LAVELY, Robert Henry, 1929-
AN INVESTIGATION COMPARING PRIMARY MENTAL ABILITIES OF TRAINABLE MENTALLY RETARDED CHILDREN, EDUCABLE MENTALLY RETARDED CHILDREN, AND NORMAL CHILDREN WITH COMPARABLE MENTAL AGES.

The Ohio State University, Ph.D., 1971
Education, special

University Microfilms, A XEROX Company, Ann Arbor, Michigan
AN INVESTIGATION COMPARING PRIMARY MENTAL
ABILITIES OF TRAINABLE MENTALLY RETARDED
CHILDREN, EDUCABLE MENTALLY RETARDED
CHILDREN, AND NORMAL CHILDREN WITH
COMPARABLE MENTAL AGES
DISSERTATION

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

By

Robert H. Lavely, B.A., M.S.

The Ohio State University
1971

Approved by

Advisor
College of Education
PLEASE NOTE:

Some Pages have indistinct print. Filmed as received.

UNIVERSITY MICROFILMS
# TABLE OF CONTENTS

| LIST OF TABLES | v |
| LIST OF FIGURES | vii |

**CHAPTER**

**I. INTRODUCTION TO THE STUDY**

- The Concept of Mental Age .......................... 3
- Intelligence Measurements .......................... 4
- Statement of the Problem .......................... 7
- Test of Primary Mental Abilities .................. 9
- Hypotheses ........................................ 11
- Significance of the Problem ....................... 11
- Procedures ....................................... 13
- Definitions of Terms Used for this Study .......... 15

**II. REVIEW OF RELATED LITERATURE**

- Learning Characteristics of the Mentally Retarded ........................................ 16
- Qualitative vs. Quantitative Differences ........ 20
- Primary Mental Abilities .......................... 34
<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>III. PROCEDURES</td>
<td>53</td>
</tr>
<tr>
<td>Experimental Design</td>
<td>53</td>
</tr>
<tr>
<td>Selection of Subjects</td>
<td>55</td>
</tr>
<tr>
<td>Sex</td>
<td>56</td>
</tr>
<tr>
<td>Physical Characteristics</td>
<td>56</td>
</tr>
<tr>
<td>Social Class Status</td>
<td>56</td>
</tr>
<tr>
<td>Description of the Instrument</td>
<td>57</td>
</tr>
<tr>
<td>Rationale for Using the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>58</td>
</tr>
<tr>
<td>Administration of the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>61</td>
</tr>
<tr>
<td>Statistical Treatment of Data: Between Groups</td>
<td>62</td>
</tr>
<tr>
<td>Analysis of Data: Within Groups</td>
<td>64</td>
</tr>
<tr>
<td>IV. RESULTS OF THE STUDY</td>
<td>65</td>
</tr>
<tr>
<td>Description of the Subjects</td>
<td>65</td>
</tr>
<tr>
<td>Group Comparisons</td>
<td>73</td>
</tr>
<tr>
<td>Analysis of Data: Within Groups</td>
<td>80</td>
</tr>
<tr>
<td>Group Sex Differences</td>
<td>89</td>
</tr>
<tr>
<td>Hypotheses</td>
<td>90</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>PAGE</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>V. SUMMARY, DISCUSSION, AND CONCLUSIONS</td>
<td>91</td>
</tr>
<tr>
<td>Summary</td>
<td>91</td>
</tr>
<tr>
<td>Discussion</td>
<td>95</td>
</tr>
<tr>
<td>Conclusions</td>
<td>97</td>
</tr>
<tr>
<td>APPENDIX</td>
<td>99</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>100</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. TMR Boys Scores on the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>67</td>
</tr>
<tr>
<td>2. EMR Boys Scores on the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>68</td>
</tr>
<tr>
<td>3. Normal Boys Scores on the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>69</td>
</tr>
<tr>
<td>4. TMR Girls Scores on the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>70</td>
</tr>
<tr>
<td>5. EMR Girls Scores on the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>71</td>
</tr>
<tr>
<td>6. Normal Girls Scores on the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>72</td>
</tr>
<tr>
<td>7. Means, t scores, and Level of Significance for Comparison Groups of TMR, EMR, and Normal Boys Matched According to Mental Age for Total Score on the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>74</td>
</tr>
</tbody>
</table>
TABLE 8. Means, t scores, and Level of Significance for Comparison Groups of TMR, EMR, and Normal Girls Matched According to Mental Age for Total Score on the SRA Primary Mental Abilities Test for Ages 5 to 7

