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AN INVESTIGATION OF BASIC GROSS MOTOR SKILL
DEVELOPMENT OF MODERATELY RETARDED CHILDREN
AND YOUTH.

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AN INVESTIGATION OF BASIC GROSS MOTOR SKILL DEVELOPMENT OF MODERATELY RETARDED CHILDREN AND YOUTH

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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The Ohio State University 1978

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To Mark -- a childhood friend
I wish to express my gratitude and appreciation to those individuals that provided assistance to me which facilitated the process and completion of this investigation.

To Jackie and Brian, their love and dedication, understanding and sacrifices have been my greatest inspiration.

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And, finally, to the 280 subjects, I appreciate their cooperation in making this study possible.
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# TABLE OF CONTENTS

* * * * *

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEDICATION</td>
<td>ii</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>VITA</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>viii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>ix</td>
</tr>
</tbody>
</table>

## CHAPTER

1. **INTRODUCTION AND STATEMENT OF THE PROBLEM**  
   - Introduction  
   - The Problem  
   - Statement of the Problem  
   - Delimitations  
   - Assumptions  
   - Definitions  

2. **SURVEY OF RELATED LITERATURE**  
   - Literature Pertaining to Quantitative Measures of Performance  
   - Literature Pertaining to Qualitative Measures of Performance  
   - Summary  

3. **METHODS AND PROCEDURES**  
   - Experimental Design  
   - Subjects Selection  
   - Selection of Evaluators  
   - The Assessment Instrument  
   - Test Administration  
   - Data Analysis Procedures  

4. **ANALYSIS OF DATA AND DISCUSSION OF RESULTS**  
   - Walking  

vi
LIST OF TABLES

** ** **

<table>
<thead>
<tr>
<th>TABLE</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Summary of ages, heights and weights for the male subjects involved in this investigation</td>
<td>31</td>
</tr>
<tr>
<td>2. Summary of ages, heights and weights for the female subjects involved in this investigation</td>
<td>32</td>
</tr>
<tr>
<td>3. Percentage and total number of mature performances recorded for all skills combined by age and sex</td>
<td>119</td>
</tr>
<tr>
<td>4. A comparison of the ages when mature levels were achieved by normal and mentally retarded males and females</td>
<td>125</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

* * *

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Performance Scores for Walking</td>
<td>46</td>
</tr>
<tr>
<td>2.</td>
<td>Performance Scores for Walking</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Performance Scores for Running</td>
<td>51</td>
</tr>
<tr>
<td>4.</td>
<td>Performance Scores for Running</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td>52</td>
</tr>
<tr>
<td>5.</td>
<td>Performance Scores for Stair Climbing</td>
<td>55</td>
</tr>
<tr>
<td>6.</td>
<td>Performance Scores for Stair Climbing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td>56</td>
</tr>
<tr>
<td>7.</td>
<td>Performance Scores for Jumping</td>
<td>60</td>
</tr>
<tr>
<td>8.</td>
<td>Performance Scores for Jumping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td>61</td>
</tr>
<tr>
<td>9.</td>
<td>Performance Scores for Hopping</td>
<td>66</td>
</tr>
<tr>
<td>10.</td>
<td>Performance Scores for Hopping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td>67</td>
</tr>
<tr>
<td>11.</td>
<td>Performance Scores for Throwing</td>
<td>71</td>
</tr>
<tr>
<td>12.</td>
<td>Performance Scores for Throwing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td>72</td>
</tr>
<tr>
<td>13.</td>
<td>Performance Scores for Catching</td>
<td>77</td>
</tr>
<tr>
<td>14.</td>
<td>Performance Scores for Catching</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td>78</td>
</tr>
<tr>
<td>15.</td>
<td>Performance Scores for Skipping</td>
<td>83</td>
</tr>
<tr>
<td>16.</td>
<td>Performance Scores for Skipping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td>84</td>
</tr>
<tr>
<td>17.</td>
<td>Performance Scores for Striking</td>
<td>88</td>
</tr>
<tr>
<td>18.</td>
<td>Performance Scores for Striking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td>89</td>
</tr>
<tr>
<td>19.</td>
<td>Performance Scores for Kicking</td>
<td>93</td>
</tr>
<tr>
<td>20.</td>
<td>Performance Scores for Kicking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td>94</td>
</tr>
<tr>
<td>21.</td>
<td>Performance Scores for Ladder Climbing</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Performance Scores for Ladder Climbing</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>With Ages Combined</td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Skill Performances for Nine Year Old Children</td>
<td>102</td>
</tr>
<tr>
<td>24.</td>
<td>Skill Performances for Ten Year Old Children</td>
<td>104</td>
</tr>
<tr>
<td>25.</td>
<td>Skill Performances for Eleven Year Old Children</td>
<td>106</td>
</tr>
<tr>
<td>26.</td>
<td>Skill Performances for Twelve Year Old Children</td>
<td>108</td>
</tr>
<tr>
<td>27.</td>
<td>Skill Performances for Thirteen Year Old Children</td>
<td>111</td>
</tr>
</tbody>
</table>
28. Skill Performances for Fourteen Year Old Children ............................................. 113
29. Skill Performances for Fifteen Year Old Children ............................................... 115
CHAPTER 1

INTRODUCTION

The development of motor behaviors in infants and children has long been of major interest to specialists involved in the area of human growth and development. Much of the current knowledge within this area has been generated from longitudinal studies in which repeated measures have been made on the same children from infancy to middle childhood.

Normal development follows a predictable, orderly, sequential pattern throughout infancy and early childhood. Auxter (2) states that during the first two years of life many gross motor patterns appear. It is important to note, however, that not all children progress through the motor stages of development at the same rate. McClenaghan and Gallahue (10) state that research has indicated that although some children are delayed in the acquisition of fundamental motor skills, they progress through the same developmental sequence.

Through systematic observation and measurement of motor behaviors by child development researchers, normative data have been established and major motor milestones identified that children experience throughout their early lives. For measurements purposes, it is
customary to subdivide the first five years of life into infant and preschool periods. Anastasi (1) arbitrarily divides this age range at 18 months. Infancy is classified from birth to approximately 18 months and the preschool periods extend from 18 to 60 months.

Presently, many infant scales of development are available for evaluation purposes. These scales, however, reflect the research of Bayley (17), Gessell (6), and Shirley (32) who, in the 1930's, had independently constructed norm related assessment scales. These original infant scales have been revised and updated. Gessell Developmental Schedules and Bayley Infant Scales of Development have been joined by the Cattell Infant Intelligent Scale and the Revised Merrill-Palmer which all evaluate motor behaviors of infants.

The Denver Developmental Screening Test (22) and the Vulpe Assessment Battery (14) measure both infant and preschool developmental stages. Normative data are available for both tools. Test items include infant developmental stages as well as more advanced motor skills involving locomotor and manipulative skills.

Measurement instruments have also been established to evaluate motor performance of school aged children and youth. Oseretsky, in 1923, published a motor development scale consisting of 85 items. This tool was
subsequently revised and restandardized in 1955 by Sloan and retitled the *Lincoln-Oseretsky Motor Development Scale* (33). The revised scale consists of 36 items and was designed to evaluate motor development of children aged six through 14.

Another evaluation method designed for preschool and primary school children has been developed at The Ohio State University which measures the qualitative variables in the performance of motor skills. This criterion referenced instrument, *The Ohio State University Scale of Intra-Gross Motor Assessment* (38) developed in 1974, evaluates proficiency of movement or maturity of motor patterns for eleven basic gross motor skills. The SIGMA is the only tool available that qualitatively measures performance of motor tasks.

Measurement and analysis of motor behaviors has not been restricted to the normal population. In the late 1950's and early 1960's, an increased amount of attention was focused upon the mentally retarded. The establishment of educational programs and facilities reflected a growing awareness of society on behalf of this population.

Through federal and state grants and the cooperation of professional and private organizations, much research has been generated about the mentally retarded
and a great body of useful information has been established. Specifically, in the area of motor development and physical education, many investigations compared the motor performance of the mentally retarded to the normal population. These studies, however, utilized norm reference tests and thus measured primarily the quantitative aspects of performance.

Auxter (36) cites: "There is considerable research on measured performance of gross motor tasks in mentally retarded and normal children. However, there is a paucity of information regarding the development of efficient gross motor patterns involving basic motor skills." Efficiency in this context refers to quality of execution or maturity of gross motor skills.

This investigation attempts to examine the quality of execution of gross motor patterns involving basic motor skills as demonstrated by the mentally retarded population. A study of this nature generates more information about the developmental motor patterns of retarded children and youth.

I. The Problem

Statement of the Problem

The intent of this study is to examine the motoric behaviors of moderately retarded children and
youth aged nine through 15. More specifically, the investigation attempts to establish the age at which moderately retarded children exhibit mature functional motor patterns in eleven basic gross motor skills. The OSU-SIGMA will be utilized to qualitatively evaluate the selected motor behaviors. Further analysis of the data will determine 1) if motor performances improve as chronological age increases and 2) if a difference exists between male and female subjects. The performance profile of each of the age groups will be reviewed to determine if age and/or sex trends are evident.

II. Justification of the Study

The proposed study was designed to investigate the motoric behaviors of retarded children. This research incorporated two unique variables. First, the subjects selected for the study were non-institutionalized, moderately retarded children. Secondly, qualitative evaluation measures were recorded based on the motor performance of the individual. Uniqueness of these variables was attributed to the fact that previous research involving the retarded and motor skills has dealt almost exclusively with quantitative measures of performance on educable mentally retarded children.

Research of this nature is of considerable importance because it broadens the information base on
motor development and provides physical educators another perspective of motor performance. Determining the age at which the moderately retarded exhibit mature functional motor patterns was of primary importance in this study. Presently, it is unknown as to the age when the majority of the retarded achieve motor proficiency. Furthermore, present research does not provide evidence clarifying if the majority of the moderately retarded population achieves mature, functional motor skills.

Programming trends within the field of physical education for the mentally retarded are beginning to focus on the developmental aspects of movement. Instructors are emphasizing the quality of movement more so than the results of the skills. Data (for age, sex and skill) interpreted from this study will provide guidelines for teachers when developing priorities for individual educational programs. It will enable physical educators to compare an individual child's level of motor skill development with that of the subjects in this investigation.

The performance profiles will not only provide valuable information for evaluating and planning an individual's program, but also can be implemented to assess the physical education program of a school. Profiles for classes or schools can be constructed and
compared to the profile evolved from this investigation.

This study may provide an explanation to the moderately mentally retarded's poor motor performance in terms of quantitative results. This investigator assumes a high correlation exists between inefficient movement or immature motor patterns and low scores on standardized fitness and motor skill tests. If this research reveals that the majority of the retarded exhibit immature motor patterns, it can be concluded that this is one of the contributing factors for deficient scores on norm based test batteries.

III. Limitations

The proposed study's results may be affected by the following limitations:

1) The moderately retarded children involved in this study were selected from large, well established 169 County Programs based throughout the state of Ohio. The metropolitan influence — programs of early intervention; better schools; more aides; more and better equipment; availability of resource people; recreation programs; and more intense physical education programming — may positively affect scores of motor performance for these children.

2) Selection into the study was restricted to
non-institutionalized, ambulatory, moderately retarded children and youth aged nine through 15. These subjects were included based on their ability to cooperate with testing procedures.

3) The investigation and collection of data was conducted during the final months of the school year. Scores on motoric behaviors for this population may be higher in June than in September due to continuous physical education programming and skill retention. Scores recorded during the early portion of the school year may be affected by the summer break when there are limited opportunities in physical education activities.

4) Only one assessment tool, The Ohio State University-Scale of Intra-Gross Motor Assessment, was utilized to qualitatively measure motor behaviors.

IV. Assumptions

It was assumed in this investigation that:

1) The data collected and the profiles constructed can be generalized to the moderately retarded population in metropolitan areas who are not institutionalized.

2) The examiners would be able to develop rapport with the subjects involved in the investigation to facilitate the testing procedures and elicit optimal test results.
3) The Ohio State University - Scale of Intra-Gross Motor Assessment was able to measure mature motor patterns.

V. Definition of Terms

**Mental Retardation** - Significantly subaverage general intellectual functioning existing concurrently with deficits in adaptive behavior, and manifested during the developmental period (9).

**Moderately Retarded** - Grossman (7) identifies the moderately mentally retarded as those individuals who are likely to fall into the educational category of "trainable." He further classifies the moderately retarded as having an Intelligence Quotient range that is three to four standard deviations below the norm. On the Stanford-Binet and Cattell, this range is 51 to 36 and on the Wechsler Scales it is 54 to 40.

**Qualitative Measures of Motoric Performance** - Observation based measurement that evaluates the efficiency or quality in the performance of a motor skill.

**Quantitative Measures of Motoric Performance** - Measurement that evaluates the products of performance of a motor skill.

**Immature Motor Patterns** - Movement patterns that do not equal adult form for a motor skill. Often times
associated with the terms -- unsatisfactory and inefficient movement.

**Mature Motor Patterns** - Movement patterns that equal the quality of adept adult performance. Often times associated with the terms -- good form and efficiency of movement.

