantially retarded on all measures of fitness and motor performance when compared with children of normal intelligence. Age changes in performance followed similar trends as reported for the normal children, although characteristically two to four years behind standards for normal children. Sex differences for performance levels of mentally retarded
children were also similar to those noted in normal children males showing superiority in all tests at all ages.

Rarick and Dobbins (44), in a recent investigation, attempted to describe the factor pattern of motor abilities of intellectually normal and of educable mentally retarded boys with the intent of qualifying the similarities between developed factor patterns. A hypothesized factor structure was formulated that consisted of twelve factors believed to encompass a major portion of the motor domain of children. Seventy-one educable mentally retarded boys with a mean age of 102.7 months and a mean IQ of 69 and seventy-one boys of normal intelligence of comparable chronological ages were selected from schools in the San Francisco Bay area. Each subject was administered a test battery consisting of forty-seven items. Analysis of data revealed marked difference in the average levels of motor performance of educable mentally retarded and intellectually normal boys. Further results from factor analysis identified six comparable factors, namely strength, gross limb-eye coordination, fine visual motor coordination, fat or dead weight, balance and leg power and coordination. The authors concluded that the basic components which underlie a major portion of the motor domain of the EMR group and normal group were tangibly coincident in the factor patterns of both subject groups.
Studies Related to the Motor Performance of Moderately Mentally Retarded Children

Francis and Rarick (66), although primarily interested in the comparison of motor performance of educable mentally retarded and normal children, as previously noted, obtained ancillary data on twenty-four institutionalized retarded children ranging in age from seven to twelve and having an IQ of 15 to 50. The institutionalized children were given five motor performance tests designed to measure the childrens' running ability, stair climbing skill, throwing, manual strength, manual dexterity and skill in striking a table top. Data were compared with those collected from sixty normal preschool children ranging in age from three to five years.

Results clearly showed extensive delay in the motor abilities of the institutionalized children. In all items except manual strength, the retarded children failed to achieve the mean performance level of the normal five year old children. In running, the institutionalized children exhibited an awkward gait characterized by the lead foot slapping the floor and the body weight shifting over the supporting leg. The throwing skill of the retarded children was described as infantile. In stair climbing, the retarded children characteristically demonstrated an alternating ascending pattern and a mark time descending pattern.
Brown (58) examined the minimum muscular fitness and flexibility of thirty-eight trainable mentally retarded children between the ages of eight and sixteen and within the IQ span of 35 to 55 and compared these results with normative data on typical youngsters. The Kraus Weber Test was utilized to collect data on the muscular fitness and flexibility of the subjects. Results indicated that the trainables were seriously deficient in muscular fitness when compared with normal children and that trainable mentally retarded girls tended to be more muscually fit and flexible than trainable mentally retarded boys. Results further showed that trainable mentally retarded children were not necessarily deficient in flexibility when compared with the normal children. The greatest percentage of failures for the trainable mentally retarded children were recorded in the low back test of minimum strength.

In a study by Londeree and Johnson (73) the motor fitness levels of trainable mentally retarded children, educable mentally retarded children and normal children were compared. Motor fitness measures on six hundred and six male and four hundred and ninety-nine female trainable mentally retarded children, aged six years to nineteen years, were compared with existing norms for educable mentally retarded and normal children for height, weight,
flexed arm hang, three hundred yard walk-run, fifty yard dash, situps, soft ball throw for distance and broad jump.

Graphic analysis of the data revealed that trainables were considerably below educable mentally retarded children and normal children on all motor items. Some overlapping of educable mentally retarded performances and normal performances were noted but generally no overlapping of the trainable mentally retarded and educable mentally retarded children performances occurred. There was a general improvement in scores with advancing age for the trainable mentally retarded children. Exceptions to this trend were seen in the older groups, which showed plateaus or decrement on most variables. The typical male-female similarities and differences in motor proficiency were exhibited by the trainable mentally retarded children. Differences between the trainable males and females were generally minimal, with males demonstrating better scores as age increased. The degree of impairment suggested a curvilinear relationship between intelligence and skill proficiency. In other words, only minimal impairment would be found with minor retardation, but increased retardation would be associated with motor decrements in an experimental manner.

Brown (91), in an investigation involving one hundred and seventy-nine trainable mentally retarded
children aged twelve to nineteen, attempted to establish a relationship between IQ and physical performance variables. Results revealed a significant difference between the mean performance of the moderately mentally retarded and the severely retarded children on all seven test items with moderately retarded children exhibiting better performance. Significant sex differences were reported with males having better performances on all seven items of the test. Age level comparisons indicated that with increased chronological age, improvement in motor performance resulted on the items measuring speed, shoulder strength and coordination. The overall performance results of the trainable children were far inferior to that of the standardized data on normal youngsters of comparable age.

In attempting to determine the sub-maximal cardiovascular capacity of a group of eighty-five trainable non-institutionalized mentally retarded children ranging in age from seven to nineteen years, Peries (104) used the Ohio State University Step Test as modified by Callan. Scores obtained by the trainable children were compared with the scores of a group of normal children of the same chronological age who had been previously tested under similar conditions. The results revealed that the cardiovascular endurance of the normal children was significantly superior to that of the moderately retarded children.
The performance of twenty-one undifferentiated trainable mentally retarded male children, chronological age ranging from fifteen to twenty-one years, IQ ranging from thirty to fifty-four, was compared with existing normative data on selected physical fitness variables in a study by Liese and Lerch (72). Each subject was assessed with aspects of the AAHPER Youth Fitness Test and the Fleishman Basic Fitness Test during the regular physical education classes. Results of the investigation indicated that the trainable children did considerably poorer than his normal intelligence counterparts, a finding which was consistent with previous studies by Francis and Rarick (66), Brown (58) and Londeree and Johnson (73). With five exceptions, all participants scored below the thirtieth percentile on each test item. Seven individual fitness items were significantly related to the IQ score, including all three running tests. The author hypothesized that higher levels of motor acts and cognitive abilities were closely related.

A study of gait patterns of trainable mentally retarded children was undertaken by Windell (105) in 1971. Electromyographic examinations of selected muscles and simultaneous measurements of time relations between swing phase and stance of lower extremities were made on a group of trainable and a group of normal children. Each subject's performance in a ten consecutive step span was
analyzed. Results of the investigation revealed that the gait pattern of trainable youngsters was consistently different from that of normal youngsters. Differences in gait patterns were not found between trainable males and females or between normal males and females. Results further revealed that chronological age was an influencing factor in the gait pattern of young trainable retarded children.

Summary

This chapter initially reviewed the pertinent studies related to educable mentally retarded children and their motor abilities. In general, the studies (55, 64, 68, 79, 70, 66, 74, 78) revealed that educable mentally retarded children were inferior to normal children on most measures of motor proficiency and physical fitness. Francis and Rarick (66) clearly demonstrated that on the average, educable mentally retarded children tended to perform two to four years behind normal individuals of the same chronological age and sex in motor abilities. Studies also (66, 78) reported that age and sex trends for educable mentally retarded children followed similar developmental patterns as those evidenced in normal children, boys being on the average superior to girls on most measures of motor proficiency at all age levels. With advanced
chronological age and task complexity, discrepancies between mentally retarded and normal children tended to increase as noted in the research of Francis and Rarick (66), Langan (101), Fait and Kupferer (64), Sloan (80), and Rarick, Widdop and Broadhead (78).

The reviewed research on educable mentally retarded children (66, 78) further revealed that some variability and overlapping of performance by educable mentally retarded children and normal children existed. Stein (82), Brace (92), Byrd (93), and Malpass (74) found that educable mentally retarded children from non-institutionalized settings performed better than institutionalized retarded children on many measures of motor ability. Finally, Rarick and Dobbins (44) concluded that the factor structure of motor abilities of educable mentally retarded children were highly similar to that of normal children.

The second focus of the reviewed literature centered on studies dealing with the moderately mentally retarded child. Evidence from these studies reveal clearly a marked inferiority in this group of children on measures of motor proficiency when compared to normal children (66, 73, 58, 72). The work of Londeree and Johnson (73) further indicated that the motor abilities of moderately mentally retarded children were significantly below that of educable mentally retarded children:
a finding which indicates that the more severe the retardation, the greater the deficit in motor performance. This finding was further substantiated from results of investigations by Brown (91) and Francis and Rarick (66), which indicated the lower the intellectual capacity, the poorer the motor performance.

It is quite evident throughout the literature that studies investigating gross motor skill performance, namely walking, running, jumping, throwing, hopping, etc. in young mentally retarded children are quite sparse. Outside of certain studies which examined the quantitative aspects of gross motor skills such as running speed, broad jumping for distance and throwing for distance, research concerned with qualitative development of gross motor skills in the mentally retarded population is non existent.
CHAPTER III

METHODS AND PROCEDURES

This chapter describes the methods and procedures utilized in investigating the qualitative differences in basic gross motor skills of young moderately mentally retarded children and children of normal intelligence. In organizing the methods and procedures, the chapter has been divided into six sections entitled: (1) Experimental Design, (2) Subject Selection, (3) Selection of Reliable Evaluators, (4) The Assessment Instrument, (5) Administration of the Ohio State University Scale of Intra Gross Motor Assessment (O.S.U. SIGMA) and (6) Data Analysis Procedures.

Experimental Design

In order to gather and compare information on basic gross motor skills of young moderately mentally retarded children and normal children, a 2 x 3 x 2 factorial design was utilized. This design makes it possible to determine if qualitative differences exist in basic gross motor skills between the two comparison groups, between sexes and across the chronological ages under study. The design is represented graphically in Figure 3.1.
The independent variables involved in the design were intelligence level (Factor A), sex (Factor B) and chronological age (Factor C). The dependent variables were the eleven gross motor skills assessed by the O.S.U. SIGMA.

The independent variable of intelligence was subdivided into two levels, \( A_1 \), moderately mentally retarded children, and \( A_2 \), children of normal intelligence. The independent variable of chronological age was divided into three sublevels, namely, \( C_1 \), six year old children, \( C_2 \), seven year old children, and \( C_3 \), eight year old children. Sublevels for independent variable B, sex, were \( B_1 \) female, and \( B_2 \), male. Emerging from the design was a twelve cell configuration with twenty subject replications per cell.

Selection of Subjects

Mentally Retarded Subject Selection. The moderately mentally retarded subjects involved in this investigation were randomly selected from seven special schools servicing moderately mentally retarded children in the State of Ohio. Four schools were located in or in close proximity to Columbus, Ohio, and under the direction and administration of the Franklin County Program for the Mentally Retarded. Two other schools were situated in Dayton, Ohio, and
Figure 1. 2 x 3 x 2 Factoral Design
functioned as part of the Montgomery County Program for the Mentally Retarded. The seventh school participating in this investigation was operated by the Lorain County Board of Mental Retardation.

According to literature distributed by the Franklin, Montgomery and Lorain County Programs for the Mentally Retarded:

The program provides for those children six to eighteen years of age (twenty-one years in certain cases), who meet certain standards set forth by the State Department of Mental Hygiene and Correction, Division of Mental Retardation. Generally, admission is based on an IQ of 50 or below for those children who have been legally excluded from public school. Classes provide training in self help and self care; motor skills, daily living, personality and social development and training in academic skills within the child's group. Classes also prepare the child for additional and more specialized experiences.

For this investigation, only those moderately mentally retarded children free from gross physical handicaps and within the chronological age range of six years to eight years were considered for selection. It was necessary to eliminate those multihandicapped children since the deficits may have prevented or interfered with their ability to execute stipulated tasks.

The investigator began the selection procedures by contacting the administrative offices of the Franklin, Montgomery and Lorain County Programs for the Mentally Retarded to secure permission to conduct a research
investigation. After being granted permission by the respective administrative offices, contact with the principals of the seven schools involved was established. Each school then supplied a list of those children who were not multi-handicapped and within the chronological age range stipulated by the investigator. The list provided the investigator with the name, birthdate, sex and intelligence quotient (IQ) of the subjects available for participation. It also identified the classroom teacher's name and room number from which the children came. From this process, ninety-one subjects from Franklin County, fifty subjects from Montgomery County and twenty-five subjects from Lorain County Programs were identified for inclusion in this investigation.

Parental permission slips were distributed to the guardians of those children identified as possible subjects for consent to participate in this investigation. One hundred and forty-one subjects were given permission to take part in the testing. Subsequent random selection procedures resulted in the acquisition of twenty male subjects at six years of age, twenty male subjects at seven years of age and twenty male subjects at eight years of age. The procedure also resulted in an equal number of females selected at each of the three age levels.
Normal Subject Selection. For comparison purposes, a group of normal six, seven and eight year old children were selected from an elementary school located in Upper Arlington, a suburb of Columbus, Ohio. The investigator established contact with the school principal and the school's central administration approved of the investigation and made available to the investigator a list of all six, seven and eight year old children enrolled in the school. The listing provided the childrens' names, birthdates, classrooms, and classroom teacher's name. Children with multihandicaps were excluded from the listing. This procedure identified one hundred and forty children within the chronological age range under scrutiny. Random selection procedures resulted in twenty male subjects being chosen for each of the three ages identified and twenty female subjects selected for each age group.

A breakdown of the chronological age groupings for the mentally retarded and normal subjects who participated in the investigation, the mean age, Standard Deviation and range within the broad age group, mean height, Standard Deviation and range, mean weight, Standard Deviation and range for each sex, are given in Tables 1 and 2.
Selection of Reliable Evaluators

Four evaluators participated in this investigation. All were associated with the Adapted Physical Education Training Project at the Ohio State University. Three evaluators were doctoral students with a major program emphasis in adapted physical education. The fourth evaluator was the project director of the Adapted Physical Education Training Project at Ohio State University. Each individual had expressed an interest in the investigation and were willing to devote numerous hours to data collection.

Reliability of Evaluators. The evaluators who participated in the investigation had some degree of familiarity with the assessment instrument prior to the official start of the investigation. Each had at one time or another in the past year reviewed, administered or lectured on the O.S.U. SIGMA.

To insure that the evaluators were competent and reliable in the administration and interpretation of the assessment instrument, a reliability pilot study was conducted prior to the beginning of formalized data collection.

Two weeks before the start of the investigation, a copy of the O.S.U. SIGMA, standardized instructions for administration, and a one page global synopsis sheet of
Table 1

DATA PERTAINING TO THE NORMAL CHILDREN WHO PARTICIPATED IN THE INVESTIGATION: THE MEAN, SD, AND RANGE OF THEIR AGE (IN MONTHS), HEIGHT (IN CMS.) AND WEIGHT (IN KGS.)

<table>
<thead>
<tr>
<th>Chronological Age (years)</th>
<th>SIX</th>
<th>SEVEN</th>
<th>EIGHT</th>
<th>SIX</th>
<th>SEVEN</th>
<th>EIGHT</th>
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<tr>
<td>Number of Subjects</td>
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<td>20</td>
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<td>20</td>
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<td>20</td>
</tr>
<tr>
<td>AGE (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>77.90</td>
<td>89.77</td>
<td>100.78</td>
<td>78.24</td>
<td>90.32</td>
<td>101.88</td>
</tr>
<tr>
<td>SD.</td>
<td>3.70</td>
<td>2.71</td>
<td>3.73</td>
<td>3.20</td>
<td>3.16</td>
<td>4.66</td>
</tr>
<tr>
<td>Range</td>
<td>72.16-83.33</td>
<td>84.4-94.33</td>
<td>96.25-106.4</td>
<td>72.33-83.03</td>
<td>84.8-95.13</td>
<td>96.3-114.03</td>
</tr>
<tr>
<td>HEIGHT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
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<td>123.93</td>
<td>132.74</td>
<td>119.58</td>
<td>123.25</td>
<td>130.42</td>
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<td>6.13</td>
<td>7.15</td>
<td>5.38</td>
<td>5.41</td>
<td>4.33</td>
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<td>Range</td>
<td>105.41-127.0</td>
<td>113.03-131.98</td>
<td>120.65-146.05</td>
<td>107.95-129.54</td>
<td>115.57-137.79</td>
<td>124.46-135.89</td>
</tr>
<tr>
<td>WEIGHT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>22.30</td>
<td>24.23</td>
<td>30.78</td>
<td>21.55</td>
<td>24.05</td>
<td>27.64</td>
</tr>
<tr>
<td>SD.</td>
<td>3.20</td>
<td>3.83</td>
<td>7.25</td>
<td>3.96</td>
<td>3.41</td>
<td>4.54</td>
</tr>
</tbody>
</table>
Table 2

DATA PERTAINING TO THE MENTALLY RETARDED CHILDREN WHO PARTICIPATED IN THE INVESTIGATION: THE MEAN, SD, AND RANGE OF THEIR AGE (IN MONTHS), IQ, HEIGHT (IN CMS.) AND WEIGHT (IN KGS.)