TABLE 9. Mean Mental Age Performance for the Six Groups by Subtest
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Profile of 15 TMR Boys for Mean Mental Age Performance on Five Subtests of the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>81</td>
</tr>
<tr>
<td>2. Profile of 15 EMR Boys for Mean Mental Age Performance on Five Subtests of the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>82</td>
</tr>
<tr>
<td>3. Profile of 15 Normal Boys for Mean Mental Age Performance on Five Subtests of the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>83</td>
</tr>
<tr>
<td>4. Profile of 15 TMR Girls for Mean Mental Age Performance on Five Subtests of the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>85</td>
</tr>
<tr>
<td>5. Profile of 15 EMR Girls for Mean Mental Age Performance on Five Subtests of the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>86</td>
</tr>
<tr>
<td>6. Profile of 15 Normal Girls for Mean Mental Age Performance on Five Subtests of the SRA Primary Mental Abilities Test for Ages 5 to 7</td>
<td>87</td>
</tr>
</tbody>
</table>
INTRODUCTION TO THE STUDY

An area of responsibility and concern to general educators and educational curriculum makers is designing, organizing, and sequencing instruction at the proper level for individual students. Planning instructional programs cannot be undertaken on a piecemeal or a spasmodic basis with only short-term and halfway goals.

Perhaps the greatest single need in American education is to achieve both the breadth and the depth in the curriculum essential to our American purposes or individual fulfillment in a democratic society. Breadth of curriculum opportunities must be provided if each individual learner is to find success for himself in the curriculum. Depth is equally significant if each individual is to develop his own potential as far as the schools can help him.

"In early psychology the main emphasis of study and research was on the learning process; however, in more recent years, that emphasis has shifted to the learner as an individual."  

"Not only how something is learned but also what is being learned should receive careful consideration. In all areas of the curriculum, the pupil should deal with content that has meaning in his life."  

---


"It is becoming increasingly obvious to educators that many traditional methods of education are inadequate to cope with present quantitative and qualitative requirements for instruction, and nowhere in the public-education system is there a stronger need for greater efficiency and quality of instruction than in programs for the mentally retarded."4

Teachers of the retarded must be alert to many factors specific to their students unique learning ability, adjustment problems, ability to understand academic instruction and strengths and weaknesses in planning individual educational programs of their students.

"The most critical phase of the entire planning process consists of the teacher's own efforts to develop plans for the pupil he teaches."5

Johnson6 states that:

"Most educable retarded children are normal or within the normal range in most areas of their development. Their primary deviation is in the area of intellectual growth where development is significantly retarded. Aside from this single deviation and the impact it may have in terms of growth and development where intelligence plays a significant role, educable retarded children appear, react, and grow in essentially the same ways and at approximately the same rate as their normal associates.

---


According to Davies:^7

No sharp dividing line can be drawn between the subnormal and the normal because none exists. The mildly retarded and the dull normal do not represent wholly different groups of human beings, but rather a continuous series differing in degree but not in kind, and shading almost indistinguishably into one another.

In discussing instructional programs for the mentally retarded, Davies feels that "the most effective programs seek by training and supervision to keep retarded persons from falling into social inadequacy."^8

As indicated by the preceding writers, providing a proper program for mentally retarded children is a difficult task. Those responsible for planning a program need to know more about a child's mental ability than a "one" number "IQ" score.

Before embarking on an educational program for retarded children, it is necessary, as in other aspects of education, to investigate their levels of attainment and capabilities and to become clear about the precise nature of the skills we want to teach.