**Intelligence Quotient -- I.Q.** - As defined by Leland and Smith (9) originally the ratio of mental age to actual chronological age as measured by standardized tests; currently a measure based on the difference between an obtained score and the score normal the age of the person.

**County Programs** - Community programs administered by the local 169 Boards which provide training and educational experiences for moderately retarded children and youth in the state of Ohio.
CHAPTER 2

REVIEW OF LITERATURE

Research involving the mentally retarded population in motor activities has revolved generally around three major topics: 1) studies of motor learning and reaction time; 2) investigation into the relationship between motor performance and intelligence and 3) comparisons between normal and mentally retarded children on motor proficiency tests including items designed to measure physical fitness.

This review will focus on motor proficiency comparisons. This investigator will subdivide the categories into two major divisions: 1) research based on quantitative measurements in the performance of motor skills and 2) research based on qualitative measures.

I. Literature Pertaining to Quantitative Measures of Motor Performance of Mentally Retarded Children

Quantitative analysis of motor performance is defined as evaluation based upon the results of the motoric behaviors. The investigator is concerned only with the product of performance and not the style, form or quality of executing the motor skill. Scores are recorded based on minutes - seconds, feet - inches or number of repetitions.
A considerable body of information is available concerning the motor characteristics of the mentally retarded child. Twenty-two years ago Fait and Kupferer (20) conducted one of the preliminary studies investigating gross motor skills of the retarded. They investigated explosive power and general body agility of 41 male subjects with an I.Q. range of 42 to 87 and the ages spanned 13 to 20 years. Explosive strength was measured by requiring the subjects to perform a vertical jump and reach task. This skill was a simple, one step movement. Body agility was measured by recording the number of squat thrusts (burpees) that was completed in a ten second interval. A squat thrust consists of a series of four sequential movements: 1) stand, move to squat position, 2) extend legs in a backward direction, 3) return to squat position and 4) return to erect standing position.

A coefficient of product moment correlation was utilized to determine the relationship of the two motor tasks and the higher and lower I.Q. levels within the test group. Little or no relationship (.190) between I.Q. and vertical jump was observed, but some relationship (.491) was found between I.Q. and squat thrusts. Furthermore, the mean T score for burpees for the retarded was considerably lower when compared to normal group data.
The investigators concluded that vertical jump scores were not affected by low or high I.Q. levels within this sample. Scores recorded for the squat thrusting movement were, however, influenced by higher and lower I.Q. scores. Fait and Kupferer felt that the complexity of the squat thrust movement affected the performance more so than general deficiencies in motor abilities.

Dawson and Edwards (19) measured static grip strength and static leg strength of 163 delinquent institutionalized subjects. These two test items were selected to research because the investigators felt that these strength tasks related directly to strength and motivation and not learning and coordination.

Subjects were divided into a low I.Q. group (50 to 84) and a higher I.Q. group (85 to 149). Height and weight measures were recorded prior to the assessment of strength levels. Static grip strength was found to be statistically significantly superior for the higher I.Q. group.

Desiring to account for the factor of physical development, the investigators rematched the subjects according to heights and weights. The developmentally controlled group (weight plus or minus ten pounds; age plus or minus one month; height plus or minus six inches) produced data that resulted in no significant mean dif-
ferences. Based on these results, Dawson and Edwards concluded that physiological development may account for a significant portion of the variation in strength scores between normal and retarded children. They further questioned the truth in the generality of muscle weakness of the retarded.

These two studies by Fair and Kupferer and Dawson and Edwards indicated that the motor and strength performances of the retarded were not as deficient as many experts proclaimed. However, in subsequent research, investigators produced results which established many inadequate motoric behaviors of the retarded.

One such significant investigation was published in 1959 by Francis and Rarick (21). They tested 284 educable mentally retarded children aged eight through fourteen. The subjects were selected from public school special education classes in Milwaukee and Madison, Wisconsin. The subjects selected had an I.Q. range of 50 to 90.

The investigators utilized motor performance tests which had previously been successfully used with normal children. This approach enabled them to compare their results from educable mentally retarded children to existing normative data. Their assessment battery consisted of five major categories of motor performance:
static strength, running speed, power, agility and balance. A total of eleven skills were investigated in this study: burpee, agility run, right grip strength, left grip strength, pulling and thrusting strength, thirty-five yard dash, thirty yard dash with running start, vertical jump, long jump, softball throw and balance beam.

Direct quantitative comparisons between the motor proficiency scores of the mentally retarded and published age appropriate norms indicated that on most measures the retardates were two to four years behind the normal child. Age and sex trends indicating improvement as chronological age increased was evident and similar to the trends generated from data analyzed from scores of normal subjects. This trend of improved scores with increased age was true for all skills except for agility tests (burpees and agility run) and jumping (vertical and long jump).

Howe (24) substantiated these results of Francis and Rarick with a study investigating motor performances of 43 educable mentally retarded children between the ages of six and one-half to 12 years. He constructed an 11 item gross motor assessment tool and administered it to educable mentally retarded children and normal children. He tested Sargent jump, balance, tracing speed, tapping speed, dotting speed, grip strength, zig zag
run, 50 yard dash, squat thrusts, accuracy throw, and paper and pencil maze test.

The results from Howe's study showed the retarded children were markedly deficient in motor activities. The normal male performances were significantly superior when compared to the retarded male on all eleven skills. The normal female had significantly better scores than the retarded female on nine of the skills. The normal female outperformed the retarded female on grip strength and accuracy throw, but the differences did not achieve statistical significance. Howe also reported that the mentally retarded subjects in his study were extremely inferior on the balancing task. He measured balance by requiring the children to stand on one foot for one minute. Only two of the 43 retarded subjects were able to maintain their balance for the required length of time.

A study investigating the motor performance of institutionalized and non-institutionalized educable mentally retarded children was conducted by Malpass (28). He compared the scores of these retarded children to a control group of normal children. Utilizing the Oseretsky Motor Development Scale (33) to assess the motor behaviors of his subjects, he was unable to differentiate between institutionalized and non-institutionalized retardates. However, Malpass was able to conclude that a significant
difference existed between the mean scores of the retarded and normal children.

Another study involving institutionalized subjects was conducted in 1961 by Brace (37). He investigated physical fitness levels of 65 educable mentally retarded males (mean I.Q. of 60) who had a mean age of 13.5 years. His subjects were selected from an institutional setting which provided no physical education or recreational services. The American Association of Health, Physical Education and Recreation (AAHPER) Youth Fitness Test (15) was used to determine fitness levels of his subjects. Test items included sit-ups, pull-ups, 600 yard run-walk, softball throw, long jump, shuttle run and 50 yard dash. Brace found that 80.5 percent of all scores fell below national age norms.

A similar study was conducted in 1965 by Stein (34). He hypothesized that non-institutionalized educable mentally retarded subjects would achieve higher standards of performance on fitness test items than institutionalized subjects. He tested 24, 13 to 17 year olds, utilizing the same procedures and assessment tool as Brace did four years earlier. Stein's subjects were enrolled in special classes in public schools and received regular physical education programming.

Results indicated that the non-institutionalized
subjects received fitness scores that were significantly superior to the institutionalized group. Furthermore, the non-institutionalized groups' scores were not significantly different from established national norms. Stein further clarified the fact that research findings about fitness levels for the retarded cannot be generalized to both the institutionalized and non-institutionalized retardates.

Sengstock (31) produced an interesting study in 1966 when he investigated the motor performances of educable mentally retarded children and compared their scores to chronological and mental age equals. He selected 30 educable retardates enrolled in special classes between the ages of ten and 15. Mental age counterparts that were selected were between the ages of six and 12. The children were assessed by the AAHPER Youth Fitness Test.

It was found that the normal chronological aged equals were significantly superior to the educable children. The educable children, however, exhibited performances that were superior to the performances of the younger children (representing mental age equals) in all skills except pull-ups and sit-ups. Overall, the performance of the educable was midway between the older normal (chronological equals) and the younger normal (mental age equals) children.
In 1970, Rarick, Widdop and Broadhead (30) administered a modified version of the AARPER Youth Fitness Test to a national sample of 4,235 educable mentally retarded children and youth. Their sample had an I.Q. range of 50 to 80 and an age range of eight to 18 years. The modified test items included: 1) flexed arm hang (in place of pull-ups), 2) sit-ups in one minute (replacing no time limit), 3) three hundred yard run-walk (substituted for the 600 yard run-walk), 4) long jump, 5) softball throw, 6) shuttle run, and 7) fifty yard dash.

The investigators obtained data on this sample and compared it to the established national standards for school aged children of normal intelligence. They found that the retarded children were well below their national counterparts in quantitative measurements of strength, power and coordination. These deficits existed for both sexes and throughout all age ranges. This later study by Rarick again found that the motor performances of educable mentally retarded children were two to four years behind national norms. An analysis of these data readily revealed that the retarded child was delayed in attaining motor skills; progressed through the developmental motor stages more slowly; and never reached levels of competence equal to the normal adult population.

Fitness levels of the moderately retarded were
investigated by Leise and Lerch (26). They selected 21 trainable retarded children (I.Q. range 30 to 54) between the ages of 15 and 21. Two physical fitness tests were administered to this group, the Fleishman Basic Fitness (5) and the AAHPER Youth Fitness Test (15). The Fleishman Test included the following skills: pull-ups, leg lifts, dynamic flexibility, extent flexibility, shuttle run, softball throw, grip strength and cable jump. All items of the AAHPER, as described earlier in this review, were included in this investigation except for the six hundred yard run-walk which was excluded due to space limitations.

The investigators found that when compared to normal counterparts, the performances of the retardates were significantly inferior. All participants scored below the thirtieth percentile on each item except for five scores. These five exceptions were recorded by two subjects.

Prior to 1974, no large scale comparisons of the trainable mentally retarded with educable mentally retarded to normal children had been published. Londeree and Johnson (27) studied 1,106 children, aged six through 19, enrolled in state schools in Missouri. Seventeen test items were administered, but only six were reported in this study to enable comparisons to be made between the two categories of retarded subjects and the normal
children. The six item test battery consisted of softball throw, standing long jump, flexed arm hang, 50 yard dash, 300 yard run-walk, and sit-ups in 30 seconds.

The authors found that when compared to the educable retarded and the normals, the trainable mentally retarded population exhibited considerable impairment on all motor variables. Interquartile channels for the trainables did not overlap the educable mentally retarded or normal channels. The trainable mentally retarded did improve with age, but a plateauing effect was evident in the older groups. Based on quantitative standards, Londeree and Johnson's study showed that the trainable mentally retarded population was clearly less proficient motorically than the educable retarded group and the normals.

Brown (18) used a different method of measuring fitness. He used the Kraus-Weber Test (5), a test to measure minimal muscular fitness and flexibility. Test items included sit-ups (straight leg and bent knee), leg lifts, prone chest lift, prone leg lift, and toe touch. The Kraus-Weber was first used in 1954 and it revealed that 56.5 percent of 4,458 American children and eight percent of 1,987 European children failed one or more of the six items.

Thirty-eight trainable children, 22 males and 16 females, who had an I.Q. range of 30 to 50 and an age span of eight to 16 years, were tested by Brown. He
compared their scores to the established norms based on the national sample. An examination of the percent test failure showed that this groups' performance was significantly ($P < .01$) deficient compared to other previously tested American children. Little difference was noted for flexibility scores. The trainable group had the highest rate of failure in the item testing low back strength. Sixty-three percent of the retarded population had multiple failures. Eighty-six percent of the retarded males and 68.7 percent of the retarded females failed at least one item. It was also noted by Brown that the trainable females, like the normal females, possess more muscle fitness than the males.

Auxter (16) in 1966 compared normal males to differentially diagnosed educable mentally retarded males on measures of grip strength, vertical jump and flexibility. The age range of the subjects was nine to 11 years. The educable mentally retarded subjects were differentially diagnosed as brain damaged, non-brain damaged and undifferentiated. These diagnoses were based on neurological examinations, EEG findings and life histories. If a disagreement existed in the classification process, the child was labeled as undifferentiated. Ninety-one retarded subjects (I.Q. range 50 to 79) and 35 normal subjects were included in the study. Grip strength was
measured by a Stoelting dynamometer and vertical jump measured by the jump reach technique. Flexibility was assessed by measuring trunk flexion and extension and ankle flexion and extension.

Results revealed that no differences existed for trunk flexion and extension among the four groups. The intellectually typical group was significantly superior to the mentally retarded groups on tasks of grip strength, vertical jump and ankle flexion and extension. On the three recorded measures, the three differentially diagnosed groups of retarded had significant differences in only the vertical jump, with the non-brain damaged group having higher mean scores.

Included on the American Association on Mental Deficiency Adaptive Behavior Scale (23) was a motor development domain. Questions included in this section were body balance, walking and running and control of hands. A sample of the items included in the scale were catching and throwing a ball, alternate foot stair climbing, running, hopping, jumping, stand on one foot for two seconds and tiptoe stand for ten seconds. These motor performances were not judged from a qualitative perspective, but were sequentially listed according to difficulty. A subject's motor proficiency was determined by recording the skills he was able to perform.
An analysis of normative data (39), based on institutionalized mentally retarded citizens, for the ages eight through 16, revealed that the vast majority (around 80 percent) exhibited the necessary skills in the categories of walking, running and control of hands to function in society. The institutionalized population in this sample included all levels of retardation from borderline through profound.