<table>
<thead>
<tr>
<th>Chronological Age (years)</th>
<th>MENTALLY RETARDED MALES</th>
<th>MENTALLY RETARDED FEMALES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SIX</td>
<td>SEVEN</td>
</tr>
<tr>
<td>Number of Subjects</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>AGE (months)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>76.95</td>
<td>89.23</td>
</tr>
<tr>
<td>SD</td>
<td>3.81</td>
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<td>72.0-82.86</td>
<td>84.5-95.46</td>
</tr>
<tr>
<td>HEIGHT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>113.75</td>
<td>121.35</td>
</tr>
<tr>
<td>SD</td>
<td>6.01</td>
<td>12.29</td>
</tr>
<tr>
<td>Range</td>
<td>105.41-123.19</td>
<td>92.71-147.32</td>
</tr>
<tr>
<td>WEIGHT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>21.21</td>
<td>26.51</td>
</tr>
<tr>
<td>SD</td>
<td>4.30</td>
<td>7.81</td>
</tr>
<tr>
<td>Range</td>
<td>15.90-34.09</td>
<td>16.36-44.54</td>
</tr>
<tr>
<td>IQ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>36.69</td>
<td>38.71</td>
</tr>
<tr>
<td>SD</td>
<td>7.93</td>
<td>10.35</td>
</tr>
<tr>
<td>Range</td>
<td>26-50</td>
<td>28.53</td>
</tr>
<tr>
<td>N</td>
<td>13</td>
<td>14</td>
</tr>
</tbody>
</table>
the eleven skills included in the O.S.U. SIGMA were
distributed to each evaluator for thorough review. Dur-
ing the subsequent week, questions and problems with the
administration and scoring of the O.S.U. SIGMA were dis-
cussed to clarify any misconceptions or problems.

The reliability study to insure consistent
evaluator agreement (percent agreement of evaluator
observations) on the motoric behaviors observed during
a subject's performance was conducted one week before
actual data collection. The reliability pilot check
involved the evaluators viewing six children who had
been videotaped while being assessed with the O.S.U.
SIGMA. Each evaluator was directed to make a determi-
nation concerning the level of motor behavior which each
child demonstrated while performing the eleven skills
included in the O.S.U. SIGMA.

The viewing process took place in a conference
room at the Nisonger Center for Mental Retardation and
Developmental Disabilities. The tapes were replayed on
a Sony Videocorder AV-8600 and transmitted on a twenty-
three inch RCA Instructional Television Receiver/Monitor
(JR-968W).

The evaluators observed each child on the tapes
performing each skill three times. At the end of the
third trial for each skill, the tape was stopped and the
evaluators were given time to record their observations on a score sheet (See Appendix A). If an evaluator wanted to see a performance again, the tape was rewound and replayed a second time. Because of limited time, only one playback was permitted. The entire process took approximately two hours.

Characteristics of the subjects utilized for the pilot reliability study are presented in Table 3, page 48.

**Analysis of Evaluator Reliability.** To determine the agreement among evaluators in observing the skill performances of the six children on videotape, a percentage of evaluator agreement (scorer reliability) for each skill was calculated. The accepted procedure was to divide the number of instances of agreement by the evaluators for each skill by the total number of evaluator agreements plus disagreements. The quotient is multiplied by one hundred and the resulting figure is the percentage of agreement among the evaluators. According to Hall (29),

the nearer the evaluators are to perfect agreement, the nearer they will be to one hundred percent. Ninety percent or above is considered desirable, but eighty percent agreement or better is acceptable for many types of observational recordings. No absolute standards have been established but the percentage of agreement gives some measure of the consistency of the evaluators' observations.
Table 3
CHARACTERISTICS OF THE SUBJECTS ASSESSED WITH THE O.S.U. SIGMA

<table>
<thead>
<tr>
<th>Children</th>
<th>Sex</th>
<th>CA Yr.</th>
<th>CA Mo.</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>4</td>
<td>3</td>
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<td>M</td>
<td>5</td>
<td>0</td>
<td>DD</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>5</td>
<td>1</td>
<td>DD</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>5</td>
<td>5</td>
<td>N</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>6</td>
<td>10</td>
<td>N</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>9</td>
<td>11</td>
<td>DD</td>
</tr>
</tbody>
</table>

N - Normal
DD - Developmentally Delayed
Results from percentage agreement computations for the eleven skills ranged from 1.0000 to .7500. Walking, stair climbing and ladder climbing resulted in scorer reliability of 1.0000. Striking and skipping yielded a scorer reliability of .9580. Percentage agreement for the skills of catching, throwing and jumping produced an agreement measure of .9166. Scorer reliability of .8333 was indicative of running and kicking skills. Hopping produced the lowest scorer reliability of .7500. The entire pilot study yielded a mean scorer reliability of .9163 for the eleven skills.

The Assessment Instrument

The Ohio State University Scale of Intra Gross Motor Assessment (O.S.U.SIGMA) developed by Loovis and Ersing (102) was utilized to collect data on the basic gross motor skill performances of the subjects involved in this investigation. The O.S.U. SIGMA is a criterion referenced assessment instrument and as such examines the quality of an individual's performance on basic gross motor skills from a developmental point of view rather than on performance results, i.e., how far one can throw a ball. Engrained within the concept of the O.S.U. SIGMA is the belief that a number of different
forms of motoric behavior with various levels of maturity and sophistication may be demonstrated by an individual in performing basic motor skills.

Through utilization of the O.S.U. SIGMA eleven basic motor skills can be evaluated from a criterion referenced standpoint. These skills include walking, running, jumping, hopping, skipping, catching, throwing, striking, kicking, ladder climbing and stair climbing. Each skill is subdivided into four observable levels of motor behavior (performance levels) ranging from the least mature level to the most mature functional level. Each of the levels is defined by performance criteria stated in behavioral form. This four level subdivision reflects the sequential motoric development of each skill.

Level I criteria of each skill is descriptive of an immature form of motor behavior. The most mature form of motor behavior exemplified for a skill is represented by Level IV criteria. Levels II and III are intermediate levels and as such depict forms of motor behavior which are immature but developmentally more mature than Level I behaviors and less mature than Level IV behaviors (See Appendix A).

Scoring is based on careful observation and comparison of a subject's performance on the eleven basic gross skills with the criteria stipulated for each level
of a skill. A subject is allowed three trials on each skill, and a score of LI, LII, LIII, or LIV is awarded for the predominant motor behavior (level demonstrated on two of three times) observed by an evaluator during the trials.

Reliability of the O.S.U. SIGMA. Reliability coefficients for the eleven skills which collectively make up the O.S.U. SIGMA were determined in a test retest reliability study (Loovis, 1975), with thirteen judges participating. Test reliability was established using Scott's Pi, while scorer reliability was based on percent agreement.

High test reliability was indicative of those skills with an average coefficient of .83 or better on the test and retest conditions; the skills in this category include: walking, catching, ladder climbing, and stair climbing. Skills with an average coefficient of .54 or higher were considered to have medium reliability; throwing, striking and skipping were included in this category. Low test reliability was produced for running, hopping, jumping and kicking and consisted of an average coefficient of .53 or lower on the test and retest conditions.

Scorer reliability, percent agreement among the judges ranged from 1.00 to .6667. The skills of walking,
ladder climbing and stair climbing were indicative of perfect agreement among the judges. Throwing, catching and skipping agreements were reported at .9167. Scorer reliability of .8333 resulted for striking. For the skills of running and kicking, scorer reliability was calculated at .7500. The skills of hopping and jumping reflected the lowest scorer reliability at .6667. A mean scorer reliability measure of .8560 was reported for the entire test.

Administration of the Ohio State University Scale of Intra Gross Motor Assessment

Materials for Assessment

Prior to the assessment of the subjects, each evaluator was given an O.S.U. Field Project Manual (See Appendix A). Contained in this manual were a copy of the O.S.U. SIGMA, a one page global synopsis sheet for all eleven skills and their four level breakdown, instructions to be followed during the assessment, and forty score sheets for assessment data recording.

In addition to the manual, an assessment kit with two regulation tennis balls, a six inch red rubber playground ball (Pennsylvania Playground Ball PG B-6), a white plastic wiffle ball four inches in diameter, a twenty-eight inch yellow plastic wiffle ball bat (Empire Home Run King - twenty-eight inch, US Patent
2597054), a six inch playground ball (PGB-6) suspended from a plastic rod by two and one-half feet of rope and an eight by eleven inch piece of cardboard were distributed to each evaluator for assessing the various skills. An eight foot aluminum ladder (Ashby Aluminum Ladder - Model 2316) with a two inch wide step and a twelve inch interval between steps was provided at each assessment location to assess the climbing behavior of the subjects.

To assess the skill of stair climbing, it was necessary to utilize a flight of stairs within each school building where the subjects were being assessed. It should be noted that some variability existed in step height and step depth from school to school. In general, steps ranged in height (rise level) from 7.75 inches to 9.00 inches and in step depth from 10.00 to 12.00 inches. In each instance, only a flight of stairs with a railing was used in the assessment.

**Assessment Environment**

All of the subjects participating in the investigation were assessed in their own school building. In assessing normal subjects, a large classroom, cleared of desks and extraneous materials, was provided to each evaluator for his use. In assessing the normal subjects, it was necessary to utilize a large hallway in addition to the classroom for performing the skills of running and skipping. This procedure was essential for safety
purposes and also to provide enough distance for the subjects to comfortably perform these two skills. Each subject was assessed individually by one of the four evaluators involved in this investigation.

Assessment of the mentally retarded subjects took place in their own school gymnasium with one exception. In one instance, it was necessary to use a large basement room in one of the schools for the assessment. At each assessment location, extraneous materials were removed from the environment. Each subject was assessed individually by one of the evaluators.

**Preliminary Data Recording**

Before initiating an assessment, the evaluator recorded the subject's name, sex, birthdate, height in centimeters, weight in kilograms and the date of the assessment on a standardized score sheet (See Appendix A).

Weight of the subjects was determined with a standard balance scale. A wall chart was utilized to acquire the height of the subjects. In each instance the subjects were asked to remove their shoes. Upon completion of the pre-assessment data recording, formalized assessment of the subjects began.

**Assessment Procedures**

Upon entering each school, the evaluators were
Provided with a list of subjects who were within the chronological age range stipulated for the investigation. The list provided the evaluators with the names and classroom of the subjects to be assessed that particular day. With this information in hand, each evaluator then went to a classroom to meet the subject. When entering the classroom, the subject was introduced to the evaluator and then escorted to the assessment area. In each instance, prior to formalized assessment, the evaluator attempted to befriend the child and win his confidence so that the child would feel at ease during the assessment procedure.

After establishing subject-evaluator rapport, preliminary data were recorded for the subject and assessment procedures initiated.

**Normal Subject Assessment**

Assessment of the normal subjects was conducted individually by an evaluator. Eleven skills were assessed for each of the subjects. In assessing the subjects the evaluators adhered to the procedural format outlined by Loovis (102). Additionally, to facilitate a consistent and precise observation pattern for all the evaluators, verbal instructions given to the subjects were standardized and a predetermined angle and distance were established for observing each trial of a skill. This was done to control the variability that might occur if different
verbal instructions were given by each evaluator and different observational positions used.

In assessment of a subject, the evaluator asked the subject to demonstrate how he or she performed a designated skill, i.e. ("Can you show me how to hop on one foot?") (See Appendix A). If for some reason the subject seemed confused or disoriented by the evaluator's instructions, the instructions were repeated to the subject and the skill demonstrated for the subject by the evaluator. For each of the eleven skills three trials were allowed. Upon completion of a trial performance, the instructions were repeated for the next trial. The evaluator observed the three trials and then recorded the predominant skill level (L1-L4) demonstrated by the subject as outlined in the O.S.U. SIGMA.

If an evaluator became confused by a subject's performance on a particular skill, another trial was allowed to the subject on that skill. Upon completion of a subject's assessment, the subject was escorted back to his or her classroom by the evaluator.

**Mentally Retarded Subject Assessment**

Assessment of the mentally retarded subjects followed a format similar to that used in assessing the normal subjects. Each subject was met by an evaluator at his/her classroom and taken to the assessment area.
On each occasion, as friendly an environment as possible was created by the evaluator. Preliminary data recording measures were taken for each subject.

Procedural evaluator format paralleled that which was used in assessing the normal subjects. Each mentally retarded subject was asked to demonstrate how he/she performed a designated skill, i.e. ("Can you skip to me?") (See Appendix A). In many instances the mentally retarded failed to pay attention or were confused by the instructions given by the evaluator. In these cases, it was necessary to repeat the instructions and demonstrate the skill for the subject. At times, more than one repetition of the instructions and demonstration was required to get a subject to perform a skill. It was also necessary in certain situations for an evaluator to physically manipulate a subject if he or she failed to respond to repeated verbal instruction and demonstration (i.e., swinging a bat in the skill of striking). Three trials per skill were allowed to each subject. If the evaluator was uncertain whether the child understood what was expected of him or her, an additional trial was allowed.

In scoring a subject, the evaluator observed the subject's performance for each skill and recorded the predominant level demonstrated ($L_I-L_{IV}$) on a subject's score
sheet. If a subject refused to perform a skill, an "R" was indicated for that particular skill performance. If the subject's performance fell below the criteria established for Level I behavior on a skill, an "I" was indicated on the score sheet for that skill.

On the average, the entire assessment procedure took approximately fifteen minutes per subject. At the conclusion of a subject's assessment, the subject was returned to his or her classroom.

**Data Analysis Procedures**

Data gathered during the conduct of the investigation were analyzed through two processes. Initially, the data ascertained on the subjects' performance in the eleven basic gross motor skills were punched onto computer cards by the investigator. These were then submitted to the Ohio State University Computer Center and analyzed through multivariate and univariate analysis of variance computer programs. Analysis yielded main effect means and F values between mentally retarded and normal subjects' performances, main effect means and F values between male and female performances, main effect means and F values for chronological age groups under scrutiny. Additionally, first and second order interaction means and F values were obtained. Scheffe's Multiple Post Hoc Comparison Test was utilized to
distinguish significant mean differences.

The second process of data analysis involved the graphic presentation of the subjects' performance in each skill. Graphs were formulated to give a descriptive profile of the subjects' performance by intelligence group (mentally retarded vs normal), by sex and by age level. Interpretation of the profiles to determine performance differences was then conducted.
CHAPTER IV

ANALYSIS OF DATA AND DISCUSSION OF RESULTS

The primary thrust of this investigation was to ascertain the differences in motor performance of moderately mentally retarded children and children of normal intelligence on eleven basic gross motor skills through the use of a criterion referenced tool, the Ohio State University Scale of Intra Gross Motor Assessment. Additionally, differences in gross motor skill performance in relation to the sex and age of the children were investigated.

Results stemming from this investigation were entirely descriptive in nature. Frequency, percentage and mean values have been used to describe the characteristic gross motor behaviors demonstrated by moderately mentally retarded and normal children in the performance of eleven fundamental gross motor skills. The data emanating from the descriptive statistics were not appropriate for determining if statistically significant differences in gross motor skill performance existed between males and females, or between age groups.

The descriptive data allowed the investigator to distinguish differences in the trends of motor skill performance for mentally retarded children and normal
children, differences in the trends of motor skill performance as related to the sex of the retarded and normal children, and the trends of motor skill performance within and across age groups. The descriptive statistics were also used to interpret whether or not a group's gross motor skill performance was developmentally more mature than another group's motor skill performance.

Initially, the investigator attempted to utilize analysis of variance techniques in addition to descriptive statistics to determine significant differences in basic gross motor skill performances as related to the intelligence level, sex and the age of the subjects involved. The use of parametric statistics, namely, analysis of variance, however, was precluded in this investigation after attempts were made to analyze the data using analysis of variance computer programs.

The reasoning for this revolved around crucial factors which confounded the analysis and subsequent interpretation of the data. First, parametric statistics are based on certain fundamental assumptions. One of these assumptions is that the data or measures to be analyzed are continuous measures with equal intervals. Data gathered through use of the Ohio State University Scale of Intra Gross Motor Assessment were ordinal in nature. In other words, there was some distinct order to the data or measures (Level I to Level IV)
but there was not an equal interval between each of the designated criterion/performance levels.

A second factor which created statistical problems was the limited range of scoring within the Ohio State University Scale of Intra Gross Motor Assessment. Gross motor skill performances were rated from a Level I to a Level IV which corresponded to the level of performance demonstrated by an individual in a basic gross motor skill. The limited rating scale created a ceiling effect on the data and therefore the amount of variability in the childrens' performance on a skill was quite restricted. This reduction in variability and small mean difference statistically confounded sound data interpretation.

An example of this was that in the ANOVAS that were statistically performed, numerous significant variable interactions arose. Upon post hoc interpretation of these interactions, significant cell differences could not be found. This was directly related to the reduced variability in the data. Without the ability to interpret significant interaction, the process of main effect interpretation becomes meaningless. It was, therefore, concluded, after deliberations with statistical consultants, to do away with analysis of variance techniques to analyze the data.
This chapter attempts to analyze, interpret and discuss the descriptive data collected during the conduct of this investigation. Initially, the chapter is divided into eleven sections which correspond to the eleven basic gross motor skills under examination. Within each section, graphic results illustrating the percentage and frequency distribution of the children's performance within the criterion performance levels of a particular skill are examined. Additionally, mean performance level values of the children for the designated skills are interpreted. Following the results of the children's performance on the eleven basic gross motor skills, a capsule summation of the results appears. The final segment of the chapter entails a discussion of the results.
WALKING

Analysis of the Graphic Data

Performance of Mentally Retarded vs Normal. The graphic account of the frequency and percentage of mentally retarded and normal children performing at each of the four levels of walking is shown in Figure 2. Analysis of the graphed data revealed no qualitative differences in the walking performance of the normal and mentally retarded children. Results comparing normal and mentally retarded children at six, seven and eight years of age (Figures 3 through 5 and Table 4) reflected similar performance levels in walking at each age level.

Performance of Male vs Female. Analysis of Figure 2 and Table 4 indicated a mature functional level of walking skill for both the mentally retarded and normal male and female children. This mature pattern of walking was evidenced in each age group compared as revealed in Figures 3 through 5 and Table 4.