THE CONCEPT OF MENTAL AGE

This concept, which was apparently first introduced as a part of the scoring procedure on the 1908 Binet-Simon test, makes it possible to define levels of mental development for every child. This concept has

---


8Ibid., p. 8.
been retained through subsequent revisions of the original test; e.g., the 1916 Stanford-Binet and the 1937 and 1960 revisions of the Stanford-Binet used the mental age in the scoring. This permits the classification of a child as to the level of mental tasks at which his teacher can reasonably expect him to succeed. By definition this is the child's level of mental development. As the 1960 Stanford-Binet is constructed, it is possible for children to obtain the same mental age score by answering different Stanford-Binet test items correctly. Thus, equal mental ages may not mean that the educable mentally retarded child and/or the trainable mentally retarded child have the same skills to the same degree as the normal child who earns the same mental age.

INTELLIGENCE MEASUREMENTS

Binet defined intelligence as (1) the ability to take and maintain a definite direction, (2) adaptability to new situations and (3) the power to evaluate and criticize one's own acts. 9

The 1908 Binet-Simon Test and its revisions by Terman and his associates provided an impetus to psychologists to study intelligence from different points of view. Investigators have provided evidence and theories in great numbers. Many psychologists agreeing with Binet, have stressed that problem-solving behavior is dependent upon something called Intelligence.

Thorndike has suggested that we recognize at least three broad areas of intelligent behavior. These "intelligences" he calls abstract, mechanical and social. He defined abstract intelligence as the "ability to understand and manage ideas and symbols". Mechanical intelligence includes "the ability to learn, to understand and manage things and mechanisms". Social intelligence is "the ability to understand and manage men and women, boys and girls, and to act wisely in human relations."

Spearman also questioned Binet's definition of intelligence. He conceded a general factor called intelligence existed but he also believed that there were specific kinds of intelligence possessed by some people.

Thurstone, by using the statistical tool of factor and analysis, identified five major intellectual factors. These five, which made up intelligence, he called space, word fluency, memory, number and reason.

Guilford has constructed a model of the structure of intellect. He suggests that intelligence is made up of five intellectual operations. These five have been identified as memory, cognition, divergent thinking, convergent thinking and evaluative thinking. These five intellectual

\[^{10}\text{ibid., p. 48.}\]
\[^{12}\text{L. L. Thurstone, Primary Mental Abilities, Chicago: University of Chicago Press, 1938).}\]
operations use what Guilford calls contents, (figures, semantics, symbols, or behavior) to produce units, classes, systems, relations, transformations and implications.

Guilford's model of operations, contents and products is three-dimensional. It has five operations using four different contents to produce six different kinds of products. Altogether, this model has 120 possible cells of intelligence.13

As a result of multiple factor analysis studies, it has been found that intelligence is not a unitary trait, but is composed of several abilities that can be described and measured. The term primary mental abilities refers to several factors that comprise "intelligence". Separate measurement of these factors would appear to provide a teacher with a more meaningful analysis of a child's intelligence and consequently, better educational planning.

Those working with trainable mentally retarded and educable mentally retarded have need of an instrument that will determine with some degree of accuracy and reliability, strengths and weaknesses and the level and rate of academic achievement that should be expected of each child. A description of mentally retarded children in terms of differential abilities, if they exist, is of considerable importance to those who are interested in the social and academic development of these children. Educators and clinicians are concerned with many facets of retardation.

Are the retarded uniformly low in all areas of ability or do they have distinctive patterns of very low or very high abilities? Are there differentials which have significance for educational practice and clinical prognosis? With this kind of information, teachers can plan an educational program for each child based upon individual abilities and needs.

According to the Thurstones¹⁴ "mental ability is confused with scholastic ability. A child may do poorly in school because he lacks verbal comprehension and word fluency. Learning in our schools depends largely on these two abilities. A child may possess mental abilities that schools do not utilize nor present opportunities to show in classwork".

STATEMENT OF THE PROBLEM

This study was designed to investigate the possibility of the existence of a qualitative difference between the organization of intelligence of trainable mentally retarded children, of educable mentally retarded children, and of normal children. Such a difference is suggested by the results of some of the learning studies in which normal children and mentally retarded children have been matched on mental age. Studies have been done comparing normals with retardates

on tasks requiring verbal learning, transfer, sensory-motor learning, associate learning and discovery and application of a principle. Researchers utilizing different methods have reported their results.