The scores for the body balance question were more widely distributed. Most of the scores centered around the final three items: stands without support; stands on one foot for two seconds; and tiptoe stand for ten seconds. About 50 percent of the younger children (eight, nine, ten year olds) achieved either the two second stand or the ten second tiptoe stand. This percentage increased to 65 percent for the older children ages 11 through 16.

This review of available data from the Adaptive Behavior Scale Project (39) indicated that based on minimal standards of performance, the majority of the institutionalized population exhibited adequate motoric development needed to function in society. Although minimal functional levels were achieved, the quality of the movement was not considered. Consequently, this statement of adequate motor development can only be generalized to the three questions on motor development in the Adaptive Behavior Scale.
II. Literature Pertaining to Qualitative Measures of Motor Performance of Mentally Retarded Children

Motor performance that is evaluated from a qualitative perspective focuses on assessing maturity of movement. Auxter (2) describes maturity of movement as good form for a fundamental skill. He describes good form for the motor pattern of a particular skill to be based upon the adept performance of the skill by adults.

A true void in the literature exists in the area of qualitative measurement of motor performance. Authors Rarick (12); Auxter (2); Kaluger and Kaluger (8); and McClenaghan and Gallahue (10) speculate that motor skills have reached motor efficiency or maturity by the age of eight in normal children. Auxter (36) states that rudimentary patterns of throwing, catching, and striking objects are observed in early childhood, but children become proficient in these skills between the ages of six and seven.

Auxter (36) studied the throwing patterns of 110 educable mentally retarded subjects. He examined the developmental patterns in the acquisition of the throwing skill. He measured maturity based on the number of body parts involved and the general coordination of the movement. This investigation demonstrated that the retarded can attain maturity in the throwing pattern and
that they progress through the same developmental sequences as normal children.

In comparing the motoric behaviors of 120 moderately retarded six, seven and eight year old children to their normal counterparts, Ryan (40) utilized a qualitative evaluation tool -- The Ohio State University - Scale of Intra-Gross Motor Assessment. He found that the majority of normal eight year old children, male and female, were using mature motor patterns in the following skills: walking, hopping, throwing, catching, jumping, striking, stair climbing, ladder climbing and skipping. Running for both sexes and kicking for the girls were the only skills where mastery was not observed. Conversely, the majority of the eight year old retarded subjects did not exhibit mature patterns in ten of the eleven skills (they did attain maturity in their walking pattern).

Summary

This chapter reviewed studies (21, 24, 26, 27, 16, 28, 30) that provided overwhelming evidence that retarded children and youth lag behind in motor development. This deficit in motoric development increased as the severity of retardation increased. Investigations repeatedly demonstrated that the trainable or moderately
retarded population had attained significantly lower scores on motor and fitness tests than the educable mentally retarded and the normal child. In a like manner, the performance of the educable child on quantitative measures of movement was inferior to the performance of the normal subject.

The studies (36,40) reviewed in this chapter that assessed motoric behaviors from a qualitative perspective revealed that the scores attained by the retarded population reflected developmental trends similar to those of normal children. The scores of the retarded were significantly lower, but the developing trends were evident.

Although the review provided limited information about qualitative measures of motor performance, the retardates appeared to have greater deficits in the quality of their movement than the resultant products of their performance. Developmental trends were identified and noted that the retarded children progressed through the same developmental sequences as normal children, only at a slower rate.
CHAPTER 3

METHODS AND PROCEDURES

Specific methods and procedures were utilized to investigate the motor skill development of 280 moderately mentally retarded children. This chapter has been divided into six headings: 1) Experimental Design; 2) Subject Selection; 3) Evaluator Selection; 4) The Assessment Instrument; 5) Test Administration and 6) Data Analysis Procedures.

Experimental Design

Two independent variables, sex and age, were incorporated into the design to compare information of basic gross motor skills. Sub-levels for factor A, sex, were A₁ male and A₂ female. Seven age levels (factor B) were involved in the study. Chronological ages were denoted as B₁, nine year old children; B₂, ten year old children; B₃, 11 year old children; B₄, 12 year old children; B₅, 13 year old children; B₆, 14 year old children; and B₇, 15 year old children.

A 2 x 7 factorial design was constructed which included twenty subjects within each cell. This design was utilized to enable motor comparisons to be made between the sexes and among and between the seven age divisions.
Subject Selection

The subjects selected for this investigation were enrolled in educational programs for the moderately retarded throughout the state of Ohio. Five 169 County Programs designed to meet the specific educational needs of the trainable student were selected by this investigator to be included in the study. The county programs selected for the study were chosen because they were located in large metropolitan areas in the state. It was necessary to conduct the research in highly populated areas to insure that the desired number of subjects were available for testing purposes.

A total of eleven schools participated in the investigation. Four schools were from the Columbus area operating under the Franklin County 169 Program for the Mentally Retarded. Three schools were associated with the Cuyahoga County Board of Mental Retardation and were located within the Cleveland city limits. Two programs from the Montgomery County Program for the Mentally Retarded within the Dayton corporation limits and one school each from Clark (Springfield) and Licking (Newark) counties were involved in this study.

Specific guidelines for inclusion into the study were established. The students in the eleven schools were considered as possible subjects if they: 1) were
ambulatory, 2) were in regular classes in their respective schools and not in developmental or transitional classes, 3) were between the chronological ages of nine and 15 years, eleven months and twenty-nine days and 4) were not multihandicapped. Tables 1 and 2 provide identifying data about the subjects by sex involved in this investigation.

Program administrators from each of the five counties were contacted requesting permission to conduct research within their schools. Permission was granted and eleven schools were identified as testing sites. Individual school principals were met and the proposed research was discussed. At this time, testing arrangements, gymnasium or multi-purpose rooms, and assisting personnel, physical education teachers or school aides were assigned to facilitate the investigation process.

School rosters were reviewed and potential subjects that satisfied the previously listed qualifying standards were identified. Parental permission forms were sent to the guardians of these students that explained the intent of the study and requested their consent to permit their child to participate in this investigation of basic gross motor skill development. The returned parental permission forms were tabulated and through a random selection process, twenty subjects for each sex in the seven age groups were selected.
### TABLE 1

SUMMARY OF AGES, HEIGHTS AND WEIGHTS FOR THE MALE SUBJECTS INVOLVED IN THIS INVESTIGATION. SCORES ARE RECORDED IN MONTHS, CENTIMETERS AND KILOGRAMS

<table>
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<th>AGE (months)</th>
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<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
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</thead>
<tbody>
<tr>
<td>Mean</td>
<td>114.03</td>
<td>115.58</td>
<td>137.87</td>
<td>150.53</td>
<td>161.56</td>
<td>175.10</td>
<td>187.09</td>
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<td>Range</td>
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<td>120.20 to 131.83</td>
<td>132.17 to 143.77</td>
<td>144.93 to 155.01</td>
<td>157.47 to 167.90</td>
<td>168.06 to 179.93</td>
<td>181.93 to 191.70</td>
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<tr>
<td>Mean</td>
<td>130.38</td>
<td>134.87</td>
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<td>147.90</td>
<td>155.58</td>
<td>160.22</td>
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<td>11.23</td>
<td>11.35</td>
<td>9.96</td>
<td>14.63</td>
<td>10.19</td>
<td>8.79</td>
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<tr>
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<td>119.38 to 156.21</td>
<td>121.92 to 161.93</td>
<td>132.08 to 170.18</td>
<td>139.70 to 189.87</td>
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<td>SD.</td>
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<td>105.82 to 359.35</td>
<td>152.12 to 507.06</td>
<td>143.30 to 418.87</td>
<td>209.44 to 429.90</td>
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TABLE 2

SUMMARY OF AGES, HEIGHTS AND WEIGHTS FOR THE FEMALE SUBJECTS INVOLVED IN THIS INVESTIGATION. SCORES ARE RECORDED IN MONTHS, CENTIMETERS AND KILOGRAMS

<table>
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<th>CHRONOLOGICAL AGE (months)</th>
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<td>AGE (months)</td>
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<tr>
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<td>112.91</td>
<td>125.44</td>
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<td>175.04</td>
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<td>145.00 to 155.43</td>
<td>156.07 to 167.37</td>
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<td>119.40 to 131.77</td>
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<td>167.37 to 179.93</td>
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<td></td>
<td>129.03</td>
<td>137.41</td>
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<td>150.34</td>
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<td>127.00 to 159.39</td>
<td>132.08 to 166.37</td>
<td>139.70</td>
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<td></td>
<td></td>
<td>146.05 to 152.40</td>
<td>160.02 to 159.39</td>
<td>166.37 to 165.10</td>
<td>170.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEIGHT (Kgs.)</td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>151.63</td>
<td>174.60</td>
<td>182.94</td>
<td>206.20</td>
<td>231.92</td>
<td>258.16</td>
<td>288.65</td>
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<td>SD.</td>
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<td>59.06</td>
<td>87.92</td>
<td>48.44</td>
<td>56.15</td>
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</tr>
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<td>Range</td>
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<td>125.66 to 121.25</td>
<td>130.07 to 174.16</td>
<td>174.16</td>
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<td></td>
<td></td>
<td>238.10 to 381.40</td>
<td>480.60 to 306.44</td>
<td>374.78 to 427.69</td>
<td>451.94</td>
<td></td>
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</tr>
</tbody>
</table>

32
Selection of Evaluators

Two evaluators participated in the collection of data for this study. Both evaluators were doctoral students in the Adapted Physical Education Program at The Ohio State University. They each had considerable experience in administering the assessment tool used in this study. They participated in a previous dissertation study involving two hundred forty subjects that were evaluated by the same assessment instrument.

A reliability check was conducted to measure the agreement between the two observers. The reliability of the evaluators was assessed through a process of comparing scores marked for observed motor performances of subjects as projected on a video tape playback machine. The evaluators observed five subjects as they performed the 11 gross motor skills as described by the OSU-SIGMA. The subjects performed each of the 11 basic gross motor skills three times. After viewing an individual skill, the playback machine was stopped and the evaluators simultaneously recorded their observation on the score sheets that were provided.

Analysis of Evaluator Reliability

The results of the total test reliability was .9090. This high rate of agreement can be attributed to
the complete and extensive knowledge and familiarity of the evaluators with the assessment tool.

Reliability scores were computed through the standard formula:

\[
\text{observer agreement} = \frac{\text{observer agreement}}{\text{observer agreement} + \text{observer disagreement}}
\]

The observers had perfect agreement for eight skills. These skills were walking, running, hopping, catching, jumping, skipping, ladder climbing and stair climbing. The evaluators attained an agreement rate of .8000 for the skill of throwing. The rate of agreement for the remaining two skills, kicking and striking was only .6000. This investigator feels that the lower rates of agreement for throwing, kicking and striking were the product of inefficient methods of determining reliability and not an element of observer incompetence.

The method of reviewing video recorded motor skills severely limited the evaluators. The motor performance was only repeated three times. In most cases, this is usually sufficient; however, isolated incidences occurred when additional different observations (not a repeat of the same three) would have been beneficial in making an accurate judgement. Also, the view shown by the video recorder equipment may not have been the most desirable. This could have been eliminated if live subjects would have been evaluated by the observers.
Intra observer agreement was assessed by evaluating and reevaluating video taped motor performances of children prior to and midway through the collection of data period. Total intra observer agreement was .9545. The evaluators attained perfect agreement scores for eight skills: walking; running; throwing; jumping; kicking; skipping; ladder climbing and stair climbing. The observers attained an agreement rate of .8750 for the two skills of hopping and catching. The intra observer agreement rate for the skill of striking was .7500.

The Assessment Instrument

The motoric behaviors of the selected sample of moderately mentally retarded students were assessed by the Ohio State University Scale of Intra Gross Motor Assessment (38). This assessment tool was constructed by Loovis and Ersing in 1974. The SIGMA is a criterion referenced test that measures the qualitative aspects of motor behaviors. It was designed to evaluate the efficiency or maturity of gross motor patterns of movement utilized for skill execution. It does not measure products of performance (i.e., how far a student can throw a ball), but it does evaluate the movement techniques used to perform the skill. The OSU-SIGMA consists
of eleven basic gross motor skills: walk, run, hop, throw, catch, kick, jump, strike, skip, ladder climbing and stair climbing.

The theoretical basis for the SIGMA is formulated on the developmental aspects of movement. Each of the eleven skills were perceived from a developmental viewpoint. Each skill is subdivided into four stages of development. These stages or levels reflect specific observable behaviors which are characteristic of stages of motor development. Level I is the least mature pattern of movement for a skill. Levels II and III are defined as intermediate and immature levels of motor performance. Level IV characterizes the mature, adult-like movement pattern. Descriptions for each level or category were designed to include major identifying characteristics of movement within each level and not all the trivial aspects of mature movement.

Reliability of the OSU-SIGMA was conducted by Loovis (38) in 1974. Thirteen judges viewed twelve children ages two and one-half to fourteen years. A test - retest reliability study was implemented whereby the judges observed and rated the performance of all twelve children and reobserved the same taped segments of the performances of the subjects one week later.