Longitudinal Performance Trends. Data from Figure 6 indicated that a stable mature Level IV walking pattern existed across the three age levels for both the normal and mentally retarded children.
Figure 2. Performance Distribution of Combined Age Groups for Levels of Walking. (□ = two or more groups at the same point.)
Figure 3. Performance Distribution of Six Year Old Children for Levels of Walking. (Θ = two or more groups at the same point)

Figure 4. Performance Distribution of Seven Year Old Children for Levels of Walking. (Θ = two or more groups at the same point)
Figure 5. Performance Distribution of Eight Year Old Children for Levels of Walking. (θ = two or more groups at the same point)
Table 4

PERFORMANCE DISTRIBUTION AND MEAN PERFORMANCE LEVELS OF SIX, SEVEN, AND EIGHT YEAR OLD NORMAL AND MENTALLY RETARDED CHILDREN IN WALKING

<table>
<thead>
<tr>
<th>Sex/Age</th>
<th>Mentally Retarded</th>
<th>Normal Children</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Levels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I    II   III   IV</td>
<td>Mean Perf.</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0     0     0    20</td>
<td>4.00</td>
</tr>
<tr>
<td>7</td>
<td>0     0     0    20</td>
<td>4.00</td>
</tr>
<tr>
<td>8</td>
<td>0     0     0    20</td>
<td>4.00</td>
</tr>
<tr>
<td>Combined</td>
<td>0     0     0    60</td>
<td>4.00</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0     0     0    20</td>
<td>4.00</td>
</tr>
<tr>
<td>7</td>
<td>0     0     0    20</td>
<td>4.00</td>
</tr>
<tr>
<td>8</td>
<td>0     0     0    20</td>
<td>4.00</td>
</tr>
<tr>
<td>Combined</td>
<td>0     0     0    60</td>
<td>4.00</td>
</tr>
</tbody>
</table>
Figure 6. Mean Performance Levels of Mentally Retarded and Normal Children for Walking ($\geq$ two or more groups at the same point)
RUNNING

Analysis of the Graphic Data

Performance of Mentally Retarded vs Normal. Figure 7 highlights the differences in running performance between the mentally retarded and normal children. Analysis of the graph revealed that the most characteristic level of running demonstrated by both the mentally retarded and normal children was a Level III pattern.

In terms of the performance distribution for levels of running, thirteen (22%) normal males demonstrated Level IV behaviors in running and forty-seven (78%) Level III behaviors. Comparatively, the performance distribution of the retarded males for levels of running revealed ten (17%) mentally retarded males at Level I, seven (12%) at Level II and forty-three (71%) at Level III. The failure of the mentally retarded males to attain Level IV behaviors in running and the clustering of the seventeen retarded males at the immature Level I and Level II patterns reflected the substantially less developed running skill of the retarded males when compared to the normal males. Comparison of the combined mean performance level of normal and retarded males in running (Table 5) revealed a higher mean level of performance for the normal males which adds further support to their higher functional level in running.
The trend of a more mature skill pattern in running by the normal males is further substantiated through analysis of Figures 8 through 10 and Table 5 which correspond to performance results of six year old children, seven year old children and eight year old children. Comparison of the graphic data and mean performance level comparison of the retarded and normal males at each age revealed significantly higher levels of performance in running by the normal males at each age compared.

The graphic account in Figure 7 indicates that forty-three (72%) of the normal females assessed in the investigation exemplified Level III behaviors while thirty-eight (63%) of the mentally retarded females performed at this level. None of the mentally retarded females demonstrated a Level IV run but seventeen of the normal females demonstrated Level IV patterns of running and six (10%) were classified as Level II performers. These findings in conjunction with the combined mean performance level difference illustrated in Table 5 clearly indicated normal females display developmentally a much more mature functional running performance than the retarded females.

Additional results supporting the more advanced running skill of normal females are highlighted in Figures 8 through 10 and Table 5. At each age level, results clearly reflected the mentally retarded females lower
functional level in running when compared to that of normal females.

Performance of Male vs Female. Percentage and frequency distribution results in Figure 7 and combined mean performance level scores from Table 5 point out a small difference in running performance favoring normal females over normal males. In terms of the performance distribution, a greater number of normal females performed at Level IV in comparison to the normal males. In terms of the combined mean level of performance, a higher mean was also recorded for the females. Comparison of the sexes at each age (Figures 8 through 10 and Table 5) revealed that at age seven and eight the normal females level of running was slightly more mature than that of the normal males but not at age six where the normal males were slightly more advanced.

For the mentally retarded children, analysis of Figure 7 and Table 5 revealed a different trend. Mentally retarded males' performance in running was at a higher functional level. Results of the performance distribution indicated a greater number of mentally retarded males at Level III and a smaller number at Level I in comparison to the results exhibited by the mentally retarded females. Comparison of the combined mean performance level scores of the retarded males and
females indicated a higher mean performance level for the mentally retarded males which further substantiated their more advanced level of running.

The analysis by age (Figures 8 through 10 and Table 5) indicated this pattern of a more advanced level of running by mentally retarded males was evidenced most dramatically at age six where retarded males' performance was substantially more mature than that of the retarded females. Comparison of seven and eight year old mentally retarded males and females indicated somewhat different findings. At these two ages, the mentally retarded females functioned at a slightly more mature level of running.

**Longitudinal Performance Trends.** For both normal males and females, performance in running improved with increasing chronological age as revealed from data in Figure 11. Graphic results pertaining to mentally retarded children revealed a more mature functional performance for retarded females with advanced age, especially from age six to seven. Data on mentally retarded males indicated more of a stationary level of running performance across the three age groups. At no one age level did the performance of mentally retarded males or females approach that of the youngest six year old children.
Figure 7. Performance Distribution of Combined Age Groups for Levels of Running.
Figure 10. Performance Distribution of Eight Year Old Children for Levels of Running.
Table 5

PERFORMANCE DISTRIBUTION AND MEAN PERFORMANCE LEVELS OF SIX, SEVEN, AND EIGHT-YEAR OLD NORMAL AND MENTALLY RETARDED CHILDREN IN RUNNING

<table>
<thead>
<tr>
<th>Sex/Age</th>
<th>Mentally Retarded Levels</th>
<th>Normal Children Levels</th>
<th>Mean Perf.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I  II  III  IV Mean Perf.</td>
<td>I  II  III  IV Mean Perf.</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3  2  15  0 2.60</td>
<td>0  0  17  3 3.15</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>4  2  14  0 2.50</td>
<td>0  0  16  4 3.20</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3  3  14  0 2.55</td>
<td>0  0  14  6 3.30</td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td>10 7 43 0 2.55</td>
<td>0 0 47 13 3.22</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>9  3  8  0 1.95</td>
<td>0  0  18  2 3.10</td>
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<tr>
<td>7</td>
<td>4  1  15  0 2.55</td>
<td>0  0  13  7 3.35</td>
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</tr>
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<td>8</td>
<td>3  2  15  0 2.60</td>
<td>0  0  12  8 3.40</td>
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</tr>
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<td>Combined</td>
<td>16 6 38 0 2.37</td>
<td>0 0 43 17 3.28</td>
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</tr>
</tbody>
</table>
Figure 11. Mean Performance Levels of Mentally Retarded and Normal Children for Running.
HOPPING

Analysis of the Graphic Data

Performance of Mentally Retarded vs Normal. Graphic results of the frequency distribution and percentage distribution of mentally retarded and normal children's performance within the levels of hopping are presented in Figure 12. Analysis revealed that Level IV hopping was highly characteristic of the mentally retarded children.

In terms of the performance distribution as seen in Figure 12, forty-seven (78%) of the sixty normal male children performed Level IV hopping in comparison to only five (8%) of the mentally retarded males. Thirty (50%) mentally retarded males performed at the immature Level I pattern of hopping and thirteen (22%) demonstrated Level II hopping in contrast to six (10%) normal males who performed at Level II hopping.

In retrospect, the graph revealed a combined total of forty-three (72%) mentally retarded males performing behaviors characteristic of Level I and Level II hopping and only seventeen (28%) performing Level III and IV patterns of hopping. Comparative figures for the normal males revealed a combined total of fifty-four (97%) at Level III and IV hopping and only six (10%) below Level III. This contrast in the performance distribution
between the mentally retarded and normal males along with the combined mean performance level differences noted in Table 6 exhibited most dramatically the significantly more advanced level of hopping exhibited by the normal male children.

An age level by age level comparison of the normal males and mentally retarded males hopping performance (Figures 13-15 and Table 6) illustrated a much more developed level of hopping at each age by the normal males.

Further scrutiny of the graphic account in Figure 12 illustrates the differences in hopping performance of normal and mentally retarded females. Analysis indicated that fifty-one of the normal females (85%) who were assessed performed Level IV hopping compared to only three (5%) mentally retarded females. Thirty-one (52%) of the mentally retarded females demonstrated immature Level I patterns of hopping compared to none of the normal females. This variability in the performance distribution illustrated most clearly the significantly more mature functional level of hopping attained by normal females in contrast to the mentally retarded females. Comparison of the combined mean performance level scores of the normal and mentally retarded females (Table 6) provided additional support of the normal females more mature level of hopping.
Analysis of Figures 13-15 and mean performance level comparisons from Table 6 indicated that at six, seven and eight years of age, normal females display developmentally a more mature functional performance in hopping than the mentally retarded females.

**Performance of Male vs Female.** Analysis of the data on hopping to distinguish performance differences between normal males and normal females is shown in Figure 12. Percentage and frequency distribution results indicated that normal females display a slightly more mature level of hopping than normal males. This finding was attributed to the greater number of normal females at Level IV in hopping and the relatively higher combined mean level of performance noted for the normal females (Table 6). Comparison of normal males and females at each age level (Figures 13-15 and Table 6) revealed that the normal females level of performance in hopping was at a higher functional level at each age level comparison.

Results from Figure 12 corresponding to performance differences of the mentally retarded children as related to sex illustrated a different trend. The mentally retarded males were developmentally slightly more advanced in the skill of hopping than the retarded females. This finding was additionally supported by comparison of the combined mean performance level scores of the mentally retarded males and females which indicated a slight
difference in the mean level of performance favoring the mentally retarded males (Table 6). Comparative data between the mentally retarded males and females at ages six, seven and eight (Figures 13-15 and Table 6) indicated a more mature level of performance by retarded males at ages six and seven but not at age eight where the retarded females displayed a higher functional level of hopping.

**Longitudinal Performance Trends.** Analysis of Figure 16 revealed that for normal males and females, hopping performance from age six to seven remained basically stable and did not show improvement. Further analysis of the data indicated that from age seven to eight the level of hopping for both normal males and females improved slightly. The graphic results from Figure 16 corresponding to the mentally retarded children indicated that the hopping performance of the retarded females improved with age. Results reflective of the mentally retarded males suggested improvements in hopping skill from age six to seven and then a leveling off of performance.
Figure 12. Performance Distribution of Combined Age Groups for Levels of Hopping.
Figure 13. Performance Distribution of Six Year Old Children for Levels of Hopping.

Figure 14. Performance Distribution of Seven Year Old Children for Levels of Hopping.
Figure 15. Performance Distribution of Eight Year Old Children for Levels of Hopping.
Table 6
PERFORMANCE DISTRIBUTION AND MEAN PERFORMANCE LEVELS OF SIX, SEVEN, AND EIGHT-YEAR OLD NORMAL AND MENTALLY RETARDED CHILDREN IN ROPPING

<table>
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<th>Sex/Age</th>
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<th>Normal Children</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>Levels</td>
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</tr>
<tr>
<td></td>
<td>I II III IV Mean Perf.</td>
<td>I II III IV Mean Perf.</td>
</tr>
<tr>
<td>Males</td>
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<td></td>
</tr>
<tr>
<td>6</td>
<td>13 3 2 2 1.60</td>
<td>0 3 2 15 3.60</td>
</tr>
<tr>
<td>7</td>
<td>8 6 4 2 2.00</td>
<td>0 3 3 14 3.55</td>
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<tr>
<td>8</td>
<td>9 4 6 1 1.95</td>
<td>0 0 2 18 3.90</td>
</tr>
<tr>
<td>Combined</td>
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<td>0 1 3 16 3.75</td>
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<td>8</td>
<td>7 4 7 2 2.20</td>
<td>0 0 2 18 3.90</td>
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<tr>
<td>Combined</td>
<td>35 10 14 3 1.78</td>
<td>0 .2 7 51 3.80</td>
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</table>
Figure 16. Mean Performance Levels of Mentally Retarded and Normal Children for Hopping.
THROWING

Analysis of the Graphic Data

Performance of Mentally Retarded vs Normal. The graphic account of the frequency and percentage of mentally retarded and normal children performing at each level of throwing is presented in Figure 17. Analysis of the graphic data revealed that Level IV throwing was highly characteristic of the normal male children while Levels II and III were most characteristic of the retarded males' performance in throwing.

In terms of the performance distribution, as viewed in Figure 16, forty-seven (78%) of the normal males demonstrated Level IV behaviors in throwing, seven (12%) Level III behavior, and six (10%) Level II behaviors. In comparison, nine (15%) of the mentally retarded males demonstrated Level IV behaviors in throwing, twenty (33%) Level III, twenty-five (42%) Level II behaviors and six (10%) Level I behaviors. The discrepancies in the distributions of performance for the mentally retarded and normal males, in particular, at Level IV throwing where the normal males far outnumbered the retarded males, illustrated most clearly the significantly more developed throwing skill of the normal males. Additionally, comparison of normal and retarded males combined mean level of performance in throwing (Table 7) indicated developmentally the more advanced level of
throwing performance by the normal males.

Lending further support to the previous findings, results comparing normal and mentally retarded males at six, seven and eight years of age (Figures 18-20 and Table 7) revealed that at each level compared, normal males displayed a more mature functional performance in throwing than the mentally retarded males.

Data from Figure 17 reflecting the throwing skill of the normal and mentally retarded females revealed that Level IV throwing was the predominant behavior of the normal females while Level II throwing characterized the greatest number of retarded females. In terms of the distribution of performance, twenty-seven (45%) normal females performed Level IV throwing, twenty (33%) Level III throwing and thirteen (22%) Level II throwing. Comparatively, five (8%) retarded females performed Level IV throwing, sixteen (27%) Level III throwing, twenty-six (43%) Level II throwing and thirteen (22%) Level I throwing. The contrasts in performance distributions, especially at the upper levels of throwing where greater numbers of normal females performed and the higher combined mean performance level of the normal females (Table 7) revealed clearly that the throwing skill of normal females was functionally more mature than that of the retarded females.
Analysis of the mentally retarded females and normal females at each age level (Figures 18-20 and Table 7) further substantiated the finding that normal females level of throwing was functionally more mature than that of the retarded females. At each age level, performance distribution comparisons and mean performance level comparisons of the mentally retarded and normal females revealed developmentally a much more advanced level of throwing skill by the normal females.

**Performance of Male vs Female.** Percentage and frequency results from Figure 17 and comparison of combined mean performance levels from Table 7 revealed that normal males displayed developmentally a more mature functional performance in throwing than normal females. In terms of frequency and percentage distribution, approximately twice the number of normal males performed at Level IV (fifty-five) in comparison to the performance of normal females (twenty-seven). Comparison of combined mean performance level scores for the normal males and females in throwing revealed a higher mean level of performance for the normal males.

Analysis of the normal males and females at six, seven and eight years of age (Figures 18-20 and Table 7) revealed developmentally the more advanced level of throwing skill by the normal males at each age level.
Results from Figure 17 corresponding to performance differences of the mentally retarded children in throwing as related to sex revealed that the throwing skill of the retarded males was slightly more developed than that of the retarded females. This finding was attributed to the greater number of retarded males who demonstrated Level III and Level IV throwing behaviors in comparison to retarded females. Additionally, a comparison of the combined mean performance level of the retarded males and females in throwing indicated a higher mean performance level for the retarded males.

Analysis of Figures 18-20 and Table 7 revealed that at age six, retarded males were clearly more mature than the retarded females in the skill of throwing, at age seven were only slightly more mature than the retarded females in throwing skill and at age eight were less mature in throwing skill than the retarded females.

**Longitudinal Performance Trends.** The throwing skill of normal males improved from age six to seven and then leveled off at a mature Level IV pattern as illustrated in Figure 21. The throwing skill of normal females advanced with increased chronological age with the greatest advancement noticed between age six and seven. Comparative data on the mentally retarded children revealed that
the performance level of the retarded males in throwing remained fairly stable across the three age levels. The performance level of the retarded females improved with increased chronological age, especially from age six to seven.
Figure 17. Performance Distribution of Combined Age Groups for Levels of Throwing
Figure 18. Performance Distribution of Six Year Old Children for Levels of Throwing

Figure 19. Performance Distribution of Seven Year Old Children for Levels of Throwing
Figure 20. Performance Distribution of Eight Year Old Children for Levels of Throwing
Table 7
PERFORMANCE DISTRIBUTION AND MEAN PERFORMANCE LEVELS OF SIX, SEVEN, AND EIGHT-YEAR OLD NORMAL AND MENTALLY RETARDED CHILDREN IN THROWING

<table>
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</tr>
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<td>7</td>
</tr>
<tr>
<td>Combined</td>
<td>13</td>
<td>26</td>
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</tbody>
</table>
Figure 21. Mean Performance Levels of Mentally Retarded and Normal Children for Throwing
Analysis of the Graphic Data

Performance of Mentally Retarded vs Normal. Highlighted in Figure 22 is the data reflecting the percentage and frequency distribution of the mentally retarded and normal children's performance for levels of catching. Analysis of the graphic data indicated that Level IV catching was most characteristic of the normal male children while Level II catching was highly characteristic of the mentally retarded males.