This study, with the use of SRA's Test of Primary Mental Abilities, concerns itself with a measurement of specific abilities in trainable mentally retarded children, educable mentally retarded children and normal children of the same mental age. Comparisons of the interrelations between the five abilities as described by Thurstone have been made. This examination and comparison was done by using equivalent mental ages in all three groups.

The Thurstones promoted the theory that intelligence was not merely an intelligence quotient nor a mental age. They write:

As a result of multiple-factor analysis studies of intelligence, we now know that intelligence is not a unitary trait, but is composed of several abilities that can be described and measured. The term "Primary Mental Abilities (PMA) refers to the several factors that comprise intelligence, and separate measurements of these factors generally provide the teacher with a more meaningful analysis of the child's intelligence."¹⁵

For various age levels, the Thurstones used batteries measuring different collections of factors. Three batteries for general educational and clinical use are available to test the primary mental abilities for ages 5-7 years, 7-11 years, and 11 to 17 years. This investigation used only the battery for those 5 to 7 years old.

¹⁵ibid., p. 3.
TEST OF PRIMARY MENTAL ABILITIES

The SRA Test of Primary Mental Abilities has been developed as a result of the extensive research on the nature of intelligence by the Thurstones.

According to the Thurstones:  

At the 5 to 7 year level, the statistical technique of multiple-factor analysis has revealed five abilities inherent in the traditional concept of "intelligence". Tests have been constructed by the authors to measure each of these abilities. The five tests are described below.

VERBAL-MEANING - the ability to understand ideas expressed in words. The communicative arts or skills involved in intelligent listening and reading depend on this ability.

PERCEPTION (Perceptual-speed) - the ability to recognize likenesses and differences between objects or symbols, quickly and accurately.

QUANTITATIVE - The ability to understand the meaning of numbers and to recognize quantitative differences.

MOTOR - the ability to coordinate hand and eye movements

SPACE - the ability to visualize and to think about objects in two or three dimensions.

According to the manual, "the examiner gives instructions and the subject does not have to know how to read. The examinee is required to give only simple manipulative responses. The scorer can obtain mental age scores for each subtest and/or a total mental age score."

16 Ibid., pp. 3-4

17 Ibid., p. 20.
Several studies\(^{18} \)\(^{19} \) have shown a close relationship between IQ's obtained on the PMA batteries and other standard intelligence tests.

The work of Thurstone\(^{20} \) in identifying and measuring Primary Mental Abilities suggests that comparisons of retarded and normal children can more successfully be accomplished in terms of differential mental abilities than by an intelligence test.

Guilford\(^{21} \) organized the dimensions of aptitude into the three major areas of (1) perceptual, (2) psychomotor and (3) intellectual.

These and other factor-oriented studies were based on the pioneer research of Kelley\(^{22} \) who, in 1928 first isolated factors of ability in young children.


\(^{19}\) J. Devlin, "The SRA Primary Mental Abilities for Ages 5-7 as a measure of intelligence, reading readiness and arithmetic readiness," (Mimeographed memorandum, Science Research Associates, Chicago, 1951).


\(^{22}\) Truman Kelley, Crossroads in the Mind of Man, (Palo Alto, California: Stanford University Press, 1928).
HYPOTHESES

It is hypothesized that:

1. The interrelations of primary mental abilities of trainable mentally retarded children will not be significantly different from the patterns of normal children of the same mental age.

2. The interrelationships of primary mental abilities of educable mentally retarded children will not be significantly different from the patterns of normal children of the same mental age.

3. The interrelations of primary mental abilities of trainable mentally retarded children will not be significantly different from the patterns of educable mentally retarded children of the same mental age.

SIGNIFICANCE OF THE PROBLEM

The tremendous growth in the last 20 years in programs for the educable mentally retarded and the trainable mentally retarded in our schools has brought with it the need for a better understanding of the retarded in terms of his abilities.