The reliability study was analyzed with Scott's Pi which produced test reliability coefficients for
inter and intra judge agreements. Test reliability and scorer reliability was determined. High reliability was indicative of those skills with an average coefficient of .83 or better on the test - retest conditions. The skills in that category were walking, ladder climbing, catching and stair climbing. Skills with an average coefficient of .54 or higher were considered to have median reliability. Throwing, striking and skipping were in this category. Low reliability was produced for running, hopping, jumping and kicking and consisted of .53 or lower on test - retest conditions.

Materials for Assessment

Proper administration of the OSU-SIGMA did not require extensive equipment demands. No materials were needed to evaluate the skills of walking, running, hopping and skipping. The evaluators were provided with identical testing equipment to assess those skills that required materials. Regulation size and weight yellow tennis balls were used to assess the skill of throwing. The competency of the subjects in catching skills were evaluated by using a whiffle ball with a diameter of seven inches. An 8 1/2 x 11 inch piece of cardboard was taped to the floor to give the child an object to jump over. A Pennsylvania Playground Ball with a
diameter of ten inches was provided to the evaluators to assess kicking skills. A plastic whiffle bat and a six inch Pennsylvania Playground Ball suspended from a wooden dowel rod by a three foot length of rope was used to measure striking skills. An eight foot aluminum ladder placed three and one-half feet from the wall was used to assess ladder climbing. The rungs were one inch wide and were spaced at intervals of twelve inches.

The equipment for these skills was standardized throughout the data collection period. The investigator, however, was unable to develop equipment specifications for the skill of stair climbing. Many of the newer schools did not have an accessible stairway in the building. The subjects from these schools were tested on a set of portable stairs that were in the schools. Other subjects in the study were tested on the stairways that were available in the school.

Testing Place

The evaluation team traveled to the five cities to test the subjects at their schools. All of the schools except one provided testing space in the gymnasium. All physical education classes were cancelled while the assessment team visited the schools. This proved to be beneficial because it reduced the number of interruptions
and distractions in the gymnasium. The lone school that did not allow testing in the gymnasium provided a large multi-purpose room which was satisfactory. All skill assessments were conducted in the gymnasium/multi-purpose room except for the skill of stair climbing which was evaluated on the nearest set of stairs.

Preliminary Data Recording

Prior to assessing the motor behaviors of the child, the evaluators recorded preliminary data about the subject. The observers recorded, on the standardized score sheet, name, age, sex, height, weight, and date of completed assessment. Name, age and sex were transposed from the schools' rosters. Height was measured using a two meter steel tape measure. Subjects were required to stand erect against a wall making contact with the wall with their heels, buttocks, back and head. A pre-measured height (5 feet) was marked on the wall behind the subjects and their height was measured from this point. Weight was recorded by using a Counselor Scale (U.S. Patent 2,667,387) that was checked daily for accuracy. The shoes of the subjects were removed to provide more precise measures for height and weight.
Assessment Procedure

A routine in the assessment procedures was developed that improved efficiency and effectiveness. In most cases, the physical education instructor of the school and/or a school aide assisted in this investigation. This person's main function was to deliver the assigned subjects to the gymnasium for testing and return them safely to their rooms after the evaluation. Students were individually brought to the gymnasium to be evaluated. During the initial contact with the subject, the evaluator attempted to establish an effective rapport with the child. At this time, preliminary data recording was completed. This measuring and weighing activity proved to be interesting for the subject and tended to relax them. Also, during these initial few moments of contact, the subject was informed that he would be observed while engaging in physical education activities.

After the preliminary information gathering session and a sufficient explanation concerning observer expectation of the subject, the assessment of gross motor skills was conducted. Specific directions (see Appendix) for each skill were provided to the subject. When appropriate, the subject was requested to perform the skill as hard or as fast as possible. This insured the
observer that the student was performing at his maximum level of maturity. If the student executed the wrong skill or did not respond, a demonstration of the desired skill was provided by the evaluator.

The testing specifications, as designed by the test originators were closely adhered to in this investigation. One exception, however, was that this investigator did not limit the number of performance trials for any of the skills. A minimum of three trials was required but no maximum number was established. This did not restrict the evaluators and enabled them to firmly determine which level of performance predominated during the assessment period. Scores were recorded immediately after the motor behavior was identified.

Data Analysis Procedures

The data generated from this investigation were analyzed by using two procedures. A computerized system was identified that was programmed to determine statistical significance for non parametric data. Chi Square analyses were computed to determine if the frequency rate of mature performances differed significantly among the various age groups and between the two sexes.

The emphasis of this study was to investigate the basic motor skill development of the moderately re-
tarded. The scores for the different age categories for the 11 skills were analyzed to determine the age when 50 percent of the subjects had attained maturity in the motor pattern for the individual skills. Data were presented in graphic form to show specific percentages within each of the skill levels for all skills.
CHAPTER 4

ANALYSIS OF DATA AND DISCUSSION OF RESULTS

The intent of this research was to investigate the basic motor skill development of moderately retarded children and youth. A key element in this study was to determine at what age these children displayed mature, functional motor patterns. Additionally, age and sex trends were examined to determine their relationship to motor skill development.

The data gathered during this investigation were compiled and analyzed through two procedures. First, due to the nature of the instrument used to assess the qualitative aspects of motor behavior, a non-parametric statistical analysis was performed. Utilization of non-parametric statistics was preferred because the data gathered were ordinal in nature and not interval.

The investigator subdivided all scores into two categories -- mature and immature. All Level I, II and III scores were recoded and singly classed as immature. Level IV scores comprised the mature category of scores.

A computer program designed to calculate Chi Square computations was identified. This program determined if significant differences existed between males and females, between males and females at each
of the seven age divisions and within each sex across the ages. Post hoc multiple comparisons were computed at the .05 level of confidence.

Presenting the data in graphic form was another method used to analyze the results. The distribution of scores within each of the four observable skill levels was graphed for each motor skill across the 7 ages. Bar graphs were developed which presented the distribution of scores in percentage terms.

Finally, an individual age analysis for each motor skill was graphed. These graphs were added to aid in identifying those ages when the majority of the subjects emitted mature motor patterns.

The first part of this chapter is designed to investigate each motor skill individually. The initial information was generated by analyzing the graphs. Male-female comparisons were addressed and age trends were discussed. This discussion of age and sex trends was based on observable differences (by viewing the graphs) and not statistical differences.

Presentation of the Chi Square statistical analysis for each skill will follow the discussion of the graphed data for the individual skills. This information will reveal if the differences were statistically significant.
Figures 1 and 2
Performance Scores for Walking

Analysis of Data for Walking

Interpretation of the graphed data presented in Figures 1 and 2 showed that every subject observed in this study exhibited a mature motor pattern for walking. This is not surprising, however, since one of the requirements for inclusion into the investigation was that the subjects must be ambulatory. The assessment tool did not discriminate between levels of independent walking. Consequently, one-hundred percent of the subjects attained scores that reflected mature walking patterns. Subsequent Chi Square analyses obviously did not reveal significant age and sex differences for this skill.
Fig. 1. Performance Scores for Walking

Male

Female
Fig. 2. Performance Scores for Walking With Ages Combined

Male - 

Female -
Figures 3 and 4
Performance Scores for Running

Analysis of Data for Running

Performances of Males and Females -- The distribution of scores for males and females for the skill of running are presented in Figures 3 and 4. Some male participants at all age levels attained mature running patterns. A total of 19.3 percent (or 26 subjects) of all males were judged to be Level IV runners. Fifteen percent of nine, ten and 11 year olds, 25 percent of the 12 and 13 year olds and 20 percent of the 14 and 15 year olds received a Level IV score. Seventy-six percent (or 107 subjects) of all males tested received Level III scores for running. Slight variability in percentage of occurrence was noticed across ages at this level. Less than one percent of the total male scores were recorded as Level II. Level I scores were recorded for 3.6 percent (5 subjects) of all the males for running. Scoring within this level were ten percent of the ten year olds and five percent of the subjects aged 11, 12 and 14.

The majority of the females, like the males, received Level III scores for the skill of running. Of all the performances demonstrated by the females, 89 percent (125 subjects) were determined to be at this level.
The percentages did not appear to increase or decrease as chronological age increased. Five percent of the nine, 11, 12 and 13 year olds and ten percent of the 14 and 15 year olds received Level IV scores. Four and one-third percent (6 subjects) of the females tested scored at Level II and one and one-half percent at Level I.

**Male and Female Comparisons for Running** -- Reviewing the graphed data, it was evident that the males exhibited more performances that were judged to be mature than the females. This male dominance was found at each of the seven age levels. Based on Level IV scores, these differences between the sexes averaged about 15 percent at each age level. Surprisingly, the males also recorded more immature Level I scores than the females.

Combining ages and comparing males and females based on the dichotomous breakdown of skill performances, mature and immature, the males were statistically significantly ($P < .05$) superior to the female for the skill of running. No differences, however, were recorded between the sexes at the seven individual ages.

**Age Trends Within Sex For Running** -- An age trend based on mature levels of performance was slightly evident for the males for the skill of running. An increased
number of cases was observed for the older ages. The intervals between the ages were very small with only a ten percent increase between the highest and lowest scores. It was difficult to determine if an age trend existed for the females due to the limited number of observations recorded at Level IV. No differences among the ages within sex were determined to be statistically significant. Neither the males nor the females showed marked improvement as chronological age increased.
Fig. 3. Performance Scores for Running

Male -

Female -
Fig. 4. Performance Scores for Running With Ages Combined

Male: 
Female: 
Figures 5 and 6
Performance Scores for Stair Climbing

Analysis of Data for Stair Climbing

Performance of Males and Females -- Figures 5 and 6 present the data for the distribution of scores for the skill of stair climbing. The majority of the scores (79 percent, 110 subjects), for the skill of stair climbing for the males was Level IV. The 12, 13, 14 and 15 year olds averaged an inclusion rate of 87.5 percent while the nine, ten and 11 year olds averaged 66.5 percent.

The males had 16.5 percent (23 subjects) of their subjects receive Level III scores. Most of these scores were recorded by the nine and ten year olds; however, every age group had performances judged as Level III.

Five percent (7 subjects) of the male performances were recorded as Level II for stair climbing. This five percent was spread over five ages (nine, ten, 11 and 14 year olds). No scores were observed as Level I.

The females scored very similar to the males for the skill of stair climbing. Seventy-two percent (101 subjects) of the scores were recorded as Level IV. Like the males, each age group had over 50 percent of its subjects performing at this level. The older female subjects had better performance rates than the younger children. The 12, 13, 14 and 15 year olds averaged 80 percent of
their subjects at Level IV while the nine, ten and 11 year olds only averaged 66.5 percent.

Level III performances were recorded for 21 percent (29 subjects) of all the females for the skill of stair climbing. Most of these scores were recorded by the nine, ten and 11 year olds. The female sample had a total of seven percent (10 subjects) score at Level II. All ages were represented except the 11 year olds. The nine year olds scored at this level 20 percent of the time. No Level I scores were recorded during this study.

Male and Female Comparisons for Stair Climbing -- Although the percentages for both sexes were high, the scores of the males at each age level, except at age 11, were slightly better than the females for stair climbing. These differences were not great enough, however, to produce statistically significant results.

Age Trends Within Sex For Stair Climbing -- A slightly observable age trend was evident for both sexes. The older four age groups exhibited mature performances more frequently than the younger subjects. Chi Square analyses did not reveal any statistically significant results among the seven age divisions for the skill of stair climbing.
Fig. 5. Performance Scores for Stair Climbing

Male - 
Female -
Fig. 6. Performance Scores for Stair Climbing
With Ages Combined

Male —

Female —
Figures 7 and 8
Performance Scores for Jumping

Analysis of Data for Jumping

Performances of Males and Females -- The distribution of scores within the four levels for the skill of jumping are presented in Figures 7 and 8. Fourteen percent (20 subjects) of all males tested for the skill of jumping attained Level IV scores. Within this level, 30 percent of the 13 year olds, 15 percent of the subjects aged 10, 14 and 15, ten percent of the nine and 12 year olds, and five percent of the 11 year olds were mature jumpers.

Most of the male performances, 60 percent (84 subjects), for all ages were marked as Level III scores. Age/performance trends could not be developed for Level III performances because an equal number of scores were recorded for younger and older children.

Level II scores were attained by 23 percent (32 subjects) of all the males. Little variance across all seven ages was recorded. Nearly three percent (4 subjects) of the performances were determined to be Level I scores. The only subjects to score at this level were those males aged ten, 11 and 12.

Few females, eight percent (11 subjects) were judged as exhibiting mature jumping patterns. Level III performances for the skill of jumping were achieved by 15
percent of the 11 and 15 year olds, ten percent of 12 year olds and five percent of the children aged nine, ten and 14.

Many of the performances were judged to be Level III for the skill of jumping. Of the females tested, 65 percent (92 subjects) scored at this level. Although all ages were represented by over 55 percent of its total in this division, the 12, 13, 14 and 15 year olds had a slightly higher percentage rate (68 percent) than the nine, ten and 11 year olds (61 percent) at this level.