In terms of the performance distribution, thirty-two (53%) of the normal males demonstrated Level IV behaviors in catching, twenty-seven (45%) Level III behaviors and one (2%) Level II behaviors. Comparatively, the distribution of performance of the mentally retarded males for levels of catching revealed none at Level IV, six (10%) at Level III, forty-three (72%) at Level II and eleven (18%) at Level I. The difference in the performance distributions, particularly at Level IV, where the normal males far outnumbered the retarded males, and the substantially higher combined mean performance level of the normal males (Table 3) demonstrated clearly their significantly more mature functional level of catching skill.

Analysis of the graphic data comparing mentally retarded and normal males at six, seven and eight years
of age (Figures 23-25 and Table 8) revealed contrasts in performance distribution and mean performance scores which indicate normal males perform at a much more advanced level of catching at each age level.

Graphic data reflecting the catching skill of normal and mentally retarded females as shown in Figure 22 revealed that Level III catching was the predominant pattern of skill by normal females while Level II catching characterized the greatest number of mentally retarded females.

In terms of the distribution of performance, twenty-three (38%) normal females demonstrated Level IV catching, thirty-six (60%) Level III and one (2%) Level II catching. In comparison, the distribution of performance for the mentally retarded females for levels of catching revealed none at Level IV, three (5%) at Level III, forty-four (73%) at Level II and thirteen (22%) at Level I. The contrast in performance distribution, especially at the upper levels of catching, where far greater numbers of normal females performed and the higher combined level of performance of the normal females (Table 8), illustrated most clearly the substantially more advanced catching skill of the normal females.

Analysis of the mentally retarded and normal females at each age level (Figures 23-25 and Table 8) further
substantiated that normal females level of catching skill was developmentally more mature than that of the retarded females.

**Performance of Male vs Female.** Percentage and frequency results from Figure 22 and comparison of the combined mean performance levels from Table 8 revealed that normal males were developmentally more advanced than normal females in the skill of catching. In terms of the performance distribution of the normal males and females for levels of catching, a greater number of males performed Level IV catching in comparison to the normal females. The contrast in distribution in conjunction with the higher combined mean performance level of the normal males noted in Table 8 clearly indicated that the catching skill of the normal male was functionally more mature than that of the normal females.

Analysis of the data on normal males and females at six, seven and eight years of age (Figures 23-25 and Table 8) revealed that at each age level the normal males' performance in catching was at a higher functional level.

With respect to the mentally retarded children, analysis of Figure 22 and Table 8 revealed differences between mentally retarded males and females supporting a slightly more mature functional level of catching skill by the mentally retarded males. In terms of the performance distribution, six (10%) of the mentally retarded
males demonstrated Level III catching, forty-three (72%) Level II catching, and eleven (18%) Level I catching. Comparatively, three (5%) mentally retarded females performed at Level III, forty-four (73%) at Level II and thirteen (32%) at Level I. The slight contrast in the distribution of performance, most notably at Level I and Level III, in conjunction with the slightly higher combined mean performance level of the retarded males, illustrated the slightly more mature catching skill of the mentally retarded males.

Comparison of the mentally retarded males and females at six, seven and eight years of age (Figures 23-25 and Table 8) indicated that at age six, the mentally retarded males exhibited a more advanced level of catching than the retarded females, but that at ages seven and eight, from a developmental standpoint, the catching skill of the retarded males and females were relatively equivalent.

Longitudinal Performance Trends. Performance in catching improved steadily with advanced chronological age for both the normal males and females as evidenced from Figure 26. Comparative data on the mentally retarded males revealed a rather stationary level of catching skill across the three age levels. The mentally retarded females' catching skill improved from age six to seven and then leveled off between the ages of seven and eight.
Figure 22. Performance Distribution of Combined Age Groups for Levels of Catching.
Figure 25. Performance Distribution of Eight Year Old Children for Levels of Catching
Table 8
PERFORMANCE DISTRIBUTION AND MEAN PERFORMANCE LEVELS OF SIX, SEVEN, AND EIGHT-YEAR OLD NORMAL AND MENTALLY RETARDED CHILDREN IN CATCHING

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<th>Sex/Age</th>
<th>Mentally Retarded</th>
<th>Normal Children</th>
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</thead>
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<td>Levels</td>
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<tr>
<td></td>
<td>I    II   III  IV</td>
<td>Mean Perf.</td>
</tr>
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<td>Males</td>
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<td>6</td>
<td>2 18 0 0 1.90</td>
<td>0 1 16 3 3.10</td>
</tr>
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<td>7</td>
<td>5 12 3 0 1.90</td>
<td>0 0 7 13 3.65</td>
</tr>
<tr>
<td>8</td>
<td>4 13 3 0 1.95</td>
<td>0 0 4 16 3.80</td>
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<td>Combined</td>
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<td>7</td>
<td>2 18 0 0 1.90</td>
<td>0 1 11 8 3.35</td>
</tr>
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<td>8</td>
<td>3 15 2 0 1.95</td>
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<tr>
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<td>0 1 36 23 3.37</td>
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</table>
Figure 26. Mean Performance Levels of Mentally Retarded and Normal Children for Catching
JUMPING

Analysis of the Graphic Data

Performance of Mentally Retarded vs Normal. Figure 27 reflects the frequency and percentage of mentally retarded and normal children performing at the four levels of jumping. Analysis of the graphic data revealed that Level IV jumping was most characteristic of normal children while Level III jumping characterized the performance of the greatest number of mentally retarded children.

In terms of the distribution of performance of the normal male children, as seen in Figure 27, thirty-eight (63%) of the normal males demonstrated Level IV behaviors in jumping, and twenty-two (37%) Level III behaviors. In comparison, one (2%) of the mentally retarded males demonstrated Level IV behaviors in jumping, thirty (50%) Level III behaviors, twenty (33%) Level II behaviors and nine (15%) Level I behaviors. The contrasts in the distribution of performance between the normal males and mentally retarded males, in particular at Level IV jumping, where the normal males far outnumbered the mentally retarded males, illustrated most clearly the substantially more developed jumping skill of the normal males. Additionally, comparison of normal and mentally retarded males combined mean performance level (Table 9) indicated
a higher mean performance level in jumping by the normal males.

The trend of a more mature skill pattern in jumping by normal male children is further substantiated through analysis of Figures 28-30 and Table 9 which correspond to performance results of six year old children, seven year old children and eight year old children. Comparison of the graphic data and mean performance level comparisons of the mentally retarded and normal males revealed that at each age, normal males displayed developmentally a more mature functional performance in jumping than the mentally retarded males.

Analysis of the performance distributions of normal females and mentally retarded females for levels of jumping as reflected in Figure 27 indicated that thirty-seven (62%) of the normal females demonstrated Level IV behaviors in jumping and twenty-three (38%) Level III behaviors. In comparison, none of the mentally retarded females demonstrated Level IV behaviors in jumping, thirty-eight (63%) demonstrated Level III behaviors, twelve (20%) Level II behaviors and ten (17%) Level I behaviors. The contrast in the distribution of performance for the mentally retarded and normal females especially at Level IV jumping where the greatest discrepancy existed and the relatively higher combined mean level of performance noted for the
normal females (Table 9) illustrated clearly that normal females' jumping skill is at a much higher functional level than that of the mentally retarded females.

Comparison of the normal females and the mentally retarded females at six, seven, and eight years of age (Figures 28-30 and Table 9) further substantiated the differences in jumping skill of the normal and mentally retarded females. At each age, the normal females' level of jumping skill was developmentally more advanced than that of the retarded females.

**Performance of Male vs Female.** Percentage and frequency results from Figure 27 and combined mean performance level scores from Table 9 reflecting the jumping skill of normal males and females revealed no differences in the level of performance between the two. In terms of the performance distribution, thirty-seven (62%) of the normal males and females exemplified Level IV behaviors in jumping and twenty-three (28%) Level III behaviors. Combined mean performance level scores of the normal males and females in jumping were exactly the same.

Analysis of the normal males and females at each age level (Figures 28-30 and Table 9) revealed striking similar developmental patterns of jumping at each age level compared, which further substantiated the parallel performance of the normal males and females in the skill.
For the mentally retarded children, analysis of Figure 27 and Table 9 revealed differences between the retarded males and females which supported a slightly more mature level of skill in jumping by the mentally retarded females.

In terms of the performance distribution, one (2%) of the mentally retarded males performed at Level IV jumping, thirty (50%) at Level III, twenty (20%) at Level II and nine (15%) at Level I. Comparatively, thirty-eight (63%) mentally retarded females performed at Level III, twelve (20%) at Level II and ten (17%) at Level I. The greater number of mentally retarded females at Level III and the higher combined mean performance level of the mentally retarded females as illustrated in Table 9 reflected the slightly more mature level of jumping skill of the mentally retarded females.

Analysis of the mentally retarded males and females at six, seven and eight years of age (Figures 28-30 and Table 9) revealed that at age six, mentally retarded males were more advanced than the mentally retarded females in jumping skill; but at age seven and eight, the mentally retarded females were slightly more advanced than the mentally retarded males in the skill of jumping.
Longitudinal Performance Trends. Analysis of Figure 31 revealed that the jumping skill of normal males and females was relatively stable from age six to eight and did not improve with increased chronological age. With respect to the mentally retarded children, analysis revealed that the retarded males' skill in jumping improved from age six to seven and then decreased slightly between the ages of seven and eight. Data on the mentally retarded females suggested a substantial increase in the level of jumping skill from age six to seven and then a leveling off of performance.
Figure 27. Performance Distribution of Combined Age Groups for Levels of Jumping
Figure 28. Performance Distribution of Six Year Old Children for Levels of Jumping

Figure 29. Performance Distribution of Seven Year Old Children for Levels of Jumping
Figure 30. Performance Distribution of Eight Year Old Children for Levels of Jumping
Table 9

PERFORMANCE DISTRIBUTION AND MEAN PERFORMANCE LEVELS OF SIX, SEVEN, AND EIGHT-YEAR OLD NORMAL AND MENTALLY RETARDED CHILDREN IN JUMPING

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<th>Sex/Age</th>
<th>Mentally Retarded</th>
<th>Normal Children</th>
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</thead>
<tbody>
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<td>Levels I II III IV Mean Perf.</td>
<td>Levels I II III IV Mean Perf.</td>
</tr>
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<td>6</td>
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</table>
Figure 31. Mean Performance Levels of Mentally Retarded and Normal Children for Jumping
KICKING

Analysis of the Graphic Data

Performance of Mentally Retarded vs Normal. The graphic account of the mentally retarded and normal children's performance in kicking is presented in Figure 32. Graphic results indicated that the performance of the normal male children was distributed almost evenly at Level III and Level IV while that of the mentally retarded males was distributed evenly at Levels II and III. Numerically, twenty-seven (45%) normal males performed at Level III and twenty-six (43%) at Level IV in comparison to the mentally retarded male distribution of twenty-five (42%) at Level II and twenty-six (43%) at Level III. The contrast in performance distribution, especially the failure of the mentally retarded males to attain Level IV performances in kicking, and the relatively higher combined mean level of performance in kicking noted for the normal males (Table 10) illustrated most dramatically the more advanced developmental level of kicking demonstrated by the normal males.

Lending further support to this finding is an age level breakdown of the normal and mentally retarded male performance in kicking (Figures 33-35 and Table 10).
At each age level, contrasts in performance distributions and mean performance level comparisons demonstrated that the kicking performance of the normal males was at a much higher functional level than that of the retarded males.

Graphic results reflecting the mentally retarded females and normal females' performance at the four levels of kicking are presented in Figure 32. Results revealed that Level II kicking were most characteristic of the mentally retarded females while Level III behaviors in kicking depicted the performance of the greatest number of normal females.

In terms of frequency and percentage distribution, eleven (13%) normal females performed Level IV kicking, eleven (65%) Level III, and ten (17%) Level II in comparison to the mentally retarded females where none performed Level IV kicking, six (10%) Level III, forty-three (72%) Level II and eleven (18%) Level I.

The contrast in performance distribution, most notably the greater number of normal females at Level III and IV in comparison to the mentally retarded females, in conjunction with the higher combined mean level of performance of the normal females (Table 10), clearly reflected the significantly more mature kicking skill of the normal females. This trend of a more mature skill
pattern in kicking by the normal females was indicative for each age level comparison as illustrated by Figures 33-35 and Table 10.

**Performance of Male vs Female.** Percentage and frequency results from Figure 32 revealed that normal males were developmentally more advanced than normal females in the skill of kicking. This finding was attributed in part to the greater number of normal males who performed at Level IV (twenty-six) in comparison to the normal females (eleven). Additionally, comparison of the combined mean performance level of the normal males and females (Table 10) indicated developmentally a more mature level of kicking for normal males.

Analysis of Figures 33-35 and Table 10 revealed findings of a higher functional kicking skill for the normal males at the six, seven and eight year old age group comparisons.

Results from Figure 32 and Table 10 corresponding to performance differences of the mentally retarded children as related to sex also indicated a more mature level of kicking skill for retarded males in comparison to retarded females. This finding stemmed from the fact that a greater number of retarded males demonstrated Level III kicking (twenty-six) in comparison to the retarded females (six). Further support of the more
mature kicking skill of retarded males was demonstrated by their higher combined mean level of performance in kicking as illustrated by Table 10.

In support of this finding, comparative data on retarded males and females at each age level (Figures 33-35 and Table 10) revealed that at each age, retarded males exhibited a more mature functional performance in kicking than the retarded females.

**Longitudinal Performance Trends.** Performance in kicking improved with chronological age for both normal males and females as illustrated from Figure 36. Comparative data on the mentally retarded females also demonstrated improvement in kicking performance with advancing chronological age. Data reflecting the performance of the mentally retarded males suggested a stable level of kicking skill from age six to eight.
Figure 32. Performance Distribution of Combined Age Groups for Levels of Kicking.
Figure 33. Performance Distribution of Six Year Old Children for Levels of Kicking

Figure 34. Performance Distribution of Seven Year Old Children for Levels of Kicking
Figure 35. Performance Distribution of Eight Year Old Children for Levels of Kicking.
### Table 10

**Performance Distribution and Mean Performance Levels of Six, Seven, and Eight-Year-Old Normal and Mentally Retarded Children in Kicking**

<table>
<thead>
<tr>
<th>Sex/Age</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>Mean Perf.</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>Mean Perf.</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td><strong>Males</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>0</td>
<td>2</td>
<td>9</td>
<td>9</td>
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<td>7</td>
<td>12</td>
<td>3.55</td>
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<td>Combined</td>
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<td>26</td>
<td>0</td>
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<td>0</td>
<td>7</td>
<td>27</td>
<td>26</td>
<td>3.32</td>
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<td>11</td>
<td>6</td>
<td>3.15</td>
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<tr>
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<td>43</td>
<td>6</td>
<td>0</td>
<td>1.92</td>
<td>0</td>
<td>10</td>
<td>39</td>
<td>11</td>
<td>3.02</td>
</tr>
</tbody>
</table>
Figure 36. Mean Performance Levels of Mentally Retarded and Normal Children for Kicking
Analysis of the Graphic Data

Mentally Retarded vs Normal. Highlighted in Figure 37 is the data reflecting the percentage and frequency distribution of the mentally retarded and normal children's performance for levels of striking. Analysis of the graphic data indicated that Level IV striking was most characteristic of the normal male children while Levels II and III were most characteristic of the retarded males.

Numerically, fifty-five (92%) of the normal males assessed performed at Level IV in striking and five (8%) at Level III in comparison to eleven (18%) retarded males at Level I, twenty-four (40%) at Level II, seventeen (28%) at Level III and eight (13%) at Level IV, respectively.

The contrast in these distributions and combined mean performance score differences as noted in Table 11 clearly revealed the significantly higher functional level attained by the normal males in the skill of striking. Analysis of the retarded males and normal males at six, seven and eight years of age (Figures 38-40 and Table 11) indicated contrasts in performance distributions and mean performance levels which were
supportive of a much more advanced level of striking skill by the normal males at each age level.

Analysis of Figure 37 revealed that Level IV striking was most predominant among the normal females while Levels I and III were predominant among the retarded females assessed. Thirty-six (60%) of the normal females assessed performed Level IV striking, twenty-one (35%) at Level III and three (5%) at Level II. Comparatively, twenty (33%) retarded females performed at Level I, thirteen (22%) at Level II and twenty-seven (45%) at Level III in striking. The differences portrayed in the distribution of the retarded females and normal females' performance in striking in conjunction with the combined mean performance level differences indicated in Table 11, demonstrated developmentally the much more advanced level of striking skill by the normal females.

Lending further support to this finding was an age group by age group comparison of retarded and normal females (Figures 38-40 and Table 11) which indicated that at each age level, normal females displayed developmentally a more mature functional performance in striking than the retarded females.

Performance of Male vs Female. Percentage and frequency distribution analysis of Figure 37 indicated that a greater number of normal males performed at Level
IV in striking than normal females. Numerically, fifty-five (92%) normal males were at Level IV compared to thirty-six (60%) normal females. This contrast in performance distribution, in conjunction with the higher combined mean performance level for normal males noted in Table 11, indicated a more mature functional level of striking by the normal males.

Findings of a more advanced level of striking by normal males were demonstrated at each age level comparison of the sexes. These findings are clearly illustrated in Figures 38-40 and Table 11.