Many investigators have attempted to discover whether there are systematic qualitative differences between groups of children of equal mental ages but with varying chronological ages. In many instances groups of normal children and groups of retarded children have been matched for comparison on the basis of mental age scores obtained from the administration of the Stanford-Binet Scale. The Researchers then
Identified the items on the Stanford-Binet which discriminated between the groups of older retarded children and the groups of younger normal children. Item analysis data is then used as evidence of differences in the mental characteristics of the groups.

Sarason\textsuperscript{23} states more experimental research needs to be done comparing mentally retarded children and normal children. Many of the interpretations of the test results have not given satisfactory answers.

Although many learning studies have been conducted comparing the retarded with the normal, none have presented a "factorial" description comparing the abilities of trainable, educable, and normal children.

According to the Thurstones:\textsuperscript{24}

The PMA 5-7 yields separate measures of five factors of intelligence. It is possible to draw a profile of the child's mental abilities. This profile gives a clear picture of the child's intellectual strengths and weaknesses, and is highly valuable when interpreting the child's test scores to teachers and parents.

It seems that the Test of Primary Mental Abilities could serve as a valuable research tool. It provides a profile of mental age scores for five mental abilities which appear to be relatively independent of one another. A study of the Primary Mental Abilities Test suggests an investigation of mental abilities would not be subject to many of the limitations imposed by other intelligence tests.


This paper sees instructional implications in the study's conclusions. Thurstone concludes one article with the following statement:

One of the most fundamental educational problems is to determine to what extent these primary abilities are native and to what extent they can be trained. If it should be found that some abilities can be trained, school curricula might be fundamentally altered. It will be of great social interest to ascertain which abilities are determined by inheritance.

PROCEDURES

Ninety subjects were selected from three different types of educational placements in Franklin County, Ohio. Thirty subjects were in each group. The first group consisted of trainable mentally retarded children in community classes. The second group of children consisted of educable mentally retarded children in Public School classes for the educable mentally retarded. The third group were normal children in regular public school classes of approximately the same mental age as the trainable mentally retarded in group I and the educable mentally retarded in group II. Each group had fifteen boys and fifteen girls. The SRA Primary Mental Abilities Test for ages five to seven was administered to all ninety subjects, in small groups. All ninety subjects were free of gross physical and motor impairments that would interfere with their ability to take the test. This was done by obser-

ving subjects, talking with teachers and building principals and by examining medical records. The same examiner administered and scored all ninety subjects and followed the procedures recommended in the Examiner's Manual.

"IT has long been recognized that children's IQs tend to vary with the socio-economic status of their families. Numerous investigators have found that children's scores on conventional intelligence tests are substantially correlated with such socioeconomic factors as the father's occupation, the parents' education, and family income."^26

Research literature has shown that "cultural familial retardation is a phenomenon of the lower end of the social class continuum."^27

This investigator has controlled the variable of social class in this study by using part of the Warner, Meaker, and Eells Test Index of Status Measurement. Parts that were used are father's occupation and source of family income. The investigator has also included father's education.

The Index of Status Characteristics is designed to provide an objective method for establishing the social level of everyone in the community and to do so by simple inexpensive means. The data for each characteristic are easily acquired and do not necessarily require interviewing.

A comprehensive discussion of procedures is presented in Chapter III.


DEFINITIONS OF TERMS USED FOR THIS STUDY

**Trainable Mentally Retarded.** The trainable mentally retarded child is one who is diagnosed as having low intelligence. A school psychologist administered the Stanford-Binet Intelligence Test and each child had an IQ between 25 and 49. Prior to this examiner's evaluation, a school psychologist determined that each child had a Mental age between 5 and 7 years of age. Each child was attending a community class for the trainable mentally retarded.

**Educable Mentally Retarded.** The educable mentally retarded child is one who is diagnosed as having low intelligence. A school psychologist used the Stanford-Binet Intelligence Test and each had an IQ between 50 and 75. Prior to this examiner's evaluation, a school psychologist determined that each child had a mental age between 5 and 7 years of age. Each child was enrolled in a class for the educable mentally retarded.