Level II scores were recorded for 23.5 percent (33 subjects) of the females. This rate was relatively stable across all ages. Nearly three percent (4 subjects) of the scores were in the Level I category. These scores were attained by the 11 and 13 year olds (five percent) and the 14 year olds (ten percent inclusion rate).

Male and Female Comparisons for Jumping — The males were judged to have slightly more Level IV performances than the females for jumping. This was true at all age divisions except for the 11 year olds where the females attained a higher percentage rate (five percent compared to 15 percent). Basically, all the cells were equal except for the 13 year old division where a 30 percent to zero percent comparison existed favoring the males.
Combining the scores for the age divisions and comparing the sexes for mature patterns of jumping, it was found that no significant differences existed. Fourteen percent of the total group of 140 males were judged to be mature jumpers while eight percent of the females were observed at this level. This difference of six percentage points did not approach significant levels. Comparing sexes at the individual ages also did not produce significant differences.

**Age Trends Within Sex for Jumping** -- Based on mature scores, no observable age trends could be identified for the skill of jumping. The percentage rates, especially for the females, of Level IV scores remained relatively stable across all age ranges. No age trends could be established because a limited number of subjects attained mature scores.

Consequently, no statistically significant differences were noted among the ages within each sex.
Fig. 7. Performance Scores for Jumping

Male -  
Female -  

PERCENT PERFORMING WITHIN EACH LEVEL

I II III IV

SKILL LEVELS

Fig. 8. Performance Scores for Jumping With Ages Combined

Male -
Female -
Figures 9 and 10
Performance Scores for Hopping

Analysis of Data for Hopping

Performances of Males and Females -- The graphed data in Figures 9 and 10 present the distribution of scores for the skill of hopping. Twenty-eight percent (39 subjects) of the males involved in this investigation exhibited mature motor patterns for the skill of hopping. This percentage tended to improve as chronological age increased. Of this 28 percent, the nine and ten year olds only had an inclusion rate of ten percent while the 15 year olds had 60 percent of the age division scoring at Level IV. An average of 28 percent of intermediate ages, 11, 12, 13 and 14, attained mature hopping scores.

The scores for the skill of hopping tended to be bunched in the Level III category for both sexes. Fifty-one percent (72 subjects) of the male scores were recorded at this level. The scores were not stable across ages but a pattern did not evolve indicating more or less scores with increased age.

Level II performances were recorded by nine percent (12 subjects) of the males; Level II performances were achieved by ten percent of the nine, 12 and 15 year olds and five percent of the males aged 10, 13 and 14.
Fifteen percent of the 11 year olds were performing at this level. Twelve percent (17 subjects) of all males tested could not hop. These Level I scores, however, were found mainly in the sample of nine (15 percent), ten (30 percent), 11 (15 percent), and 12 (20 percent) year olds with a total of only one score in the 13, 14 and 15 year old range.

Twenty-five percent (35 subjects) of the females in the study demonstrated mature hopping skills. Most of these Level IV performances were attained by the 13 (40 percent), 14 (25 percent) and 15 (50 percent) year old subjects. The remaining four ages — nine, ten, 11 and 12 averaged 15 percent of each group at this level.

Like the males for hopping, a large percentage (49 percent, 69 subjects) of the scores were concentrated in Level III. Also, like the males, a pattern was not established that indicated improved scores with increased age. The inclusion rate fluctuated from a high of 70 percent for the 12 year olds to a low of 30 percent for the ten year age group. Level II scores were recorded for 15 percent (21 subjects) of the female subjects. Most of these scores, 80 percent, were achieved by the nine, ten and 11 year olds. Eleven percent (15 subjects) of the females could not hop and received Level I scores.
Male and Female Comparisons for Hopping -- The graphed results based on the performances of the two sexes were quite similar. Nearly an equal number of males and females was represented in each of the performance levels across all ages. Females emitted slightly more mature performances for hopping at the ages of nine, ten and 13. At the other ages, the males were judged to exhibit mature hopping skills more frequently than the females.

A Chi Square method of analysis was utilized to determine if significant differences existed between sexes. The seven age groups were combined and the number of mature performances of the males and females were compared. No statistical differences were observed between the sexes. Further analysis compared the sexes at individual ages. Again, no differences were found between the sexes.

Age Trends Within Sex for Hopping -- A definite, observable age trend was evident for both sexes when viewing mature performances. The older subjects, male and female, aged 13, 14 and 15, had considerably more Level IV scores than the younger subjects. This indicates that hopping skills tended to improve as age increased. Reversing the scope of the investigation and reviewing immature motor performances, Levels I and II scores occurred more often in the younger ages for both sexes.
Comparing the number of subjects exhibiting mature performances within each sex at the different age levels revealed significant differences for the males, but not the females. The group of 15 year old males exhibited significantly superior (P<.05) scores when compared to younger males aged nine and ten. The inclusion rate for the 15 year olds was 60 percent while only ten percent of the nine and ten year olds achieved mature scores.
PERCENTAGE PERFORMING WITHIN EACH LEVEL

Fig. 9. Performance Scores for Hopping

Ages

Male -

Female -
Fig. 10. Performance Scores for Hopping With Ages Combined

Male -

Female -
Figures 11 and 12
Performance Scores for Throwing

Analysis of Data for Throwing

Performances of Males and Females -- The graphic account of the distribution of scores for children performing at each level for throwing is presented in Figures 11 and 12. The majority of scores for throwing were recorded in Levels II and IV for both sexes. Forty-four percent (62 subjects) of all males achieved scores indicating mature throwing patterns. Performances tended to fluctuate with a slight trend indicating improvement with age except for the 15 year olds. Two ages, 13 and 14, had 50 and 65 percent of its subjects at this level while 45 percent of the ten and 12 year olds were at Level IV. The other three ages, nine, 11 and 15, had inclusion rates of 35 percent, 40 percent and 30 percent, respectively. Level III performances were recorded by 12 percent (17 subjects) of the male subjects. These scores were nearly evenly distributed across all age divisions. Four ages -- nine, 11, 13 and 15, had the highest rate of 15 percent, while the 14 year olds had the lowest rate of 5 percent. The performances of 42.5 percent (59 subjects) of the male subjects were judged as Level II. The percent of performances judged to be Level II remained relatively constant (mean of 42 percent) across the nine,
ten, 11, 12 and 13 year old age divisions. The 14 year olds had the lowest inclusion rate of 30 percent while the highest rate was recorded for the 15 year olds. The remaining one percent of the scores were in Level I.

A total of 35.75 percent (50 subjects) of the throwing scores for females was located in Level IV. Sixty and 50 percent of the 14 and 15 year olds, respectively, attained mature throwing scores. An average of 33 percent of 11, 12 and 13 year olds, and a mean score of 20 percent of the nine and ten year olds were scored as mature throwers (Level IV).

Sixteen percent (23 subjects) of the females scored at Level III. Most of the Level III scores (78 percent) were achieved by the 11, 12, 13 and 15 year olds. Level II scores were attained by 47 percent (66 subjects) of the females. Sixty and 75 percent of the nine and ten year olds, respectively, were scored as Level II performances. Forty-five percent of 11, 12 and 13 year olds and 35 percent of 14 year olds, and 25 percent of 15 year olds were in this division. One percent of the scores was recorded as Level I.

**Male and Female Comparisons for Throwing** — Based on mature performances for throwing, the males achieved Level IV scores more frequently at each age level except
at the 15 year old division. The total differences between the sexes was small with the greatest discrepancy occurring at the age of ten where 45 percent of the males attained Level IV scores while only 15 percent of the females achieved this performance level.

The total number of males emitting proficient throwing skills did not statistically significantly differ from the females. Furthermore, Chi Square computations did not identify any significant differences between the sexes at the individual ages.

**Age Trends Within Sex for Throwing** — A definite age trend was recognizable for both sexes. It was observed that the older children exhibited mature scores more frequently than the younger children except for the 15 year olds. Peak performances for both sexes were demonstrated by the 14 year olds. Differences appeared across the ages, but often it was limited to only an additional subject or two.

Although observable differences existed across age levels, these differences were found to be non-significant. Similar non-significant results were obtained when examining differences between the males and the females.
Fig. 11. Performance Scores for Throwing

Male -
Female -
PERCENT PERFORMING WITHIN EACH LEVEL

Fig. 12. Performance Scores for Throwing With Ages Combined

Male - [Graph Markings]

Female - [Graph Markings]
Figures 13 and 14
Performance Scores for Catching

Analysis of Data for Catching

Performances of Males and Females -- The graphed results for the skill of catching are presented in Figures 13 and 14. Mature performances for catching were exhibited by 23.6 percent (33 subjects) of the tested male population. The percentage of subjects within each age division exhibiting Level IV performances tended to increase as chronological age increased except for 12 year olds. The 15 year old males had 50 percent of their age performing at Level IV while only five percent of the nine year old age group were at this level.

Most of the catching performances (50 percent or 70 subjects) for the males were scored as Level III. No age trends could be interpreted from the data. A like number of younger and older subjects scored in this category.

Level II scores were mainly recorded by the younger ages. Twenty-four percent (33 subjects) of the scores were at this level. Seventy-three percent of this total was recorded by nine, ten and 11 year olds. Two percent (4 subjects) of the males' scores were at Level I.
The females had 11.5 percent (16 subjects) of their population exhibiting mature catching patterns. Fifty-six percent of this total was achieved by the 15 year olds who had 45 percent of their age group at this level. No nine or ten year olds scored in this category and the 11, 12, 13 and 14 year olds only averaged eight percent.

The majority of females (51 percent, 71 subjects), like the males, demonstrated performances that were judged to be Level III. A higher percentage of older children scored in this level than the younger children. Level II was represented by 35 percent (49 subjects) of the scores with most of them being achieved by nine, ten, 11 and 12 year olds who had an average rate of 49 percent per age group. Twenty and 30 percent of the 13 and 14 year olds scored at this level while no 15 year olds were categorized as Level II catchers. Nearly three percent (4 subjects) of the females scored at Level I. Within this level, ten percent of the ten year olds and five percent of the 13 and 14 year olds exhibited immature performances.

Male and Female Comparisons for Catching -- Based on the graphed data generated from this investigation, the male subjects' performances for the skill of catching
were superior to the females' performances. Their performances overshadowed the females at each of the seven age divisions at the mature level. Most of the age comparisons were not overwhelming except at age 14 where 40 percent of the males achieved mature scores while only five percent of the females were judged to be mature catchers.

Based on the mature-immature criterion, the group of male subjects in this study were judged to be statistically superior (P< .05) to the females for the skill of catching. Twenty-three and one-half percent of the males emitted mature functional patterns while only 11 percent of the females attained equal performance levels. Differences between the sexes at individual ages were determined to be non-significant statistically.

Age Trends Within Sex for Catching — An analysis of the graph for catching revealed that an age trend existed for both sexes, but more noticeably for the males. The percentage of males that scored at Level IV tended to gradually increase at each age interval. The females on the other hand, had a very limited number of subjects judged as mature performers between the age of nine through 14. The 15 year olds, however, had 45 percent of their scores in the mature range. This was a drastic increase when compared to the younger ages.
Significant differences (P< .05) were observed for both sexes as chronological age increased. The cells composed of 15 year old males significantly outperformed the nine year old males. The 15 year old age group for the females also exhibited significantly more mature performances than the nine and ten year old females.
Fig. 13. Performance scores for catching

Percentage performing within each level of age.
Fig. 14. Performance Scores for Catching With Ages Combined

Male -
Female ---
Figures 15 and 16
Performance Scores for Skipping

Analysis of Data for Skipping

Performances of Males and Females -- Unlike other skills, most of the male scores (48 percent, 67 subjects) recorded for skipping (Figures 15 and 16), were at Level I. The nine and ten year olds had an inclusion rate of 65 percent while those aged 11, 12, 13 and 15 averaged 46 percent of their total at this most immature level of skill execution. Only 20 percent of the 14 year olds were included as Level I performers. Level II performances were exhibited by five percent (7 subjects) of the males for the skill of skipping. These scores were distributed among the nine, 11, 14 and 15 year old subjects.

All age groups were represented by subjects that scored in the Level III category. Nineteen percent (26 subjects) of the males received Level III scores. Judged to be within this Level III category were 25 percent of the ten and 14 year olds, 40 percent of all 12 and 13 year olds, 15 percent of the 11 and 15 year olds and ten percent of the nine year olds. Mature motor patterns for the skill of skipping were achieved by 28 percent (40 subjects) of the males. The percentage of subjects within each age category scoring at Level IV tended to increase as age increased except for the ten and 15 year olds.
The 14 year olds had the highest rate of performers at this level with a total percentage of forty-five.

The females present a performance profile similar to the males. A large percentage, 48 percent (67 subjects), of the performances were Level I. The percentage of scores at this level tended to decrease as age increased. The ten year olds had 70 percent of their performers at Level I, while the rate of incidence gradually decreased with each advancing year to the 15 year olds who had 35 percent of their subjects at this level.