Results from Figure 37 and Table 11 corresponding to differences in performance of retarded males and females in striking revealed that mentally retarded males exhibited a more mature level of striking than the mentally retarded females. This finding was derived from the fact that eight of the mentally retarded males (13%) performed at Level IV and eleven (18%) at Level I which is in contrast to the retarded female performance where none performed at Level IV and twenty (33%) retarded females performed at Level I. Additionally, combined mean performance level comparison of the retarded males and females (Table 11) revealed a higher mean performance level for retarded males than retarded females.
Analysis of retarded males and females striking performance at each age level as illustrated by Figures 38-40 and Table 11 indicated that at age six, retarded males' striking skill was more advanced than that of the retarded females, but at ages seven and eight, performance levels were almost equal between the retarded males and females.

**Longitudinal Performance Trends.** Performance in striking improved slightly from age six to seven for normal males and then leveled off at a mature Level IV pattern between age seven and eight as seen in Figure 37. Data on the normal females suggested a decline in performance from age six to seven and then improvement in the skill from age seven to eight. Comparative data on the retarded males revealed a stationary level of performance across the three age levels. The striking skill of the retarded females improved from age six to seven and then leveled off between the ages of seven and eight.
Figure 37. Performance Distribution of Combined Age Groups for Levels of Striking.
Figure 38. Performance Distribution of Six Year Old Children for Levels of Striking.

Figure 39. Performance Distribution of Seven Year Old Children for Levels of Striking.
Figure 40. Performance Distribution of Eight Year Old Children for Levels of Striking.
Table 11

PERFORMANCE DISTRIBUTION AND MEAN PERFORMANCE LEVELS OF SIX, SEVEN, AND EIGHT-YEAR OLD NORMAL AND MENTALLY RETARDED CHILDREN IN STRIKING

<table>
<thead>
<tr>
<th>Sex/Age</th>
<th>Mentally Retarded</th>
<th>Normal Children</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Levels I II III IV Mean Perf.</td>
<td>Levels I II III IV Mean Perf.</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>5 7 4 4</td>
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<td>7</td>
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<td>2.40</td>
</tr>
<tr>
<td>8</td>
<td>3 8 3 1</td>
<td>2.35</td>
</tr>
<tr>
<td>Combined</td>
<td>11 24 17 8</td>
<td>2.37</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>11 5 4 0</td>
<td>1.65</td>
</tr>
<tr>
<td>7</td>
<td>4 4 12 0</td>
<td>2.35</td>
</tr>
<tr>
<td>8</td>
<td>5 4 11 0</td>
<td>2.30</td>
</tr>
<tr>
<td>Combined</td>
<td>20 13 27 0</td>
<td>2.10</td>
</tr>
</tbody>
</table>
Figure 41. Mean Performance Levels of Mentally Retarded and Normal Children for Striking
SKIPPING

Analysis of the Graphic Data.

Performance of Mentally Retarded vs Normal. Percentage and frequency distribution results of the mentally retarded and normal childrens' performance for levels of skipping are illustrated in Figure 42. Analysis of the graphic data revealed that Level IV skipping was most characteristic of the normal children while Level I skipping characterized the greatest number of retarded children.

Forty-eight (80%) of the normal males assessed performed at Level IV, seven (12%) at Level III, and five (8%) at Level I in comparison to the mentally retarded males where it was found that one (2%) child performed at Level IV skipping, four (7%) at Level III, three (5%) at Level II and fifty-two (87%) at Level I. The difference in the distribution of performance of these two groups revealed most dramatically from a developmental perspective the substantially more advanced skipping skill of the normal males. Comparison of the combined mean performance level of the mentally retarded males to that of the normal males (Table 12) further substantiated the immature level of skipping demonstrated by the retarded males.
An age level by age level comparison of the mentally retarded males and normal males in the skill of skipping is shown in Figures 43-45 and Table 12. Results supporting a more advanced skipping skill for normal males were found at each age level comparison.

Analysis of the graphic data from Figure 42 comparing the mentally retarded females and normal females indicated that fifty-two (87%) of the normal females who performed attained a Level IV in skipping, seven (12%) Level II skipping and one (2%) Level I skipping. Comparatively, fifty-four (90%) of the mentally retarded females attained Level I skipping, one (2%) Level II skipping and five (8%) Level III skipping. The contrast in performance distributions and the difference demonstrated between the combined mean performance scores of the retarded females and normal females as shown in Table 12, clearly indicated that normal females displayed a much more mature functional performance in skipping than the mentally retarded females.

Additional results supportive of this finding are illustrated in the graphic data of Figures 43-45 and mean performance level scores of the normal and mentally retarded females in the skill of skipping (Table 12). Analysis of this data indicated a much more mature level of skipping skill by the normal females at each age level.
Performance of Male vs. Female. Percentage and frequency distribution data reflecting the normal male and female performances in skipping are illustrated in Figure 42. Analysis of the percentage and frequency distribution data indicated that normal females were slightly more mature than normal males in the skill of skipping.

In terms of the performance distribution, fifty-two (87%) normal females performed at Level IV in skipping, seven (12%) at Level III, and one (2%) at Level I compared to the normal males where it was found that forty-nine (82%) were at Level IV, seven (12%) at Level III and four (7%) at Level I in skipping. This contrast in performance distribution in conjunction with combined mean performance level differences between normal females and males as noted in Table 12 reflected the slightly more mature level of skipping skill attained by the normal females.

At each age level compared, six, seven and eight, results supporting the slightly more advanced skipping skill of the normal females were demonstrated. These findings are illustrated clearly in Figures 43-45 and Table 12.

Results from Figure 42 corresponding to differences in the performances of retarded males and retarded females in skipping revealed that mentally retarded males
demonstrated a slightly higher functioning level in skipping than the retarded females. As illustrated from Figure 42 and Table 12, performance distribution results were slightly in favor of the retarded males and combined mean performance level comparisons revealed a slightly higher mean score for the retarded males.

Figures 43-45 and Table 12 provide data for the analysis of retarded males and females skipping performance at each age level. Results revealed that at age six, no differences existed between the retarded males and females in skipping skill. At age seven, the retarded males were at a slightly higher functional level while at age eight, the performance of the retarded males and females was almost equivalent.

**Longitudinal Performance Trends.** Graphic analysis of the data in Figure 46 revealed that the level of skipping performance of normal males was fairly stable between the ages of six to seven and then improved from age seven to eight. Data reflecting the level of skipping performance of the normal females suggested a similar stable level of performance from age six to seven and then improvement from age seven to eight.

Data from Figure 46 corresponding to the performance of mentally retarded males, revealed a stable level of
performance in skipping across the three age levels. Analysis of the mentally retarded females indicated a slight decline in the performance of skipping from age six to seven and then from age seven to eight, a slight upward trend resulting in a level comparable to that at age six.
Figure 42. Performance Distribution of Combined Age Groups for Levels of Skipping.
Figure 43. Performance Distribution of Six Year Old Children for Levels of Skipping

Figure 44. Performance Distribution of Seven Year Old Children for Levels of Skipping
Figure 45. Performance Distribution of Eight Year Old Children for Levels of Skipping
Table 12
PERFORMANCE DISTRIBUTION AND MEAN PERFORMANCE LEVELS OF SIX, SEVEN, AND EIGHT-YEAR OLD NORMAL AND MENTALLY RETARDED CHILDREN IN SKIPPING

<table>
<thead>
<tr>
<th>Sex/Age</th>
<th>Mentally Retarded Levels</th>
<th>Normal Children Levels</th>
<th>Mean Perf.</th>
<th>Mean Perf.</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
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<td>1</td>
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<tr>
<td>8</td>
<td>17</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Combined</td>
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<td>4</td>
<td>1</td>
</tr>
<tr>
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<td>Combined</td>
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</table>
Figure 46. Mean Performance Levels of Mentally Retarded and Normal Children for Skipping
LADDER CLIMBING

Analysis of the Graphic Data

Performance of Mentally Retarded vs Normal. Illustrated in Figure 47 are the percentage and frequency distribution results of the mentally retarded and normal childrens' performance in ladder climbing. Analysis of the graphic data indicated that Level IV ladder climbing was highly characteristic of the normal children while Level II ladder climbing was most characteristic of the mentally retarded children.

In terms of the performance distribution, as viewed in Figure 46, forty-seven (78%) of the normal males performed at Level IV in ladder climbing, and thirteen (22%) at Level III. In comparison, seven (12%) mentally retarded males performed at Level IV in ladder climbing, fifteen (25%) at Level III, thirty-five (58%) at Level II and three (5%) at Level I. The differences between these distributions, most notably at Level IV where far greater numbers of normal males performed, revealed developmentally the significantly more advanced level of ladder climbing ascertained by the normal males. Further results supportive of this finding are revealed from combined mean performance level scores of the two groups (Table 13) which clearly illustrated a level of skill in ladder climbing for the normal males which was at a much higher functional level.
Figures 48-50 and Table 13 present data comparing mentally retarded males and normal males at age six, seven and eight years. Analysis of this data revealed contrasts in performance distributions and mean performance differences supportive of the much more mature ladder climbing skill of the normal males at each age compared.

Results from Figure 47 corresponding to normal and retarded females revealed that fifty-five (92%) of the normal females assessed demonstrated Level IV ladder climbing, four (7%) Level III climbing and one (2%) Level II climbing. Comparatively, three (5%) mentally retarded females demonstrated Level IV ladder climbing, nine (15%) Level III climbing, thirty-eight (65%) Level II climbing and ten (17%) Level I ladder climbing. The contrast in performance distributions between the retarded females and normal females in conjunction with combined mean performance level differences (Table 13) demonstrated that normal females exhibited developmentally a much more mature functional level of ladder climbing than the retarded females.

Data comparing the retarded females and normal females at six, seven and eight years of age are presented in Figures 48-50 and Table 13. Analysis of each age level comparison revealed the mentally retarded females'
performance in ladder climbing was far less developed than that of the normal females.

**Performance of Male vs Female.** Percentage and frequency distribution analysis from Figure 47 indicated that normal females' level of performance in ladder climbing was slightly more advanced developmentally than that of the normal males. Numerically, forty-seven (78%) of the normal males demonstrated Level IV climbing and thirteen (22%) Level III climbing while in comparison, fifty-five (92%) of the normal females demonstrated Level IV climbing, four (7%) Level III climbing and one (2%) Level II climbing. Comparison of combined mean performance level scores of the two groups (Table 13) further revealed a slightly higher functional level of performance in ladder climbing by the normal females.

Comparison of the normal females and males at each age level (Figures 48-50 and Table 13) indicated that at each age, normal females were slightly more mature than males in the skill of ladder climbing.

Results from Figure 47 and Table 13 corresponding to differences in the performance of mentally retarded males and females in ladder climbing revealed that mentally retarded males were more advanced than retarded females in the skill of ladder climbing. In terms of the
performance distribution, seven (12%) retarded males attained Level IV climbing, fifteen (25%) Level III climbing, thirty-five (58%) Level II climbing and three (5%) Level I climbing in comparison to the retarded females where it was found that three (5%) attained Level IV climbing, nine (15%) Level III climbing, thirty-eight (63%) Level II climbing and ten (16%) Level I climbing. With respect to the combined mean performance level scores (Table 13), the retarded males were at a slightly higher developmental level than the retarded females. Comparative data between the mentally retarded males and females indicated that at each age, the performance of the retarded males in ladder climbing was at a slightly more mature functional level.

Longitudinal Performance Trends. The ladder climbing skill of the normal male children remained fairly constant from age six to eight as illustrated by Figure 51. Performance of the normal females improved slightly with advanced chronological age.

In comparison, Figure 51 revealed that the performance of the mentally retarded males advanced a good deal from age six to seven and then only slightly from age seven to eight. Data reflecting the retarded females' performance in ladder climbing illustrated a slight positive trend in performance with increased chronological age.
Figure 47. Performance Distribution of Combined Age Groups for Levels of Ladder Climbing.
Figure 48. Performance Distribution of Six Year Old Children for Levels of Ladder Climbing.

Figure 49. Performance Distribution of Seven Year Old Children for Levels of Ladder Climbing.
Figure 50. Performance Distribution of Eight Year Old Children for Levels of Ladder Climbing.
Table 13

PERFORMANCE DISTRIBUTION AND MEAN PERFORMANCE LEVELS OF SIX, SEVEN, AND EIGHT-YEAR OLD NORMAL AND MENTALLY RETARDED CHILDREN IN LADDER CLIMBING

<table>
<thead>
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<th>Sex/Age</th>
<th>Mentally Retarded</th>
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<tbody>
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<td></td>
<td>Levels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I    II  III IV</td>
<td>Mean Perf.</td>
</tr>
<tr>
<td>Males</td>
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</tr>
<tr>
<td>6</td>
<td>1    16  2 1</td>
<td>2.15</td>
</tr>
<tr>
<td>7</td>
<td>0    12  5 3</td>
<td>2.55</td>
</tr>
<tr>
<td>8</td>
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<td>2.43</td>
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<td>2.00</td>
</tr>
<tr>
<td>7</td>
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<td>2.08</td>
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</table>
Figure 51. Mean Performance Levels of Mentally Retarded and Normal Children for Ladder Climbing.
STAIR CLIMBING

Analysis of the Graphic Data

Performance of Mentally Retarded vs Normal. Figure 52 reflects the percentage and frequency of mentally retarded and normal children performing at the four levels of stair climbing. Analysis of the graphic data indicated that Level IV stair climbing was the predominant behavior demonstrated among the normal children, while Level III and IV stair climbing behavior predominated among the mentally retarded children.

Analysis of the data from Figure 52 pertaining to the normal males and mentally retarded males revealed that all the normal males assessed demonstrated Level IV behaviors in stair climbing. Comparatively, twenty (33%) of the retarded males assessed in stair climbing demonstrated Level IV behaviors, twenty-seven (45%) Level III behavior, eleven (18%) Level II behaviors and two (3%) Level I behaviors. Combined mean performance level comparison of normal males and retarded males (Table 14) indicated a higher combined mean level of performance for the normal males. The differences in the performance distribution of the retarded males and normal males and the difference in the combined mean level of performance between the two reflected developmentally a much more mature level of stair climbing for the normal males.
The trend of a more mature skill pattern in stair climbing by normal males was further substantiated through analysis of Figures 53-55 and Table 14 which correspond to performance results of six year old children, seven year old children and eight year old children. Comparison of the graphic data and mean performance level comparison of the normal and mentally retarded males revealed a more advanced level of performance in stair climbing by the normal males at each age.

Analysis of the distribution of performance of normal females and mentally retarded females for levels of stair climbing (Figure 52) indicated fifty-nine (98%) of the normal females demonstrated Level IV behaviors in stair climbing and one (2%) Level III behavior. In comparison, fourteen (23%) of the retarded females demonstrated Level IV behaviors in stair climbing, four (40%) Level III behaviors, seventeen (23%) Level II behaviors and five (8%) Level I behaviors. The contrast in the distribution of the retarded females and normal females' performance in stair climbing, most notably at Level IV, in conjunction with the relatively higher combined mean performance level of the normal females noted in Table 14 demonstrated clearly the substantially higher functional level of stair climbing skill attained by the normal females.
Analysis of the normal females and retarded females at six, seven and eight years of age (Figures 53-55 and Table 14) revealed contrasts in performance supporting developmentally a more mature level of stair climbing by the normal females.

**Performance of Male vs Female.** Percentage and frequency distribution data from Figure 52 reflecting the stair climbing skill of normal males and females indicated that there were no differences in the skill level of the two groups. Numerically, the entire normal male group attained Level IV behaviors in stair climbing and fifty-nine of the normal females. Comparison of the combined mean performance levels of the normal male and female stair climbing skill revealed strikingly similar means (Table 14).

Analysis of the normal males and females at each age level (Figures 53-55 and Table 14) further illustrated the parallel performance of the normal males and females at each age.

For the mentally retarded children, analysis of Figure 52 and Table 14 revealed differences between the mentally retarded males and females supporting a more developed level of skill in stair climbing by the mentally retarded males.
In terms of the performance distribution as seen in Table 52, twenty (33%) of the mentally retarded males demonstrated Level IV stair climbing, twenty-seven (45%) Level III behaviors, eleven (18%) Level II behaviors, and two (3%) Level I behaviors. Comparatively, fourteen (23%) mentally retarded females demonstrated Level IV behaviors, twenty-four (40%) Level III behaviors, seventeen (28%) Level II behaviors and five (8%) Level I behaviors. The contrasts in performance distributions, particularly at Level III and Level IV where the mentally retarded males far outnumbered the mentally retarded females, taken in conjunction with the higher combined mean performance level of the mentally retarded males, as noted in Table 13, reflected a more mature level of stair climbing skill for the mentally retarded males.

Analysis of the mentally retarded males and females at six, seven and eight years of age (Figures 53-55 and Table 14) revealed a more advanced level of stair climbing for the mentally retarded males at ages six and seven but not at age eight where results indicated a fairly equal level of skill between the mentally retarded males and females.

**Longitudinal Performance Trends.** Analysis of Figure 56 revealed a mature level of stair climbing skill existed for normal males and females across the three age
levels. Data corresponding to the mentally retarded children indicated that the stair climbing skill of the retarded males advanced substantially from age six to seven and then declined from age seven to eight. Mentally retarded females' performance in stair climbing improved steadily with increased chronological age, with the most noticeable increase from age six to seven.
Figure 52. Performance Distribution of Combined Age Groups for Levels of Stair Climbing.
Figure 53. Performance Distribution of Six Year Old Children for Levels of Stair Climbing.