Level II performances were recorded for eight percent (12 subjects) of all the females. Females aged nine, ten and 14 had an inclusion rate of 15 percent, while 11, 12 and 13 year olds had an average of five percent of their performers at this level.

Eighteen percent (25 subjects) of the skipping scores for females were Level III. The scores were spread over six ages with the ten year olds being excluded. The 14 year olds had the highest rate of 30 percent.

Functional mature motor skipping patterns were demonstrated by 26 percent (36 subjects) of the females. The percentage of performers within each age division scoring at Level IV generally tended to increase or remain the same (except for the 14 year olds) as chronolog-
The age increased. The 15 year olds had 50 percent of their subjects score at this mature level.

**Male and Female Comparisons for Skipping** — For the skill of skipping, like so many of the other skills, the males and females produced very similar profiles. Performances were nearly equal across the seven age ranges at the mature level with the greatest discrepancy occurring at age 14 where 45 percent of the males were observed to be mature skippers while only 20 percent of the females were in this category.

Based on the number of recorded mature performances, statistical analyses did not reveal differences between the males and females for the skill of skipping. Differences did not exist when ages were combined or individually compared.

**Age Trends Within Sex for Skipping** — A definite but limited age trend was evident for the skill of skipping within both sexes. Scores appeared to improve as chronological age increased. The younger children of both sexes did not reach the performance standards of the older subjects in this study.

Age trends within each sex could not be statistically identified. The differences among the seven age
groups although observable were not great enough to pro-
duce statistical significance.
Fig. 15. Performance Scores for Skipping

Male —

Female —
Fig. 16. Performance Scores for Skipping With Ages Combined

Male -

Female -
Figures 17 and 18
Performance Scores for Striking

Analysis of Data for Striking

Performances of Males and Females -- The distribution of scores for males and females for the skill of striking are presented in Figures 17 and 18. Forty-one percent (58 subjects) of the male subjects received scores indicating mature striking patterns have been established. Fifty percent of all 12, 13, 14 and 15 year olds attained a mark of Level IV. The nine, ten and 11 year olds had 30 percent of their subjects demonstrate mature, functional striking patterns.

Level III scores were recorded for 41 percent (59 subjects) of the males. The percentage across ages tended to be stable with slightly fewer scores being recorded for the older age groups. All age levels were represented by Level II scores. Twelve percent (19 subjects) of the males scored at this level with higher percentage rates occurring for the four younger age divisions. Four percent (6 subjects) of the scores were judged as Level I. Within this performance level were ten percent of the ten and 12 year olds and five percent of 11 and 15 year olds. These were the only subjects to be judged at this level.
Level IV striking performances were demonstrated by 36 percent (50 subjects) of the females. Only the 13 year olds attained an inclusion rate higher than 50 percent (55%). Some subjects in all the ages attained Level IV scores. The older age groups (13, 14 and 15 year olds) had a higher inclusion percentage rate (45 percent) than the younger groups (28 percent).

Forty-one percent (58 subjects) of the females received Level III scores. The scores were nearly constant across ages except for the ten and 13 year olds who had low incidence rates, 15 and 20 percent, respectively. The other age divisions averaged 51 percent of their subjects as Level III performers. The females received Level II performance scores 20 percent (28 subjects) of the time. Group performances did not consistently decrease or increase according to age. All age levels were represented by Level II marks. Forty-five percent of the ten year olds were at Level II but all other ages were considerably less well represented. Three percent (4 subjects) of the subjects received Level I scores. All of these scores were attained by nine, ten and 11 year old children.

Male and Female Comparisons for Striking -- The males and females had nearly equal numbers performing at
Level IV for the skill of striking. The males equaled or slightly exceeded the females at all age divisions except at age 13. The greatest discrepancy between the sexes appeared at age 12 where the males frequency rate of mature performances exceeded the females 50 to 30 percent.

The analysis of the results for the skill of striking did not produce statistically significant differences between the sexes. These non-significant differences existed when the ages were grouped or individually compared at each level.

Age Trends Within Sex for Striking -- A slight trend for improved scores as chronological age increased was apparent. The older subjects in both groups -- male and female -- had higher inclusion rates for this motor skill of striking than the younger children in the study. The younger subjects for both sexes aged nine, ten and 11, averaged an inclusion rate of mature performances at 30 percent. The females and males of the older four age divisions averaged 41 and 50 percentages, respectively. No significant differences were recorded for either sex when the data were compared using a Chi Square statistic.
Fig. 17. Performance Scores for Striking

PERCENTAGE PERFORMING WITHIN EACH LEVEL

Male:

Female:

AGES
9 10 11 12 13 14 15
Fig. 18. Performance Scores for Striking With Ages Combined

Male - 

Female - 

PERCENT PERFORMING WITHIN EACH LEVEL

SKILL LEVELS
Figures 19 and 20
Performance Scores for Kicking

Analysis of Data for Kicking

Performances of Males and Females -- Graphed analysis of the performances for the skill of kicking are presented in Figures 19 and 20. Scores were achieved indicating that mature kicking patterns have been established by 16 percent (23 subjects) of the males. The older males (12, 13, 14 and 15) exhibited slightly more mature performances (17.5 percent) than the younger subjects (11.5 percent). The 15 year olds had the highest rate of only 25 percent of the group's subjects at Level IV.

A major portion of the scores were located in Level III. Fifty-seven percent (80 subjects) of the scores recorded as Level III maintained relatively stable across ages for the males. Level II performances were demonstrated by 25 percent (35 subjects) of the males. This percentage generally was constant across all ages. One percent of the subjects scored at Level I. The males for the skill of kicking showed very little improvement across ages. The percentage of subjects scoring within each level remained stable throughout the age range.

The females present a slightly different profile than the males. Level IV performances were not frequently observed (9 percent, 13 subjects). However, 30 percent
of the 15 year olds were judged as mature kickers. The other ages did not equal their performance as only nine percent of the total female group scored at Level IV.

Sixty-six percent (93 subjects) of the females scored at Level III. The percentage of scores falling into this category could not be arranged to establish age trends. The scores within this level varied from a high of 80 percent for the nine and eleven year olds to a low of 55 percent for the ten year age division. A small percentage of the females, two percent (3 subjects), exhibited Level I performances. Five percent of the nine, ten, and 13 year olds performed at this level.

Male and Female Comparisons for Kicking -- Viewing the mature performances of the males, they outperformed the females on the skill of kicking at each age category except for the ages of 11 and 15. The comparisons between the males and females at the various age levels produced rather small differences between the sexes.

Computation of the Chi Square analysis of the scores for kicking did not reveal significant results for this skill when the ages were combined. In addition, non-significant differences were recorded when the sexes were compared at individual age divisions.
Age Trends Within Sex for Kicking -- The number of performances classified as Level IV kickers was relatively small for all ages. Due to the small size of the sample, age comparisons within sex were difficult. The older groups did have more subjects judged to be mature kickers, but this difference was of little consequence.

Analysis of this dichotomous data did not reveal statistically significant differences among the age groups for either sex. A limited number of mature performances were recorded for kicking during the data collection period. Consequently, significant age trends were not identified.
Fig. 19. Performance Scores for Kicking

Male - GIGIGI

Female - GIGIGI
Fig. 20. Performance Scores for Kicking With Ages Combined

Male —
Female —
Figures 21 and 22
Performance Scores for Ladder Climbing

Analysis of Data for Ladder Climbing

Performances of Males and Females -- The graphed results of the distribution of scores for the data attained by assessing ladder climbing skills are presented in Figures 21 and 22. Forty-five percent (62 subjects) of the male subjects exhibited mature motor patterns for ladder climbing. Most of these scores were recorded by the 12, 13, 14 and 15 year olds who included 63 percent of their group at Level IV. Twenty-five percent of the nine year olds, 45 percent of the ten year olds, and 30 percent of the 11 year olds displayed Level IV skills.

Level III scores were recorded 25 percent of the time (35 subjects) for male subjects. The scores were relatively stable fluctuating between a high of 35 to a low of 15 percent. Performances judged to be Level II were recorded for 29 percent (40 subjects) of the males.

The percentage within each age group was nearly stable across all ages. Two percent (3 subjects) of the scores were marked as Level I. Scoring within Level I were five percent of the nine, ten and 11 year olds.

Mature ladder climbing skills were demonstrated by 29 percent (41 subjects) of the females. This percent-
age is appreciably lower than the male rate. One age group, the 15 year olds, had 50 percent of its group at this level. An average of 25 percent of the other six age groups scored at Level IV.

Thirty-one percent (44 subjects) of the females were judged as Level III performers. An age/performance trend was not observed at this level. The 12 year olds had the highest inclusion rate of 50 percent while the nine year olds had a low of 15 percent.

Ladder climbing performances were marked as Level II scores for 31 percent (43 subjects) of the females. The percentage rates did not follow an orderly increase or decrease according to age. Nine percent (12 subjects) of the performers were classified as Level I. The scores were distributed across all ages for the females except the ten year olds with the nine year olds having the highest rate of 20 percent.

Male and Female Comparisons for Ladder Climbing --

The males had more performers score at Level IV than the females for the skill of ladder climbing. This advantage was observed across all age levels except the 15 year olds where the females demonstrated slightly more mature performances. At the other ages, however, the males had considerably more mature performances than the females.
The results of the Chi Square analysis revealed that the males had statistically significantly ($P < .05$) more performers attain mature motor patterns for the skill of ladder climbing than the females. Reviewing the computed data for differences between the sexes at individual ages, no significant differences were recorded.

**Age Trends Within Sex for Ladder Climbing** — Age trends were not readily observed for either sex. The younger ages had only slightly fewer performances judged to be mature than the older children in this study. Although observable differences were viewed among the ages for both sexes, these differences were not found to be statistically significant.
Fig. 21. Performance Scores for Ladder Climbing

Female -

Male -

AGES
Fig. 22. Performance Scores for Ladder Climbing With Ages Combined

Male -

Female -
The results generated by analyzing the seven age groups will be the second part of this chapter. This presentation will identify those ages when the majority of the subjects emitted mature patterns for the gross motor skills. Majority in this study refers to 50 percent or more of the subjects within one age group attaining Level IV scores for one skill.

**Analysis of Data for All Skills by Age**

This section of the analysis of data examines the skills within each individual chronological age for the purpose of determining if or when the majority of the subjects within an age group attained mature patterns for the eleven basic gross motor skills. Majority, in this study, refers to having 50 percent of the subjects within an age group judged as mature performers for a particular skill. Intermediate levels (Level III) of performance and immature levels (Level I and Level II) will also be discussed for each age using the same 50 percent criterion level. This measure indicates the type of motoric behavior which characterizes a particular age group.
Figure 23 presents the eleven skills and the distribution of scores for all nine year old children. The males attained mastery criterion levels (50 percent of the group) for two skills -- walking and stair climbing. Intermediate levels of performance were recorded for running, hopping, catching, jumping, kicking and striking. Immature levels of performance dominated two skills for this group -- throwing and skipping. Scores for the skill of ladder climbing were nearly evenly distributed among Levels II, III and Level I.

Also included in Figure 23 are the performances for the nine year old females. Like the male at this age, the female has achieved mastery over the skills of walking and stair climbing. Level III scores or intermediate levels of performance dominated in the skills of running, jumping, kicking and striking. Immature scores of Level II seemed to characterize the skills of throwing and catching. Level I scores were most frequently recorded for skipping. Similar to the male, the female did not have one score which was characteristic for ladder climbing.
Fig. 23. Skill Performances for Nine Year Old Children

PERCENTAGE OF CHILDREN PERFORMING WITHIN EACH SKILL LEVEL
In examining the performances of the ten year old children, the males achieved mature functional patterns for walking and stair climbing. Running, hopping, jumping and kicking were motor skills that the ten year olds most frequently emitted as Level III performances. No skill was dominated by Level II performances, but skipping was judged to occur as a Level I sixty-five percent of the time. The other skills of throwing, catching, striking and ladder climbing had results that were more evenly distributed among the four levels.

The majority of the ten year old females exhibited functional mature patterns for walking and stair climbing. Skills that were marked with a high frequency of Level III performances were running, catching, jumping and kicking. Level II performances for throwing and Level I for skipping were the only other skills that were characterized by one particular skill level. Performances for hopping, striking and ladder climbing reflected a more evenly distributed rate of frequency.
Fig. 24. Skill performances for ten year old children.
The eleven year old males achieved mature levels for the skills of walking and stair climbing. Level III scores characterized this age division's performances for the skills of running and kicking. All other skills -- hopping, throwing, catching, jumping, striking, skipping and ladder climbing were not dominated by one particular skill level.

The females, like the males, attained mature levels for walking and stair climbing. Fifty percent or more of the females were judged to be Level III performers for the motor skills of running, hopping, catching, jumping, kicking and striking. Skipping scores were recorded as Level I for 65 percent of the 11 year old females. Ladder climbing and throwing were two skills that had scores that appeared to be evenly distributed.
PERCENTAGE OF CHILDREN PERFORMING WITHIN EACH SKILL LEVEL

Fig. 25. Skill Performances for Eleven Year Old Children

SKILL LEVELS

STRIKE

SKIP

LADDER

STAR

KICK

WALK

RUN

HOP
Figure 26
Skill Performances for Twelve Year Old Children

Analyzing the performance of 12 year old children, the males achieved mature levels for walking, stair climbing, striking and ladder climbing. This age group of males added striking and ladder climbing to the skills that previously had been achieved by younger male subjects. Level III performances occurred 50 percent or more of the time for the five skills of running, hopping, catching, jumping and kicking. No skills were predominantly judged as Level II and only skipping was judged as Level I for this group of twelve year old males. The scores for throwing were distributed in such a manner that one skill level was not observed more than fifty percent of the time.