Figure 54. Performance Distribution of Seven Year Old Children for Levels of Stair Climbing.
Figure 55. Performance Distribution of Eight Year Old Children for Levels of Stair Climbing.
| Sex/Age | Mentally Retarded | | | | Normal Children | | | |
|---------|------------------|---|---|---|---|---|---|---|---|
|         | Levels | I | II | III | IV | Mean Perf. | I | II | III | IV | Mean Perf. |
| Males   |        |   |    |     |    |             |   |    |     |    |            |
| 6       |        | 1 | 4  | 13  | 2  | 2.80        | 0 | 0  | 0    | 20 | 4.00       |
| 7       |        | 0 | 3  | 6   | 11 | 3.14        | 0 | 0  | 0    | 20 | 4.00       |
| 8       |        | 1 | 4  | 8   | 7  | 3.05        | 0 | 0  | 0    | 20 | 4.00       |
| Combined|        | 2 | 11 | 27  | 20 | 3.08        | 0 | 0  | 0    | 60 | 4.00       |
| Females |        |   |    |     |    |             |   |    |     |    |            |
| 6       |        | 4 | 7  | 5   | 4  | 2.45        | 0 | 0  | 0    | 20 | 4.00       |
| 7       |        | 0 | 5  | 12  | 3  | 2.90        | 0 | 1  | 1    | 19 | 3.95       |
| 8       |        | 1 | 5  | 7   | 7  | 3.00        | 0 | 0  | 0    | 20 | 4.00       |
| Combined|        | 5 | 17 | 24  | 14 | 2.78        | 0 | 1  | 1    | 59 | 3.97       |
Figure 56. Mean Performance Levels of Mentally Retarded and Normal Children for Stair Climbing.
SUMMARY

Results from this investigation clearly demonstrated the basic gross motor skill performance of moderately mentally retarded children to be significantly less developed than that of normal children when compared to on a qualitative basis. As seen in Tables 15 and 16, these results were exhibited across all age group comparisons, comparisons made on the basis of intellectual level, and comparisons made by sex. In only one skill, namely walking, did results indicate a similar level of performance between normal and mentally retarded children. In the remaining ten skills, very low levels of performance were generally noted in the retarded population. The mentally retarded children's least mature performances were in the fairly complex skills of skipping, hopping and catching. Kicking, striking, throwing and ladder climbing performances were also at a strikingly low functional level. With the exception of the mentally retarded children's performance in walking, the gross motor skill performances of the youngest normal children were developmentally more advanced than the gross motor skill performances of the oldest mentally retarded children.
In terms of results related to sex trends (Table 15), normal males tended to demonstrate more mature functional performances when compared to normal females in throwing, catching, kicking, and striking skill, or skills that have some social significance. Normal females' level of performance was more mature than that of the normal males on the skills of running, hopping, skipping and ladder climbing. Comparable levels of performance were recorded between normal males and females in the skills of walking, jumping and stair climbing.

Sex trends, as related to the performances of the mentally retarded children followed a somewhat different pattern. From a developmental point of view, the overall level of performance recorded for mentally retarded males was more advanced than that of the mentally retarded females on all skills except jumping where retarded females were slightly more developed and in walking where no differences existed between the two groups (Table 15). Greatest differences were evidenced in the skills of kicking, ladder climbing, throwing, stair climbing and striking. It should be noted that at age eight, the running, hopping, throwing and skipping skill of retarded females was at a more mature level than that of the retarded males. Also, at age seven, retarded females' performance
in running was at a higher functional level than that of the retarded males (Table 16).

With respect to longitudinal performance trends (Table 16), the gross motor skill performances of normal male and female children improved qualitatively with increased chronological age in general. Exceptions to this were noted in the skills of jumping and stair climbing where a stable level of performance existed from age six to eight for both males and females and in ladder climbing where the performance of normal males was relatively stable from age six to eight.

In the male retarded population, as evidenced from Table 16, advanced chronological age did not necessarily result in improvements in the qualitative aspects of skill performance. In the skills of hopping, jumping, ladder climbing, throwing and stair climbing, improved levels of performance were noted from age six to seven and then a leveling off of performance or slight decrement in performance occurred. In the remaining skills, with one exception, performance was generally stable from age six to eight. In ladder climbing, improved performance was evidenced with increased chronological age.
The performance of the mentally retarded females, as seen in Table 16, tended to improve with increased chronological age on the skills of running, throwing, kicking, ladder climbing and stair climbing. In the skills of running, catching, jumping, and striking, performance of the retarded females generally improved from age six to seven and then plateaued. The skipping performance of the retarded females decreased from age six to seven and then increased to a level comparable to that at age six.

Finally, the overall evidence suggested that with advanced chronological age, the differences in functional performances between normal and retarded children widens with respect to qualitative levels of gross motor skill performance as measured by the Ohio State University Scale of Intra Gross Motor Assessment.
Table 15

MEAN PERFORMANCE LEVEL OF MENTALLY RETARDED AND NORMAL CHILDREN AFTER COMBINING AGE GROUPS

<table>
<thead>
<tr>
<th>SKILLS</th>
<th>MENTALLY RETARDED MALES</th>
<th>NORMAL MALES</th>
<th>MENTALLY RETARDED FEMALES</th>
<th>NORMAL FEMALES</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALK</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>RUN</td>
<td>2.55</td>
<td>3.22</td>
<td>2.37</td>
<td>3.28</td>
</tr>
<tr>
<td>HOP</td>
<td>1.85</td>
<td>3.68</td>
<td>1.78</td>
<td>3.80</td>
</tr>
<tr>
<td>THROW</td>
<td>2.53</td>
<td>3.92</td>
<td>2.22</td>
<td>3.23</td>
</tr>
<tr>
<td>CATCH</td>
<td>1.92</td>
<td>3.52</td>
<td>1.83</td>
<td>3.37</td>
</tr>
<tr>
<td>JUMP</td>
<td>2.38</td>
<td>3.63</td>
<td>2.46</td>
<td>3.63</td>
</tr>
<tr>
<td>KICK</td>
<td>2.28</td>
<td>3.32</td>
<td>1.92</td>
<td>3.02</td>
</tr>
<tr>
<td>STRIKE</td>
<td>2.37</td>
<td>3.92</td>
<td>2.10</td>
<td>3.55</td>
</tr>
<tr>
<td>SKIP</td>
<td>1.23</td>
<td>3.63</td>
<td>1.18</td>
<td>3.83</td>
</tr>
<tr>
<td>LADDER</td>
<td>2.43</td>
<td>3.78</td>
<td>2.08</td>
<td>3.90</td>
</tr>
<tr>
<td>STAIRS</td>
<td>3.08</td>
<td>4.00</td>
<td>2.78</td>
<td>3.97</td>
</tr>
<tr>
<td>Table 16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>MEAN PERFORMANCE LEVELS OF SIX, SEVEN, AND EIGHT YEAR OLD NORMAL AND MENTALLY RETARDED CHILDREN FOR SELECTED GROSS MOTOR SKILLS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Six Year Old Children</td>
<td></td>
<td>Seven Year Old Children</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal Male</td>
<td>Normal Female</td>
<td>MR Male</td>
<td>MR Female</td>
</tr>
<tr>
<td>Walk</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Run</td>
<td>3.15</td>
<td>3.10</td>
<td>2.60</td>
<td>1.95</td>
</tr>
<tr>
<td>Hop</td>
<td>3.60</td>
<td>3.75</td>
<td>1.60</td>
<td>1.40</td>
</tr>
<tr>
<td>Throw</td>
<td>3.75</td>
<td>2.85</td>
<td>2.50</td>
<td>1.60</td>
</tr>
<tr>
<td>Catch</td>
<td>3.10</td>
<td>3.05</td>
<td>1.90</td>
<td>1.65</td>
</tr>
<tr>
<td>Jump</td>
<td>3.60</td>
<td>3.65</td>
<td>2.25</td>
<td>2.00</td>
</tr>
<tr>
<td>Kick</td>
<td>3.05</td>
<td>2.85</td>
<td>2.25</td>
<td>1.70</td>
</tr>
<tr>
<td>Strike</td>
<td>3.80</td>
<td>3.55</td>
<td>2.35</td>
<td>1.65</td>
</tr>
<tr>
<td>Skip</td>
<td>3.55</td>
<td>3.75</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>Ladder</td>
<td>3.80</td>
<td>3.85</td>
<td>2.15</td>
<td>2.00</td>
</tr>
<tr>
<td>Stair</td>
<td>4.00</td>
<td>4.00</td>
<td>2.80</td>
<td>2.45</td>
</tr>
</tbody>
</table>
DISCUSSION

This investigation attempted to distinguish the qualitative differences in basic gross motor skill performance between moderately mentally retarded children and normal children. It further sought to identify differences in performance as related to the sex and age of the groups of children studied. Numerous investigations in the past have shown that mentally retarded children lag well behind children of normal intelligence in motor abilities. The descriptive evidence generated by this investigation was in agreement with previous research in revealing less mature levels of gross motor skill development of moderately retarded children when compared to normal children.

This investigation does differ, however, from previous research in a number of ways. It differs, first of all, in that the qualitative differences in gross motor skill performance (developmental level) rather than the quantitative differences in gross motor skill performance (speed, distance, time, etc.) between mentally retarded and normal children were identified. It further differs from previous research in that it was an investigation of basic gross motor skills (i.e., running, jumping, hopping, skipping, throwing, etc.)
rather than an aspect of physical ability such as muscular endurance, flexibility or strength, etc. Finally, the investigation was distinguishable from others in that it was primarily concerned with moderately retarded children instead of older age group and higher functioning children.

Variables Associated with Performance Differences of Mentally Retarded and Normal Children

As indicated previously, results revealed qualitative differences in the performance levels of moderately retarded and normal children when demonstrating basic gross motor skills. Numerous factors could have, and in most likelihood did, contribute to low levels of performance demonstrated by the moderately retarded children.

In this investigation, the qualitative levels of performance exhibited by the retarded children in running, hopping, kicking, throwing, catching, skipping, jumping, striking, ladder climbing and stair climbing were at a significantly lower developmental level. This would seem congruent with the research evidence of Francis and Rarick (66), Brown (91), Liese and Lerch (72), and Londeree and Johnson (73), who found low levels of motor performance in moderately retarded children. The immature
levels of performance in these skills could have partly been a result of poor balance, poor eye-hand coordination, poor eye-foot coordination and poor rhythm demonstrated by the retarded children. Literature on basic gross motor skill development cites these variables as crucial factors for adequate skill performance (46, 51, 23, 68). Thus, with deficiencies such as those identified, immature levels of running, hopping, throwing, etc. would be expected.

Another factor possibly contributing to the low performance levels of the retarded children in this investigation was the nature of the task. The skills under examination in this investigation were fairly easily acquired by normal children. For the retarded children, the combination of movements involved in the performance of hopping, skipping, striking, etc. were quite complex. It is possible that the retarded children could not comprehend all the components of the skills, thus resulting in their low level of performance. This finding is in general agreement with other research (16, 64, 81, 84), which found that skill complexity or skills comprised of a number of integrated movements created the greatest problems for the retarded child. Fortifying this point even to a greater extent is the
fact that the retarded children exhibited the lowest levels of performance on the skills of skipping, hopping, catching, or the skills which developmentally are more complex.

Another factor, which in all probability contributed to the low levels of performance of the retarded children was their lack of experience in the realm of gross motor skills. Normal children are surrounded daily with opportunities to run, jump, catch, etc. in school and in after school play experiences. These same formal and informal play experiences within the schools and home environment have not been available generally to the same degree for mentally retarded children. In most instances, sound developmental programs for retarded children to foster development in gross motor skills are infrequently seen. Also, the availability of after school activities, such as park and playground experiences, intramurals and age group athletics (i.e., Little League baseball, Little League Soccer) are limited for the young moderately retarded child (103). If retarded children do not have the opportunities, how can they be expected to develop and acquire reasonable levels of proficiency in these skills?

Motivational factors could have been a variable associated with differences in performance between the
normal and retarded children. Normal children, for the most part, enjoy gross motor activities and obtain a great deal of personal satisfaction, peer praise and reward for successful participation (50, 43, 49). On the other hand, mentally retarded children, specifically, the moderately retarded, are not intrinsically or extrinsically motivated to do well in gross motor activities.

A possible final factor contributing to performance differences may be attributed to parental and societal overprotection. Parents of retarded children often excuse or keep their children from participating in activities of a gross motor nature (37, 43). They fear their children might be injured or taken advantage of and thus feel it would be more desirable for them not to participate. This belief reduces the opportunity for worthwhile experiences in the gross motor skill area.

Similarly, society as a whole has a protective/negative attitude toward mentally retarded children engaging in physical activities (37). It is felt that if the mentally retarded do participate, injuries could result, behavioral problems could arise, and possibly increased difficulties in program planning could occur.

All these factors, in varying degrees, may have contributed to the retarded childrens' lower performance
in the gross motor skills. It must be recognized by all that retarded children have the same basic rights to participate and the same essential needs for sound gross motor activity.

Variables Associated With Male and Female Performance Differences

A second question entertained by the investigator in this study was whether or not differences in gross motor skill performance were related to the sex of the children. Among the normal subjects, males were more advanced than females in the skills of throwing, catching, kicking and striking. It is highly likely that their more mature level of performance in these skills was culturally influenced. Males, for the most part, have the opportunity to participate in organized youth activities and thus the possibility of greater exposure to activities requiring the skills studied.

In the same sense, normal females more mature level of performance in skipping, and hopping might reflect a culturally related discrepancy (18, 43, 51, 46). Females seemingly are involved in more games and experiences which incorporate these skills, thus possibly giving them a slight advantage in these skills. It should also be mentioned that the more advanced levels of performance by
the normal females in the skills of skipping, hopping, ladder climbing and running may indicate a higher level of functioning with regard to dynamic balance. Balance is a crucial aspect in all of these skills. With females showing advantages in all items, it is not out of context to suggest a higher level of dynamic balance in the normal female.

Closely related to the previous point is the factor of motivation. Males are rewarded to a greater degree intrinsically and extrinsically (parents, peers) for participation in activities (i.e., baseball, football, soccer) involving the utilization of the skills of throwing, catching, kicking, and striking (18, 43, 46). On the other hand, participation by females in these activities has not been given strong support until just recently with the advocacy of women's sports.

In terms of the retarded population, mentally retarded males tended to be developmentally more mature than mentally retarded females on all the gross motor skills except jumping where they were only slightly less mature and in walking, a skill in which both were equally proficient. These findings are in general agreement with other research (66, 43, 69), which has found retarded males to be more advanced than retarded females on nearly all measures of motor ability. Reasoning for this is
Quite speculative at this time. Rarick (43) suggests that it might be that more males than females are placed in classes for the retarded because of behavioral problems or learning difficulties, rather than for clear cut evidence of mental retardation. It might also be that retarded males find motor activities to be more satisfying than retarded females do and as a result, devote more time to this activity. The fact that mentally retarded males have more opportunity for physical activity may have also contributed to the observed performance differences between mentally retarded males and females (103).

Variables Associated with Longitudinal Performance Differences

With respect to age trends, normal children tended to improve with advanced chronological age. This fact seems extremely viable with current research (66, 43, 51, 23, 34). Certainly, these years under examination, a great many experiences, much time and much promotion are given to gross motor skill acquisition in the normal population.

In terms of the retarded children, the fairly stationary level of gross motor performance which is exemplified by them across the three year age span is alarming. Three factors arise as possible reasons for
this. The moderately retarded childrens' rate of learning/development is no doubt extremely slow, thus not providing visibly significant improvements in performance from year to year. Secondly, present physical education and recreation programs may not be providing appropriate gross motor skill activities, thus curtailing to a certain extent improvements in this area of functioning. Another factor which is closely related to this is the frequency of physical education classes for the retarded. As reported by Loovis (103), retarded children generally receive physical education once a week for approximately thirty to forty-five minutes. It is unlikely that this is enough time for adequate practice in gross motor skill development.

In connection with the age trend discussion, the performance of the six year old females should be looked upon with some caution. In each skill, their level of performance was extremely immature. Reasons for this low level of performance are at best suppositional, but should be forwarded. There is a possibility that the selection process resulted in a very low skilled group being chosen. It was extremely difficult to find six year old retarded females to participate, thus reducing to a great extent sound sampling techniques.
Other possibilities in explaining their immature performance levels might lie in the fact that this was their first year in school or that most of the children came from poor homes or group homes where little was being done in terms of additional leisure physical activity. It is also highly probable that a number of the six year old retarded females at one time or another had been institutionalized, thus giving rise to questions concerning their true functional level.

Finally, although no quantitative measures of gross motor skill performance were recorded during the investigation, quantitative differences were observed by the investigator. Jumping distance, running speed, throwing accuracy and striking power, etc. tended to be much more advanced in the normal population. This information is in general agreement with the numerous studies comparing mentally retarded and normal children on quantitative measures of skill performance (66, 43, 38, 73, 68).

This discussion has focused on numerous factors which could have contributed to the qualitative performance differences noted between mentally retarded and normal children, between males and females and differences related to advancements in age. All these factors must be taken into account when planning programs to facilitate basic gross motor skill development in children.
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this investigation was to compare selected basic gross motor skill performances of moderately mentally retarded children and children of normal intelligence through utilization of a criterion referenced assessment tool, The Ohio State University Scale of Intra Gross Motor Assessment. More specifically, the investigation attempted to distinguish the qualitative differences in performance between the two groups in the execution of the skills of walking, running, hopping, throwing, catching, jumping, kicking, striking, skipping, ladder climbing, and stair climbing. Additionally, the investigation attempted to determine if qualitative differences in skill performance were related to the age and sex of the children.