The group of twelve year old female subjects were judged to exhibit mature levels for walking and stair climbing. These two mastered skills were the same that were mastered by the children aged nine, ten and eleven. Level III scores characterized the performances of the 12 year old females for the motor skills of running, hopping, jumping, kicking, striking and ladder climbing. Catching was observed as Level II, the majority of the time. Throwing and skipping did not have a dominant level of performance.

107
Fig. 26. Skill Performance for Twelve Year Old Children

PERCENTAGE OF CHILDREN PERFORMING WITHIN EACH SKILL LEVEL

SKILL LEVELS

- CROSSLAND
- SKIING
- LADDER
- SKIP
- KICK
- JUMP
- THROW
- THRESH
- WALK
- RUN
- HOP
- MALE
- FEMALE
Mature motor patterns were exhibited for walking, throwing, striking and ladder and stair climbing by the 13 year old males. Throwing was added to this list of mastered skills which did not appear at the younger ages for the males. Level III performances were observed most frequently for the skills of running, hopping, catching, jumping and kicking. These skills were all previously noted as Level III skills for the younger children. No skills were observed to be primarily Level I or II performances. This age group had mastered five skills and were predominantly performing at Level III for five other motor skills.

The 13 year old females exhibited mature patterns for walking, striking and stair climbing. Striking represents the first skill mastered beyond walking and stair climbing. Five skills — running, hopping, catching, jumping and kicking were primarily judged to be Level III performances for this group. The remaining skills of throwing, skipping and ladder climbing did not have 50 percent or more of the scores in any of the four skill levels. The performance of this group was an improvement over the younger children in several respects. First, they mastered an additional skill and, secondly, none of the motor skills were predominantly judged as Level I or
II, indicating their performances were either more widely distributed or judged to be more mature.
PERCENTAGE OF CHILDREN PERFORMING WITHIN EACH SKILL LEVEL

Fig. 27. Skill Performances for Thirteen Year Old Children
Mature standards of performances were achieved by the 14 year old males for the motor skills of walking, throwing, striking, ladder climbing and stair climbing. These five skills represent the same five that were recorded by the thirteen year old males. Level III performances were primarily observed for running, hopping and jumping. The other three motor skills -- catching, kicking and skipping -- did not have observable behaviors that dominated any of the four skill levels.

The group of 14 year old females achieved mature levels for the skills of walking, throwing and stair climbing. Throwing represented a newly mastered skill for the females but this group failed to maintain mature patterns for striking which was previously accomplished by a younger age group. Level III scores characterized the performances of these females for the motor skills of running, hopping, catching, jumping, kicking and striking. No skills were judged to be dominated by Level I or II scores.
PERCENTAGE OF CHILDREN PERFORMING WITHIN EACH SKILL LEVEL

Fig. 28. Skill Performances for Fourteen-Year-Old Children
Figure 29
Skill Performances for Fifteen Year Old Children

The majority of the 15 year old males achieved mature levels for walking, hopping, catching, striking, ladder climbing and stair climbing. Hopping and catching included in this list represented skills that had not previously been mastered by the males. Level III skills included running, hopping and jumping. The performance of the fifteen year old males regressed in one respect. They failed to achieve mastery for throwing. Furthermore, their throwing performance was judged to be primarily Level II which was not reported for any of the younger age groups.

The females achieved mature mastery levels for walking, hopping, throwing, skipping, ladder climbing and stair climbing. This represented three additions to the list of mature skills for females -- skipping, hopping and ladder climbing. Skills that were dominated by Level III for fifteen year old females were running, catching, jumping and kicking. None of the remaining motor skills were characterized by Levels I or II.
Summary

In review, this analysis was designed to investigate age and sex trends and determine when the moderately retarded subjects in this study achieved mature levels of performance for basic gross motor skills. The data were analyzed statistically and graphically to further understand the motoric behaviors of this population.

Sex Trends

Chi Square statistical analyses were computed to determine if significant differences existed between the sexes based on the number of subjects that attained mature performances. This analysis revealed that significant differences (P < .05) existed between the sexes for the motor skills of running, catching and ladder climbing. Each of these differences favored the male performers. Further statistical analysis of these data did not reveal differences between the sexes at individual ages.

The graphed data revealed numerous observable differences between the sexes. The most obvious differences appeared in running, catching, climbing and throwing where the males received considerably better scores than the females. Minute differences usually favoring the males were observed for hopping, striking, skipping,
kicking and jumping. No differences between the sexes were observed for walking and stair climbing.

Additional data ascertained from the graphed data favored the males. Computations revealed that forty percent of all performances emitted by the males were judged to be mature, while the females recorded thirty-two percent of their scores at this mature level.

**Age Trends**

Chi Square analyses were computed to determine if differences existed among the seven ages within the sex variable. Three cases were identified revealing that increased chronological age resulted in an increase in the improved number of performances. The group performances of the fifteen year old males were statistically significantly superior ($P < .05$) when compared to males aged nine and ten for the skill of hopping. In a like manner for the skill of catching, the fifteen year olds for both sexes produced significantly better scores than the younger children aged nine in this study.

The graphs revealed several readily observable age trends for some of the skills. Hopping and catching for both sexes and throwing for the females were graphed to show that subjects of increased chronological ages tended to be judged as better performers. The skills
of striking for both sexes and throwing for the males and skipping for the females revealed somewhat of a trend indicating improved scores across the ages. No differences among the ages for both sexes were recorded for running, jumping, kicking, ladder climbing and stair climbing. In addition, no marked differences were observed in skipping for the males.

Table 3 presents the individual ages and the total percent of their performances that were judged to be mature. A review of this table reveals that based on the mature performances, the older subjects usually achieved Level IV scores more frequently than the younger children. These percentage figures ranged for the males from twenty-nine percent for the nine year olds to forty-nine and one-half percent for the fourteen year olds. The range of the females was twenty-five percent for the nine year olds to forty-seven and one-half percent for the fifteen year olds.

Age trends were evident on the graphed data involving mastery levels for the eleven skills. Generally, for the males, as chronological ages increased, the number of mature, functional skills increased. The subjects aged nine, ten and eleven had mastered walking and stair climbing skills. The twelve year olds, building upon the walking and stair climbing skills, added striking
TABLE 3

PERCENTAGE AND TOTAL NUMBER OF MATURE PERFORMANCES RECORDED FOR ALL SKILLS COMBINED BY AGE AND SEX

<table>
<thead>
<tr>
<th>AGES</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
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<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent</td>
<td>29.0</td>
<td>34.1</td>
<td>31.8</td>
<td>40.9</td>
<td>45.5</td>
<td>49.5</td>
<td>45.5</td>
</tr>
<tr>
<td>Total No.</td>
<td>64</td>
<td>75</td>
<td>70</td>
<td>90</td>
<td>100</td>
<td>109</td>
<td>100</td>
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<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent</td>
<td>25.1</td>
<td>23.6</td>
<td>31.0</td>
<td>31.4</td>
<td>36.4</td>
<td>33.6</td>
<td>47.5</td>
</tr>
<tr>
<td>Total No.</td>
<td>55</td>
<td>52</td>
<td>68</td>
<td>69</td>
<td>80</td>
<td>74</td>
<td>104</td>
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</tbody>
</table>
and ladder climbing to their repertoire of mastered skills. The thirteen and fourteen year olds added throwing to the previously mentioned skills of walking, stair climbing, striking and ladder climbing. The fifteen year olds combined catching and hopping but not throwing to the list of skills that the majority of students demonstrated as mature levels.

The trend for the females was similar to the males, but on a lower scale. Nine, ten, eleven and twelve year old females mastered walking and stair climbing. The thirteen year olds achieved mature patterns in striking. The fourteen year olds emitted mature performance standards for walking, stair climbing and throwing. The fifteen year olds added hopping, skipping and ladder climbing to the skills attained by the fourteen year olds.

This data demonstrated that mature levels of motor skill performances for both the male and female improved as age increased. The older subjects exhibited developmentally mature motoric patterns more frequently than the younger subjects.

Discussion

The intent of this study was to investigate the basic gross motor skill development of moderately
mentally retarded children and youth. This research was designed to evaluate the qualitative aspects of motoric behaviors of subjects aged nine through fifteen. Three questions were identified and addressed throughout the conduct of this research. These questions were: 1) do the performances of males and females differ on qualitative measures of motor behavior; 2) do performances tend to improve as age increases and 3) at what age does this group of moderately mentally retarded subjects attain mastery levels for basic gross motor skills?

Male — Female Differences

The males in this study tended to outperform the females. This difference between the sexes was true for most of the eleven gross motor skills at the various age divisions. This finding was not unexpected; however, because literature (27, 30, 12, 24) pertaining to motor skills and the retarded consistently reported that males exhibited superior scores. This information from the review of literature was based upon research conducted to measure quantitative measures of performance. It can be concluded from the observable results of this study and the results of previous studies that the retarded female is inferior to the retarded male on quantitative and qualitative measures of motor performance.
It is difficult to determine the causative factors that produced these results. Physical education programming was provided at all of the schools included in the study. The males and females received equal class time in the gymnasium with the physical education instructor. Extracurricular activities within the school systems may somewhat favor the male student. Athletic competition has long been an avenue for refining skills for the moderately retarded students in the school. Schools have only recently begun to sponsor teams for female participants in some of these sports.

Hypothesizing, this investigator feels that the primary reason for the differences between the sexes stems from the attitudes of society. Males, normal and mentally retarded, are encouraged to engage in movement, sport type activities. Equipment and experiences are provided which encourage participation. Normal models for the retarded males engage in everyday neighborhood play activities that include basic gross motor skills—running, jumping, striking, kicking, throwing, catching, etc.. Retarded males may become involved in these activities and receive the necessary experiences to improve their proficiency in gross motor skills. The females, on the other hand, have normal models that do not regularly engage in gross motor/sport type activities.
Younger girls and adolescent females in society today primarily engage in play and activities that are not designed to improve gross motor functioning.

**Individual Age Differences Within Each Sex**

Observable performance differences among ages were revealed throughout the course of this study. This rate of improved development was oftentimes minute or delayed. This finding is in agreement with the quantitative research conducted in previous years. Rarick (30) concluded that the mentally retarded progress through the developmental motor stages more slowly and may never reach performance standards equal to the normal population.

The probable reason for improved scores across ages is due to increased exposure to gross motor experiences and physical education activities. Increases in physical strength of the older children may also have been a contributing factor producing these differences among ages.

**Comparison of Mature, Functional Levels of Performance for Retarded and Normal Children**

Several authors (12, 10, 8, 2) suggest that normal children exhibit mature motor patterns around age seven or eight. Ryan (40) compared normal and
retarded children aged six, seven, and eight on gross motor-skills assessing the qualitative aspects of movement. He found that by the age of six the majority of the normal male and female children had attained mature levels of performance for walking, hopping, ladder climbing, jumping, striking, skipping and stair climbing. Males aged six achieved mastery levels for throwing while the females attained mastery at age seven. Seven year old males were judged as mature catchers with the females achieving mature status for this skill at age eight. The males in the eight year old category were judged to be mature kickers. The only skills that the majority of the normal children did not emit mature performances were running for both sexes and kicking for the females.

Comparing the results of the normal children aged six, seven and eight in Ryan's study to this study involving nine through fifteen year olds reveals that the moderately mentally retarded subjects are markedly inferior in the quality of their motor performances (see Table 4). Neither study identified a high percentage of subjects exhibiting mature running patterns. Hopping was a skill that the majority of the normal children were judged as mature performers by the age of six. The retarded subjects did not exhibit mature performances before age fifteen. Normal children's performances for
TABLE 4
A COMPARISON OF THE AGES WHEN MATURE LEVELS WERE ACHIEVED BY NORMAL AND MENTALLY RETARDED MALES AND FEMALES. (NOTE: THE SAMPLE OF NORMAL CHILDREN INCLUDED ONLY THE AGES OF 6, 7 and 8 WHILE THE RETARDED CHILDREN WERE AGES 6 THROUGH 15.)

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>WALK</th>
<th>RUN</th>
<th>STAIR CLIMB</th>
<th>JUMP</th>
<th>HOP</th>
<th>THROW</th>
<th>CATCH</th>
<th>SKIP</th>
<th>STRIKE</th>
<th>KICK</th>
<th>LADDER CLIMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal C.A.</td>
<td>6</td>
<td>*</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Retarded C.A.</td>
<td>6</td>
<td>*</td>
<td>7</td>
<td>*</td>
<td>15</td>
<td>13</td>
<td>15</td>
<td>*</td>
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<td>0</td>
<td>-</td>
<td>1</td>
<td>9+</td>
<td>9</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>6</td>
<td>7+</td>
<td>6</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Normal C.A.</td>
<td>6</td>
<td>*</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>*</td>
</tr>
<tr>
<td>Retarded C.A.</td>
<td>6</td>
<td>*</td>
<td>9</td>
<td>*</td>
<td>15</td>
<td>14</td>
<td>*</td>
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<td>-</td>
<td>3</td>
<td>9+</td>
<td>9</td>
<td>7</td>
<td>7+</td>
<td>9</td>
<td>7</td>
<td>-</td>
<td>9</td>
</tr>
</tbody>
</table>

* Mature motor patterns were not demonstrated by the majority of any one age group.
the skill of throwing were mature by the age of six for males and seven for females. The retarded males achieved these mature levels at age thirteen while the females attained maturity only at the age of fourteen. The majority of normal children were jumping and skipping with mature patterns by the age of six. The moderately retarded children in this study did not attain mature levels for jumping and only the fifteen year old females met the mastery standards for skipping. Normal seven year old males and eight year old females achieved mature levels for catching. The fifteen year old retarded males were the only subjects in this study to be classified as mature catchers. No age group of the moderately retarded subjects in this study had a majority that exhibited mature kicking patterns. The eight year old normal males attained mature levels for the skill of kicking. Normal children at the age of six mastered the skill of ladder climbing while the twelve year old male retardates were the first in this study to attain mature standards. The retarded females did not exhibit mature ladder climbing skills until age fifteen. Striking skills were mastered by the twelve year old males and thirteen year old females of the retarded group. The normal children on the other hand exhibited mature striking patterns at age six. Based on this percentage oriented data, walking performances were equal for the normal
and retarded subjects. Stair climbing skills were mastered by the retarded children at the age of six and seven by the males and females, respectively, while the normal children exhibited mature performances by the age of six.

This discussion exemplifies the lag in motor development based on qualitative measures of performance. These data reveal that based on group performances, the retarded children and youth have a motor deficit that exceeds nine years for some skills.

This lag could possibly be explained through improper physical education programming. Many instructors of programs do not have a strong background in the qualitative aspects of movement. Consequently, their programs do not reflect instruction based on developmental elements of movement.

Viewing the general motor characteristics of this population, one could generalize that the poorer performances were due to balancing deficits, eye-hand and eye-foot coordination problems, lack of explosive power for purposeful activities and the retardates inability to perform complex activities. It is well documented in the literature that the retardates experience difficulty with balancing tasks, eye-hand activities and complex motor behaviors. These variables and the explosive power element are present in the skills that the subjects in
this study could not master — running (explosive power), jumping (explosive power, complex activity), kicking (explosive power and balance), skipping (complex activity), catching (eye-hand coordination), and hopping (balance, explosive power).

Those activities that were readily mastered (walking, stair climbing, ladder climbing, striking and throwing) involve these variables to a lesser degree or the subjects have been exposed to the activity during their educational training. The importance of prior experience and exposure to an activity cannot be underestimated. Classroom and physical education teachers for years have trained students to use an alternate stepping pattern when ascending and descending a flight of stairs. This type of training reduces the visibility of the retarded in the community which is an integral part of their educational training. Every age group mastered stair climbing probably due to programming and repeated exposure to the situation.

The effects of experience or prior exposure surfaced in this study for the skill of ladder climbing. Most of the subjects were familiar with all the gross motor activities included on the SIGMA except ladder climbing. Many of the subjects approached this task with fear and apprehension. Apparently, the only experiences
they have had with ladder climbing were when the ladder was on the floor in a horizontal position. Often, during the testing session, an individual's performance would improve with each climbing opportunity. The subject was permitted to repeat the skill until a predominant climbing pattern emerged. This highlights the effect of experience and learning or relearning for this population. This pattern of behavior did not frequently occur in the other skills.

Another variable affecting the number of mastered skills which is somewhat related to the complexity of the task can be more fully understood by reviewing the mastered and unmastered skills for this population. The mastered list of skills (stair climbing, walking, throwing and striking) are not complex (striking is an exception) and mature levels of performance are not difficult to identify. An untrained observer could easily determine performances that were mature or immature. The unmastered skills (running, hopping, jumping, catching, kicking and skipping) can all be executed and appear to the inexperienced observer to be mature. There are particular elements within each task however that must be emitted before the performance is judged to be mature. For example, in jumping the arms must move in a precise pattern throughout the jump; kicking requires that the subject leaves the ground with the non-kicking leg during
the follow through; running requires that a period of suspension is observed. These intricate complexities do not exist for the mastered skills.

The emphasis of this discussion is to demonstrate that untrained home and school personnel may be capable of providing appropriate assistance and skill feedback information about the list of mastered skills due to the simplistic nature of the motor patterns. Due to a lack of knowledge about the qualitative aspects of movement, the educator/caretaker may not be able to provide the appropriate programming and feedback information about the performance of the complex skills.

A final observation concerning the performance of the moderately retarded subjects in this study should be stated. Although the thrust of this investigation did not involve quantitative measures, this investigator noted throughout the data collection period the substandard results of their performance. Generalizing, the subjects as a whole lacked power or explosive force which produces better quantitative scores.
CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this research was to investigate the basic gross motor skill performances of moderately retarded children and youth. More specifically, this investigator wished to determine at what age mature motor patterns were performed by the majority of the tested population. Additional information pertaining to age and sex trends was examined by the author.

The review of literature examined for this study revolved around two measurement concepts. The review was divided into 1) studies and publications that assessed motor performances from a quantitative perspective and 2) research based on developmental or qualitative aspects of movement.

There is considerable research that investigates quantitative measures of motor performance of the mentally retarded. Many of the preliminary studies researched the motor abilities of the mentally retarded children on physical fitness parameters, primarily strength, flexibility and endurance. Other studies investigating quantitative aspects of motor performances compared institutionalized versus non-institutionalized subjects;
high I.Q. versus low I.Q. subjects; students receiving no physical education training versus those receiving daily physical education experiences; and brain damaged versus non-brain damaged children on various measures of muscular strength and fitness and test batteries designed to evaluate motor/sport type activities.

The results of these studies using quantitative measures clearly indicated that both moderate and educable retarded children were significantly deficient in motor performances. The moderately retarded were found to be more deficient than the educable mentally retarded children. Studies invariably showed that the educable child was two to four years behind his normal counterparts on motor skills. Literature pertaining to qualitative assessment was not as plentiful. Although limited, these studies revealed a marked inferiority in motor proficiency for the retarded subjects.

One hundred and forty males and 140 females were selected to participate in this investigation. The subjects were enrolled in county based programs for the moderately mentally retarded throughout the state of Ohio. The ages of the subjects spanned nine through fifteen years for both sexes. The resulting design consisted of twenty subjects included in each age division for each sex.
To assess the motor proficiency of these children and youth, a criterion referenced test was utilized which emphasized the qualitative aspects of performance. The O.S.U. SIGMA was the evaluation tool selected. This instrument categorized motor behaviors into one of four developmental levels. Three levels were classified as immature and one as the mature, adult-like motor pattern. Eleven skills -- walking; running; hopping; throwing; catching; jumping; kicking; striking; skipping; ladder climbing; and stair climbing were included in this assessment package.

Standardized instructions and testing procedures were followed throughout the study. The children were individually assessed at their own school in the gymnasium. The collection of data spanned two months during the Spring of the year.

The data generated from this investigation were analyzed both graphically and statistically. It was deemed desirable to demonstrate observable differences as well as statistical significant differences between the performers. The graphed data was presented in percentage terms which indicated the frequency of motor performances that were judged to be in one of the four levels. Chi Square analyses were computed to assist in interpreting these data.
The results emanating from this investigation appeared to be consistent with earlier research findings — namely, that motor performance of retarded children is at sub-standard levels. It was revealed that the retarded males tended to outperform the females on all the motor skills except walking where no measurable differences were observed. Age trends were evident for both sexes. It was found that the younger children did not attain the mature performance standards emitted by the older subjects in the study. Furthermore, it was discovered that for some skills, scores tended to improve gradually as chronological age increased.

Mastered skills were identified for each age group. For the males, this list tended to expand in an orderly developmental pattern. If a skill was mastered by a younger age division, the older age groups would also exhibit mastery for that particular skill and usually others. This pattern was true in all cases except for the skill of throwing for the fifteen year old boys.

The females exhibited a more sporadic pattern. The older females achieved mastery levels for more skills than the younger subjects. These skills, however, did not develop in an orderly fashion — one middle age group
would master a skill, but the following ages would **not** attain mastery for that particular skill but would master another skill.

**Conclusions**

The design and implementation of this research and analysis of the results enabled the investigator to conclude that:

1) The mentally retarded male subjects demonstrated significantly \( P < .05 \) more mature functional (Level IV) motor performances in the skills of running, catching and ladder climbing than the female retarded subjects.

2) The mentally retarded male subjects as a group exhibited more mature movement patterns than the retarded females for all skills except walking where no differences were observed.

3) Based on observable differences analyzed from the data presented by the graphs, the scores of the males equaled or exceeded the performance of the females sixty-six times out of a possible seventy-seven age/sex comparisons.

4) More males attained mature levels for the various mastered skills than the females.
5) Significant differences in performance levels among the ages within each sex were recorded for the skills of hopping (males) and catching (males and females).

6) Observable age trends or differences among the ages were reported for the skills of: stair climbing (males and females); ladder climbing (males); skipping (males and females); striking (males and females); jumping (males); catching (males and females); throwing (males and females); hopping (males and females); and running (males).

7) The list of mastered skills and mastery age levels for the males were: walking (nine through fifteen); striking (twelve, thirteen, fourteen, fifteen); throwing (thirteen and fourteen); stair climbing (nine through fifteen); catching (fifteen); hopping (fifteen) and ladder climbing (twelve, thirteen, fourteen and fifteen). The females achieved mastery for: walking (six through fifteen); stair climbing (six through fifteen); striking (thirteen); throwing (fifteen); hopping (fifteen); skipping (fifteen), and ladder climbing (fifteen).

8) Compared to normal children's (Ryan, 40) qualitative measures of performance, the subjects in this study were alarmingly inferior. Both the retarded males and
females exhibited motor performances that normal children mastered at a much younger age. These deficits ranged from over nine years to no differences (walking and stair climbing) with an average difference of almost six years.

Recommendations

Based on the results of this study, this investigator feels the following recommendations would supplement the information base established by this research:

1) Investigate the motor skills of older mentally retarded individuals to determine when or if the unmastered skills are achieved. Also attempt to determine when a plateau in the performance of these subjects appears.

2) Investigate and compare the motor performances of endogenous and exogenous mentally retarded subjects.

3) Explore if differences exist between Black and Caucasian children.

4) Determine if children from metropolitan areas exhibit different motor behaviors than children from rural areas.

5) Compare the motor patterns of autistic children to trainable and educable retarded children and normal children.
6) Determine if intense physical education programming based on qualitative measures affects motor performance scores as judged by the O.S.U. SIGMA.

7) Investigate the differences in motor performances between retarded children and matched normal subjects representing mental aged equals.
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 INSTRUCTIONS

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."

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 at 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 onto railing if so desired.
APPENDIX B

TEST SCORES AND OTHER DESCRIPTIVE DATA FOR
THE SUBJECTS INVOLVED IN THIS INVESTIGATION
INTERPRETATION CODE

* * * * *

SUBJECTS — Identification Numbers 001 thru 280

Age — Subject's Age Group 09 thru 15

Sex — 1 = Male  2 = Female

Height — Recorded in inches

Weight — Recorded in pounds

SIGMA SKILLS — T1 = Walk
T2 = Run
T3 = Hop
T4 = Throw
T5 = Catch
T6 = Jump
T7 = Kick
T8 = Strike
T9 = Skip
T10 = Ladder Climb
T11 = Stair Climb

M.R. Classification — D = Down's Syndrome  ND = Non Down's

Race — C = Caucasian  B = Black

School — SP = Springfield (Clark Co.)
NK = Newark (Licking Co.)
NE = Northeast (Franklin Co.)
SE = Southeast (Franklin Co.)
HF = Holy Family (Franklin Co.)
FA = First Avenue (Franklin Co.)
NV = Northview (Montgomery Co.)
SV = Southview (Montgomery Co.)
PD = Wm. Patrick Day (Cuyahoga Co.)
WC = Warrensville (Cuyahoga Co.)
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APPENDIX C

PARENT CONSENT FORM
PARENT CONSENT FORM

A study investigating basic motor skills will be conducted in the ________ County Schools for the Mentally Retarded. The physical education skills to be tested are: running, jumping, hopping, skipping, throwing, catching, stair climbing, ladder climbing, striking, kicking, and walking. No stress or physical danger is involved in the evaluation process.

Your permission to evaluate your child's motor skills is requested. If you have any questions, please phone me at home (488-3366), or at Nisonger Center (422-9605), or the physical education instructor at your child's school.

Thank you for your cooperation.

Sincerely,

TOM HEMMERT

______________________ may be involved in the investigation of basic motor skills as described above.

(Parent or Guardian) _______ (Date)
BIBLIOGRAPHY

** Books **


Articles


**Unpublished Materials**