The literature is replete with studies examining motor performance variables in the educable mentally retarded population but extremely sparse with studies pertaining to young moderately retarded children and their gross motor skill performance. The literature also reveals that most of the studies conducted with retarded children in the motor realm are quantitative rather than qualitative in nature.
One hundred and twenty moderately retarded children between the ages of six to eight and with I.Q.'s ranging from twenty to fifty-three were selected as participants in the investigation. These children came from seven schools servicing mentally retarded children in the State of Ohio. An equal number of children with normal intelligence and ages between six to eight were chosen for comparison purposes from a public school in Columbus, Ohio. As a result of the selection procedures, a $2 \times 3 \times 2$ design configuration with twenty normal males, twenty normal females, twenty retarded males and twenty retarded females at six, seven and eight years of age evolved.

In order to ascertain data on the gross motor skill performances of the children, a criterion referenced assessment tool, The O.S.U. SIGMA was utilized. The instrument is designed in a manner to examine the qualitative aspects of an individual's skill performance rather than quantitative aspects of an individual's performance in eleven basic gross motor skills. Each skill in the O.S.U. SIGMA is subdivided into four observable levels of motor behavior ranging from a very immature level to a mature functional level. Each of the levels is defined by performance criteria stated in behavioral form. This four level arrangement reflects the sequential development within a skill.
The mentally retarded children were individually assessed by one of four evaluators at their respective schools. In all but one school location, assessments took place in the school gymnasium. Because of scheduling conflicts at one school, assessments had to be conducted in a large basement room. Assessment of the normal children took place in four large classrooms which had been cleared of extraneous materials. Generally, an assessment involved ten to fifteen minutes of each child's time. Only one assessment per child was necessary.

In assessing a child, the evaluator allowed three trials per skill. Explicit directions and skill demonstrations were given prior to the executions of each trial. Scoring was based on careful observation of the child's motoric behavior in performing a skill and then comparison of the performance with the performance criteria outlined for each skill level in the O.S.U. SIGMA. Scoring ranged from \( L_1 \) to \( L_4 \), with \( L_1 \) being the lowest score possible and \( L_4 \) the highest score possible. The evaluator gave a score corresponding to the predominant motoric behaviors (performance level) demonstrated by the child in two out of the three trials. If for some reason an additional trial or two was necessary to determine a level of performance in a given skill, it was allowed.
Data attained from the assessment procedures were graphed to provide a descriptive profile of the mentally retarded and normal children's performance in each skill. The descriptive evidence generated from this investigation revealed that qualitatively the performance level of mentally retarded children in basic gross motor skills was significantly less advanced developmentally than that of normal children. These results were consistent from age group to age group comparisons and comparisons made by sex. The skill performances of the oldest retarded children did not approach that of the youngest normal children. The greatest differences in performance were evidenced in the complex skills of skipping, hopping and catching.

Comparisons made within the retarded population revealed that the overall performance level of retarded males exceeded the level of performance of retarded females in each skill except jumping where the retarded females were slightly advanced, and in walking where no differences existed. Results pertaining to normal children indicated that males were advanced developmentally in the skills of throwing, striking, kicking and catching. Normal females' level of performance in running, hopping, skipping and ladder climbing was more mature than that of the normal males. No measureable performance differences were recorded between normal males and females in the skills of walking, jumping, and stair climbing.
Age trend results revealed that advanced chronological age generally resulted in an improved level of skill performance in the normal population. Exceptions to this were noted in the skills of walking and stair climbing, where a mature level of performance existed at age six for both males and females and in jumping where a stable performance level was evidenced from age six to eight for both groups. In terms of the retarded population, increased chronological age did not necessarily result in higher levels of skill performance. As noted from results on retarded males, stable levels of performance were recorded from age six to eight in the skills of walking, running, throwing, catching, striking, skipping, and kicking. Some performance improvement was evidenced from age six to seven in the skills of jumping, ladder climbing, hopping and stair climbing. With retarded females, advanced chronological age resulted in improved hopping, throwing, kicking, ladder climbing, and stair climbing skills. In the skills of running, catching, jumping and striking performance of the retarded females improved from age six to seven and then plateaued.

Conclusions

Within the limitations of this investigation, the following conclusions seem justified:

1. In terms of the qualitative aspects of gross
motor skill performance, as defined in the O.S.U. SIGMA, the performances exhibited by the mentally retarded children were significantly less mature than the performances demonstrated by the normal children.

2. Qualitatively, the performance level of normal male children surpassed that of normal females in the skills of throwing, catching, striking and kicking.

3. In the skills of skipping, hopping, and ladder climbing, the qualitative level of performance demonstrated by normal females was more mature than that of normal male children.

4. The overall performance level of mentally retarded males exceeded that of retarded females from a qualitative aspect in the skills of running, hopping, skipping, throwing, catching, kicking, striking, ladder climbing and stair climbing.

5. The qualitative level of performance demonstrated by mentally retarded females in the skill of jumping was at a higher developmental level than that of the retarded males.

6. Generally, advanced chronological age resulted in improved qualitative levels of performance in the normal population. In the retarded population, advanced chronological age did not necessarily produce changes in performance levels.
7. The greatest differences in performances between mentally retarded and normal children were evidenced in the complex skills of skipping, hopping, and catching.

8. The O.S.U. SIGMA proved to be a viable and efficient instrument in the acquisition of data on the qualitative aspects of gross motor skill performance.

Recommendations

The following recommendations may be of assistance in pursuing additional research:

1. Consider investigating younger and older mentally retarded children so that an age span profile can be developed.

2. In order to better understand the qualitative aspects of gross motor skill performance in the mentally retarded population, future research should examine groups of a higher and lower functioning status.

3. A study of Down's Syndrome children to determine if their level of gross motor skill performance differs from that of other retarded children has some merit.

4. Closely related to the previous recommendation, the level of gross motor skill performance of institutionalized versus non-institutionalized retardates should be examined.
5. Various atypical populations such as deaf, blind and autistic should be evaluated with the O.S.U. SIGMA to determine their levels of gross motor skill performance.

6. An investigation should be conducted to measure the amount of change in the qualitative levels of gross motor skill performance envisioned in a mentally retarded population after a one or two year intervention program utilizing the O.S.U. Performance Based Curriculum.

7. To facilitate standardization of the assessment process and its widespread use, thought should be given to the development of a test manual.
APPENDIX A

O.S.U. FIELD PROJECT MANUAL
**SKILL OF Walking**

**TEST EQUIPMENT:** Wall, Bench, Rail in a stationary position  
**NOTE:** Examiner cannot be used.

<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
</tr>
</thead>
</table>
| When assisted from an all 4's position by the examiner.  
**NOTE:** Examiner may take hands but should not pull child up. | When from an all 4's position and within arms reach of a wall, bench, rail, etc. | Same | When from an all 4's position. |

The child is capable of maintaining an erect standing posture either assisted, unassisted, or a combination of both for a minimum of ten seconds in two out of three trials.

The child demonstrates the following behaviors in two out of three trials:
- a. assumes a standing position either with assistance from support objects or independently,
- b. walks forward at least ten steps with arms raised to approximately shoulder level and foot spread wide,
- c. touches support object next.

The child demonstrates the following behaviors in two out of three trials:
- a. assumes a standing position independently,
- b. walks forward totally unassisted with a gait characterized by arm and leg action, i.e., right arm and left leg swing forward together and vice versa, in a straight path for a distance of fifteen feet.

*McGraw, 1940*

*Angle, 1972*  
*Brackenridge and Murphy, 1969*  
*Gesell and Anand, 1974*  
*Shirley, 1933*

*Heyl, 1935*  
*Gesell, 1940*  
*Shirley, 1933*

*Burnett and Johnson, 1971*  
*McGraw, 1940*
### Skill of Hopping

<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>When in a standing position with the feet parallel and next to each other,</td>
<td>When in a standing position supported on one leg with the other foot held just a few inches above the floor, <strong>Note:</strong> Child may use either foot but may not hold the other foot.</td>
<td>Same</td>
<td>Same</td>
</tr>
</tbody>
</table>

**Test Conditions:**
- The child, using a simultaneous two foot take off and landing, jumps at least three consecutive times in two out of three trials, either straight up and down or forward in a broad jump fashion.
- The child attempts to hop and demonstrates the following behaviors in two out of three trials:
  a. Raises both arms sideways, usually to chest level (high), arm(s) on side of non-support leg may be straight; arm on side of support leg may be bent.
  b. Raises non-support leg with knee cut out to side as high as possible simultaneously with arm movement.
  c. Straights knee and ankle of support leg to rise up on toes when attempting to hop but support foot does not leave ground.

**Performance:**
- Gutteridge, 1939
- Mackin and Wellman, 1938
- Wellman, 1937
- Halverson et al., 1973

**Notes:**
- The child hops forward across the floor on one foot, two or more times by coordinating the following behaviors in two out of three trials:
  a. Raises arms upward to aid in lifting body off the floor.
  b. Lifts bent non-support leg off the floor with knee at approximately waist level.
  c. Lifts foot of support leg off the floor and quickly returns it. The child hops forward across the floor on one foot, two or more times by coordinating the following behaviors in two out of three trials:
  a. Raises arms upward to aid in lifting body off the floor.
  b. Lifts bent non-support leg off the floor with knee at approximately waist level.
  c. Lifts foot of support leg off the floor and quickly returns it.
<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing in front of and five feet from the examiner,</td>
<td>Same</td>
<td>Standing in front of and ten feet from the examiner,</td>
<td>Standing in front of and fifteen feet from the examiner,</td>
</tr>
</tbody>
</table>

**NOTE:** Ask child to throw the ball as "hard" as he can.

- The child throws the 6" ball in the direction of the examiner and demonstrates the following behaviors in two out of three trials:
  a. uses a single-handed throw with the arm swinging in a sideward (right to left or vice versa) motion, and the direction of swing is either downward or flat,
  b. twists upper body backwards to side of throwing arm during backswing then forward to side opposite throwing arm during throw,
  c. no movement of feet,
  d. uses a single-handed throw with the arm swinging in a sideward (right to left or vice versa) motion, and the direction of swing is downward,

- The child throws the tennis ball in the direction of the examiner and demonstrates the following behaviors in two out of three trials:
  a. uses a single-handed throw with the arm swinging in a sideward (right to left or vice versa) motion, and the direction of swing is downward,
  b. twists upper body backwards and shifts weight to front on side of throwing arm during backswing then forward to side opposite throwing arm during throw,
  c. twists upper body forward after shifting weight to front opposite throwing arm,
  d. snaps wrist in process of releasing ball.

**PERFORMANCE**

Gutteridge, 1939  
Wild, 1938  
Wild, 1938  
Wild, 1938
**SKILL OF CATCHING**

**TEST EQUIPMENT:** 6" Rubber Playground Ball

<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>When the examiner stands five feet in front of the child and throws the ball underhand, NOTE: Ball should reach the child between the shoulders and the waist! Ball should travel in an arc, not a straight line!</td>
<td>Same</td>
<td>Same</td>
<td>Same</td>
</tr>
</tbody>
</table>

The child attempts to catch the ball twice in three trials by extending his outstretched arms in a stiff manner in front of his body thereby causing the ball to rebound off the arms.

The child, using the hands and arms (bent at the elbows) to scoop or bring the ball into the body, catches the ball twice in three trials.

The child catches the ball and demonstrates the following behaviors in two out of three trials:

a. holds arms bent at the elbows in front of the body
b. uses hands in opposition to one another, i.e., a "clapping" motion, and attempt to trap ball.

The child catches the ball and demonstrates the following behaviors in two out of three trials:

a. holds arms bent at the elbows on the sides of body
b. uses hands in a cupped fashion such that:
   1. on throws above the waist the thumbs are nearly touching and
   2. on throws below the waist the little fingers are close together.

---

Wickstrom, 1970

Gutteridge, 1939
McCaskill and Heilman, 1938
Seefeldt et al., 1972
Wellman, 1937
Wickstrom, 1970

Gutteridge, 1939
McCaskill and Heilman, 1938
Seefeldt et al., 1972
Wellman, 1937
Wickstrom, 1970

McCaskill and Heilman, 1938
Wellman, 1937
Wickstrom, 1970
# Skill of Jumping (Bread J.)

**Test Equipment:** Step 6" high; Piece of paper 8" x 11" (alternatives: tape, rope, etc.)

<table>
<thead>
<tr>
<th>Level I</th>
<th>Level II</th>
<th>Level III</th>
<th>Level IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>When in a standing position on the edge of an object or step, approximately 6&quot; high, with his toes touching the 11&quot; side (length) of an 8” x 11” piece of paper (test sheet),</td>
<td>When in a standing position with his toes touching the 8&quot; side (width) of an 8” x 11” piece of paper (test sheet),</td>
<td>Same</td>
<td>When in a standing position with his toes touching the 8&quot; side (width) of an 8” x 11” piece of paper (test sheet),</td>
</tr>
<tr>
<td><strong>Note:</strong> Encourage child to jump as far past the paper as possible!</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Test Conditions:**
  - The child, using a simultaneous two foot take-off and landing, independently jumps down from the step in two out of three trials.
  - The child jumps the width (8") of the paper and demonstrates the following behaviors in two out of three trials:
    - a. uses two foot take-off which looks more like a two foot jump in place,
    - b. maintains arms at the sides in a bent manner during the jump.

- **Performance References:**
  - Gutteridge, 1939
  - Hellebrandt et al., 1961
  - Wellman, 1957

- **Hellebrandt et al., 1961**
  - The child jumps the width (8") of the paper and demonstrates the following behaviors in two out of three trials:
    - a. uses two foot take-off and landing,
    - b. swings arms backwards initially then forward and overhead during push-off of jump,
    - c. drops arms to a position in front of body in landing to assist with balance,
    - d. maintains balance without touching the hands to the floor at end of jump.

- **Hellebrandt et al., 1961**
  - Wickstrom, 1970

- **Hellebrandt et al., 1961**
  - Seefeldt et al., 1972
  - Wickstrom, 1970
**SKILL OF Kicking**

**TEST EQUIPMENT:** 6" Rubber Playground Ball

<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>When in a standing position with a ball approximately 6&quot; in diameter placed in front of but not more than ten feet away from him,</td>
<td>Same</td>
<td>When in a standing position with a ball approximately 6&quot; in diameter placed in front of but not more than ten feet away from him,</td>
<td>When in a standing position with a ball approximately 6&quot; in diameter placed in front of but not more than ten feet away from him,</td>
</tr>
</tbody>
</table>

**NOTE:** Ask child to kick the ball as "hard" as he can!

**TEST CONDITIONS**

The child walks up to the ball, makes contact with a stiff-leg and continues with the walking/running pattern in two out of three trials. Kick appears as part of walking/running pattern and shows no attempt to swing the kicking leg.

**PERFORMANCE**

- Gesell, 1940
- Kickstrom, 1970

The child runs up to and kicks the ball forward in the direction of the examiner and demonstrates the following behaviors in two out of three trials:

- a. uses a stiff-leg swinging primarily from the hip with little or no bending of the knees,
- b. moves the arms and trunk only slightly, if at all.

The child runs up to and kicks the ball forward in the direction of the examiner and demonstrates the following behaviors in two out of three trials:

- a. uses the bent kicking leg backwards and then forward with a simultaneous straightening of the leg,
- b. holds arm opposite from kicking leg cut in the side approximately shoulder level,
- c. returns kicking leg to a position next to the support leg after executing kick.

The child runs up to and kicks the ball forward in the direction of the examiner and demonstrates the following behaviors in two out of three trials:

- a. uses both arms held out to the sides of the body to maintain balance,
- b. moves slightly backward as kick is performed,
- c. maintains balance on non-kicking leg during kicking action and follow through,
- d. steps forward onto kicking leg only after kicking action and follow through are completed.

Wickstrom, 1970
**SKILL: Striking**

**TEST EQUIPMENT:** Plastic bat 30" to 36" long depending on size of child and 6" playground ball suspended by a string approx. 4' long which is attached to a stick.

<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHEN IN A STANDING POSITION, HOLDING A PLASTIC BAT 30&quot; TO 36&quot; LONG, AND FACING A BALL 6&quot; IN DIAMETER SUSPENDED BY A STRING TO WAIST LEVEL,</td>
<td>SAME</td>
<td>SAME</td>
<td>SAME</td>
</tr>
<tr>
<td>The child strikes the ball and demonstrates the following behaviors in two out of three trials:</td>
<td>The child strikes the ball and demonstrates the following behaviors in two out of three trials:</td>
<td>The child strikes the ball and demonstrates the following behaviors in two out of three trials:</td>
<td>The child strikes the ball and demonstrates the following behaviors in two out of three trials:</td>
</tr>
<tr>
<td>a. uses both arms, the bat being positioned on or near the shoulder.</td>
<td>a. uses both arms, the bat being positioned in front of and adjacent to the shoulder.</td>
<td>a. uses both arms, the bat being positioned in front of and adjacent to the shoulder.</td>
<td>a. uses both arms, the bat being positioned in front of and adjacent to the shoulder.</td>
</tr>
<tr>
<td>b. swings in an overhand (chopping) motion or a sideward motion (right to left or vice versa).</td>
<td>b. swings in an overhand motion with a downward (chopping) motion.</td>
<td>b. swings in an overhand motion with a downward (chopping) motion.</td>
<td>b. swings in an overhand motion with a downward (chopping) motion.</td>
</tr>
<tr>
<td><strong>PERFORMANCE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*NOTE:* Ask child to hit the ball as "hard" as he can.

*The child strikes the ball and demonstrates the following behaviors in two out of three trials:*

*STEP*: twist hips and upper body during and following the shifting motion - "TURN",

*SWING*: swing in a sideward motion (right to left or vice versa), but arc of swing is flat (horizontal) or downward.

*NOTE:* Items "b", "c", "d" are swiftly merging movements which can be observed as **STEP-TURN-SWING.**

Sinclair, 1973

Wickstrom, 1970
<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TEST CONDITIONS</strong></td>
<td><strong>PERFORMANCE</strong></td>
<td><strong>TEST EQUIPMENT</strong></td>
<td><strong>REFERENCES</strong></td>
</tr>
<tr>
<td>When in a standing position and with the examiner approximately 25 feet in front of him.</td>
<td>The child cannot skip but will likely demonstrate any of the following behaviors in two out of three trials: a. running, b. hopping, c. leaping--take off made from one foot and landing on the alternate foot, d. galloping--combination of walk and leap.</td>
<td>None</td>
<td>Guttidge, 1939</td>
</tr>
<tr>
<td></td>
<td>The child attempts to do 4 or more consecutive skips while doing a normal walking or running pattern and demonstrates the following behaviors in two out of three trials: a. performs skip more often than not on the same leg though not necessarily consecutively, b. holds arms sidewardly and slightly bent with hands at approximately chest level.</td>
<td></td>
<td>Wellman, 1937</td>
</tr>
<tr>
<td></td>
<td>The child skips 4 or more times consecutively and demonstrates the following behaviors in two out of three trials: a. alternates foot, b. does not use arms in opposition, if at all, c. does skipping pattern slowly, and it appears segmented (the child may walk or run for brief periods).</td>
<td></td>
<td>Goffroy and Kephart, 1959</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Guttidge, 1939</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Wellman and Wellman, 1938</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Wellman, 1937</td>
</tr>
</tbody>
</table>
# Skill of Ladder Climbing

**Test Equipment:** Ladder

<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>When standing in front of and touching a ladder,</td>
<td>Same</td>
<td>Same</td>
<td>Same</td>
</tr>
</tbody>
</table>

**Test Conditions:**

<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>The child, using any method at all, climbs up and down one step in two out of three trials.</td>
<td>The child climbs up and down three to five steps and demonstrates the following behaviors in two out of three trials: a. climbs up using a two foot landing. b. climbs down in the same manner.</td>
<td>The child climbs up and down three to five steps and demonstrates the following behaviors in two out of three trials: a. climbs up using an alternate stepping pattern. b. climbs down using a two foot landing.</td>
<td>The child climbs up and down three to five steps and demonstrates the following behaviors in two out of three trials: a. climbs up using an alternate stepping pattern. b. climbs down in the same manner.</td>
</tr>
</tbody>
</table>

**Performance:**

<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayley, 1935</td>
<td>Gutteridge, 1939</td>
<td>McCaskill and Wellman, 1938</td>
<td>Wellman, 1937</td>
</tr>
<tr>
<td>Gutteridge, 1939</td>
<td>Bayley, 1935</td>
<td>McCaskill and Wellman, 1938</td>
<td>McCaskill and Wellman, 1938</td>
</tr>
<tr>
<td>McCaskill and Wellman, 1938</td>
<td>Wellman, 1937</td>
<td>Wellman, 1937</td>
<td>Wellman, 1937</td>
</tr>
<tr>
<td>LEVEL I</td>
<td>LEVEL II</td>
<td>LEVEL III</td>
<td>LEVEL IV</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>TEST CONDITIONS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When positioned at the bottom of a series of steps,</td>
<td>When standing at the bottom of a series of steps;</td>
<td>Same</td>
<td>Same</td>
</tr>
<tr>
<td><strong>NOTE:</strong></td>
<td>Examiner cannot serve as an aid</td>
<td>in place of railing or wall</td>
<td></td>
</tr>
<tr>
<td>The child demonstrates one of the following behaviors:</td>
<td>The child, with or without the aid of the railing or wall, walks up and down 5 steps and demonstrates the following behaviors in two out of three trials:</td>
<td>The child, with the aid of the railing or wall, walks up and down 5 steps and demonstrates the following behaviors in two out of three trials:</td>
<td>The child independently walks up and down 5 steps and demonstrates the following behaviors in two out of three trials:</td>
</tr>
<tr>
<td>a. creeps up 5 steps and slides down from step to step on the buttocks</td>
<td>a. walks up using a two-foot landing (mark-time pattern)</td>
<td>a. walks up using an alternate stepping pattern, b. walks down using an alternate stepping pattern, c. walks down with a two-foot landing (mark-time pattern).</td>
<td>a. walks up using an alternate stepping pattern, b. walks down using an alternate stepping pattern, c. walks down with a two-foot landing (mark-time pattern).</td>
</tr>
<tr>
<td>b. creeps up and down 5 steps</td>
<td>b. walks down in the same manner or by sliding from step to step on the buttocks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. walks up and backs down while in a hands-foot position like animal walking</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PERFORMANCE**

Shirley, 1933  
Espeutshis and Eckert, 1967  
Bayley, 1935  
Gutteridge, 1939  
McArdle and Wellman, 1938  
Wellman, 1937  
Bayley, 1935  
Gutteridge, 1939  
McArdle and Wellman, 1938  
Wellman, 1937
O.S.U. SIGMA FIELD PROJECT

GENERAL INSTRUCTIONS

DIRECTIONS TO SUBJECTS:

1. First ask the subject if he/she can do the skill.
   Example - "Show me how you can skip."

2. Secondly, if the subject does not understand,
   seems confused or will not do the skill, demonstrate
   the skill with instruction and then ask the subject
   if he/she can do the skill.

SCORING:

1. Indicate the predominate level observed (2 out of
   3 trials) for each motor skill performed by a subject
   by placing a LEVEL 1, 2, 3, or 4 in the designated
   spot on the score sheet.

2. Indicate an "R" for a subject who refuses to participate
   on a desired skill.

SPECIFIC TEST INSTRUCTION

SKILL I: WALKING

Equipment: 2 Plastic cones (pylon)
Examiner Position/Verbal Direction:
Trial 1 - Standing 35' from the subject, have the subject walk to
you. "I want you to walk to me."

Trial 2 - Have the subject walk from one cone to another cone
positioned 35' away. Examiner takes a position 10'
from the midpoint of the subject's intended path.
"Walk from this cone (examiner positions subject at
starting cone) to that cone."

Trial 3 - "Same" as T2.
SKILL II: RUNNING

Equipment: 2 Plastic cones (pylon)

Examiner Position/Verbal Direction:

Trial 1 - Standing 45'-65' from the subject have the subject run to you as "fast" as he/she can. "Run to me as fast as you can."

Trial 2 - Standing behind the subject, have the subject run as "fast" as he/she can to a cone placed 45'-65' away. "Run as fast as you can to that cone. (Examiner places subject at starting point)

Trial 3 - Have the subject run as "fast" as he/she can from one cone to another cone positioned 45' away. Examiner takes a position 10' from the midpoint of the subject's intended path. "Run from this cone (Examiner positions subject at starting cone) to that cone as fast as you can."

SKILL III: HOPPING

Equipment: None

Examiner Position/Verbal Direction:

Trial 1 - Standing 10' in front of the subject, have the subject hop on one foot 2 times. "Hop on one foot 2 times."

Trial 2 - Standing to the side of the subject at a distance of 10', have the subject hop on one foot 2 times. "Hop on one foot 2 times.

Trial 3 - "Same" as T2.

*If subject is not getting off the ground, ask subject to hop "Higher" and to slow down.

SKILL IV: THROWING

Equipment: Tennis Ball

Examiner Position/Verbal Direction:

Trial 1 - Standing 15' in front of the subject, have the subject throw the ball as "Hard" as he/she can to you. "Throw the ball as hard as you can to me."

Trial 2 - "Same" as T1.

Trial 3 - "Same" as T2.
SKILL V: CATCHING

Equipment: 3 1/2" Diameter Plastic Ball (Softball size)
Examiner Position/Verbal Direction:
Trial 1 - Standing 5'-7' in front of the subject, toss the ball underhand with an arc so that the ball reaches the subject at chin level. "Catch the ball when I throw it underhand to you."

Trial 2 - Standing 5' in front of the subject, toss the ball with an underhand arc so that the ball reaches the subject slightly below waist level. "Catch the ball when I throw it underhand to you."

Trial 3 - Standing 5' in front of the subject, toss the ball underhand with an arc so that the ball reaches the subject between the shoulders and waist. "Catch the ball when I throw it underhand to you."

SKILL VI: JUMPING

Equipment: 8" x 11" Piece of Paper
Examiner Position/Verbal Direction:
Trial 1 - Standing in front of the subject, have the subject jump as "Far" as he/she can past a piece of paper which has been placed on the floor at the subject's toes. (Examiner may slap floor to indicate where the subject should attempt to land.) "I want you to jump as far as you can past that piece of paper."

Trial 2 - Standing 10' from the side of the subject, have the subject jump over the piece of paper as "Far" as he/she can. "I want you to jump as far as you can past that piece of paper."

Trial 3 - "Same" as T2.

SKILL VII: KICKING

Equipment: 6" Rubber Playground Ball
Examiner Position/Verbal Direction:
Trial 1 - Standing 20' in front of the subject, have the subject kick the ball to you as "Hard" as he/she can. (Examiner places the ball 3'-5' directly in front of the subject prior to the kick). "Kick the ball to me as hard as you can."

Trial 2 - "Same as T1."

Trial 3 - "Same" as T2.
SKILL VIII: STRIKING

Equipment: 28" Plastic Bat; 7" Rubber playground ball suspended from tether.
Examiner Position/Verbal Direction:
Trial 1 - While facing the subject, hold the suspended ball at approximately waist level and have the subject hit the ball. "I want you to take the bat and hit the ball as hard as you can."

Trial 2 - "Same" as T1.

Trial 3 - "Same" as T2.

*Present the bat to the subject as the middle of the body. If the subject attempts to use the bat with one hand, ask the subject to use two hands. Also, if the subject uses an improper grip (Ex. reverse grip) ask the subject if he/she can hold the bat another way.

SKILL IX: SKIPPING

Equipment: None
Examiner Position/Verbal Direction:
Trial 1 - When standing 35'-45' from the subject, have the subject skip to you. "Skip to me."

Trial 2 - Have the subject skip from one cone to another cone positioned 35'-45' away. Examiner takes a position 10' from the midpoint of the subject's intended path. "Skip from this cone (examiner positions subject at starting cone) to that cone."

Trial 3 - "Same" as T2.

SKILL X: LADDER CLIMBING

Equipment: 8' Ladder with 12" step intervals
Examiner Position/Verbal Direction:
Trial 1 - Standing at the base of an 8' ladder (base of ladder 4' from wall), have the subject climb up the ladder and then climb down. "Climb up the ladder and then down."

Trial 2 - "Same" as T1.

Trial 3 - "Same" as T2.
SKILL XI: STAIR CLIMBING

Equipment: None
Examiner Position/Verbal Direction:
Trial 1 - Standing at the base of a flight of stairs, have the subject walk up the stairs and then down the stairs. (at least 5 stairs). "Walk up the stairs and then down the stairs."

Trial 2 - "Same" as T1.

Trial 3 - "Same" as T2.

*Subject may hold on to railing if so desired.
### The O.S.U. Scale of Intra-Gross Motor Assessment

<table>
<thead>
<tr>
<th>Basic Skill</th>
<th>Level I</th>
<th>Level II</th>
<th>Level III</th>
<th>Level IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking:</td>
<td>Ten Second stand</td>
<td>Cruising</td>
<td>Walks-1 support</td>
<td>Opposition walk</td>
</tr>
<tr>
<td>Stair Climbing:</td>
<td>Creeps or animal walk</td>
<td>Two foot landing</td>
<td>Alternate up, two foot landing down</td>
<td></td>
</tr>
<tr>
<td>Running:</td>
<td>Rapid walk</td>
<td>Wide base, wide arms</td>
<td>Egg beater</td>
<td>Non-support</td>
</tr>
<tr>
<td>Throwing:</td>
<td>Two hand push</td>
<td>Arm only, no foot move</td>
<td>One-sided/homolateral</td>
<td>Opposition Throw</td>
</tr>
<tr>
<td>Catching:</td>
<td>Arm stretch</td>
<td>Scoop</td>
<td>Vice squeeze</td>
<td>Cup fashion</td>
</tr>
<tr>
<td>Kicking:</td>
<td>Part of walk</td>
<td>Stiff leg</td>
<td>Knee action kick</td>
<td>Knee action kick with follow through</td>
</tr>
<tr>
<td>Jumping:</td>
<td>Jumps down</td>
<td>Jump in place, no arms</td>
<td>Jump, improper arm action</td>
<td>Jump with arm action</td>
</tr>
<tr>
<td>Hopping:</td>
<td>Jump</td>
<td>Raises up on toes</td>
<td>Leg lift hop</td>
<td>Body lift hop</td>
</tr>
<tr>
<td>Skipping:</td>
<td>Runs/hops</td>
<td>Same side skip</td>
<td>Segmented alternate skip</td>
<td>Alternate skip</td>
</tr>
<tr>
<td>Striking:</td>
<td>One hand chopping action</td>
<td>Two hand chopping, waist bending</td>
<td>Rocking swing</td>
<td>Twisting swing</td>
</tr>
<tr>
<td>Ladder Climbing:</td>
<td>Climbs one step</td>
<td>Two step climb</td>
<td>Alternate up, two down</td>
<td>Alternate step up and down</td>
</tr>
</tbody>
</table>
SCORING SHEET

HEIGHT: ________  DATE OF TEST: ________

WEIGHT: ________  BIRTHDATE: ________

SEX: ________  C A: ________

NAME OF JUDGE: __________________________

NAME OF SUBJECT: __________________________

Skills: 

Assessment Level: (level to be that as observed)

Walking: ______________

Running: ______________

Hopping: ______________

Throwing: ______________

Catching: ______________

Jumping: ______________

Kicking: ______________

Striking: ______________

Skipping: ______________

Climbing: ______________

Stair Climbing: ______________

Comments:

* I₁ - Incomplete Level 1

* I₉ - Refusal To Participate
APPENDIX B

LETTER TO CLASSROOM TEACHERS - CONSENT FORM
Dear

Your class has been chosen to participate in a survey which will hopefully identify basic motor performances which are characteristic of six, seven and eight year old children. This information will be used to develop a motor skill performance profile for each child and age group involved. The information yielded will be given to you and your physical education teacher for use in program planning.

The motor performance to be required of each child will involve those basic motor skills all children are naturally using at present and will not place any unusual stress on the child. The O.S.U. SIGMA, the instrument used in this survey, is a criterion reference tool and as such looks at the quality of the execution of the skill from a developmental point of view and not on performance results. The skills surveyed by the O.S.U. SIGMA include walking, running, throwing, catching, jumping, hopping, striking, kicking, stair climbing, skipping and ladder climbing.

Each child selected will be assessed individually with approximately eight to ten minutes needed to complete the process. Only one assessment per child will be needed.

Your involvement in this survey will be greatly appreciated. If at any time, you have questions concerning the survey please feel free to contact us.

Sincerely,

Dr. Walter Erzing

Terrence Ryan
Department of Physical Education
Ohio State University
422-6226
422-9174

TR/ml
The Ohio State University
Gross Motor Performance Project

Dear Parent:

Your child has been randomly selected along with 100 other children to participate in a project to investigate gross motor skills of young children. The project under the direction of Dr. Walter Ersing and Terrence M. Ryan, Staff Members of the Physical Education Department at Ohio State University, has been approved by __________________________ your child's school administrator.

The purpose of the investigation is to compare the gross motor performance of a select group of Public School children and a select group of children from the Franklin County Program. The motor performance to be required of your child will involve those basic motor skills (walking, running, jumping, hopping, skipping, throwing, catching, kicking, climbing, and striking) all children are naturally using presently and will not place any unusual stress on your child. Each child will be assessed individually with approximately twelve to fourteen minutes needed to complete the process. During this time your child will be asked to demonstrate how he or she performs the skills mentioned above. Individual's performance results on the skills will remain completely confidential. At no time will names or pictures be used in reporting the results of the investigation. Parents interested in obtaining their child's results may do so by contacting Mr. Ryan or Dr. Ersing.

Hopefully, information gained from this project will aid physical education and motor development to specialists to plan more effective motor development programs for your child.

Your child's participation in this project will be greatly appreciated. Please return the enclosed form to your child's homeroom teacher as soon as possible. If you have any further questions please feel free to contact me.

Sincerely,

Dr. Walter Ersing
Project Supervisor
422-6226

Terrence M. Ryan
Project Coordinator
422-5175

Division of Physical Education
The Ohio State University

TMR/ml
Enclosure
CONSENT FORM

I consent to the performance of my child as a subject in the research investigation entitled, A Comparison of Basic Gross Motor Skill Performance of Franklin County School Children and Public School Children Utilizing The Ohio State University Scale of Intra Gross Motor Assessment.

The nature and general purpose of the research project have been explained to me. This research is to be performed by or under the direction of Dr. Walter Ersing and Mr. Terrence M. Ryan, who are authorized to use the services of others in the performance of the research.

I understand that any further inquiries I make concerning this procedure will be answered. I understand the identity of my child will not be revealed in any publication, document, recording, video tape, photograph, computer data storage, or in any other way which relates to this research. Finally, I understand that I am free to withdraw my consent and terminate my child's participation at any time following the notification of the Project Director.

Signed ____________________________
Date _____________________________

Witness __________________________
BIBLIOGRAPHY

BOOKS


41. President's Committee on Mental Retardation. Mental Retardation, the Known and the Unknown. Superintendent of Documents: Washington, D.C., 1975.


**ARTICLES**


69. "Compensation or Correlation?" Education, 1960, 80, 341-343.


UNPUBLISHED MATERIAL