**Normal.** The normal child for the purpose of this study is one who is in a regular class. His teacher identified him as an "average" child. Each normal child had a chronological age between 5 and 7 years and obtained an IQ in the normal range on a group test of intelligence.

**Mental Age.** This refers to the present level of intelligence and corresponds to the performance of the average for a given chronological age.
CHAPTER II

REVIEW OF RELATED LITERATURE AND RESEARCH

Learning Characteristics of the Mentally Retarded

In the past, various authorities in the field of special education discussed the mentally retarded in terms of gross retardation with reference to qualitative psychological differences. The following quotations from Baker\(^1\) reflect these philosophical viewpoints: "They show a tendency to stereotype answers by repeating the same response to different questions; they lack powers of self-criticism; their powers of association are limited; they are unable to keep unusual instruction in mind; they fail to detect errors and absurdities in statements and in commonplace situations; they tend to have concrete abilities rather than abstract; they have limited powers of reasoning and similar mental traits."

Studies of the learning characteristics of the retarded according to Magnifico\(^2\) can be summarized as follows:

1. Greater comprehension of the concrete than the abstract.
2. Reasoning power is limited.
3. Short attention span.

---


4. Limited power of association.
5. Lack of powers of self-criticism.
6. Limited judgment and
7. Lack of foresight

Kirk defines retarded mental development as "a slowness in maturation of specific intellectual functions which may include memory for visual and auditory materials, generalizing ability, language ability, conceptual and perceptual abilities, imagination and creative abilities and other functions considered basically intellectual."

According to Erdman, the learning characteristics of the retarded that influence the selection of curriculum content are:

1. They have more success learning concrete concepts and skills.
2. They have difficulty in transferring.
3. They do not learn incidentally as effectively as do children of higher intelligence.

Goldstein and Seigle identify the learning disabilities of the retarded as "a tendency to over simplify ideas and concepts, reduced ability in generalization, short memory and attention span and limitations in incidental learning."

---

Dunn states: "the retarded have been considered extremely inept in the transfer of learning."

Norris, Hayslip, and Noonan take the stand "that there are intellectual characteristics which differentiate the gifted from the dull and among them are ability to take initiative, power to generalize, ability to make logical associations, a longer span of attention, greater originality and deeper and more varied interests."

The preceding authorities all basically agree, and other writers and many studies support, the commonly held beliefs that the retarded neither learn as quickly nor achieve as much academically as children of normal intellect. They forget more rapidly. In fact, a "leaky bucket" theory of rapid forgetting of the mentally retarded has been used.

Recent investigators have caused us to question the above philosophical viewpoints and to seriously doubt these generalizations concerning the mentally retarded. Among the investigators is Johnson who feels there is enough evidence to support the fact that basic learning characteristics of the mentally retarded are in all probability the same as for normal children of approximately the same mental age and that qualitative differences between retarded and normal children have


resulted in very little data to support the thesis that the differences exist. Johnson⁸ in one of his writings states:

The concept that mentally retarded children require more time to learn a task they are capable of learning than do normal children has not been verified by most of the reported research. The same is true for the often expressed necessity for the inclusion of more repetition or practice in their learning experiences.

Most of the evidence, instead, indicates that the retarded learn in the same way as normal children. The laws of learning that hold true for the normal also hold true for the retarded. They are not "slow learners" in the sense that they comprehend slowly or grasp new concepts slowly or learn a skill slowly. That is one of the prime determiners of when they will be able to comprehend, grasp a concept or learn a skill. The difference between retarded and normal children is not one of learning but rather one of development.¹¹

Other investigators include Wallin & Reppert.⁹ They say:

Many observations or experimental studies have been made on the differences in mental traits between normal and mentally deficient children. The main question at issue has been whether the differences between the defectives and the normals are qualitative or quantitative in nature. . . .It is not true, for example, that there is a qualitative memory difference. . . .If the sense defectives do not possess any logical memory at all. While they do not possess as much logical memory as normal children do, they do possess some and what logical memory they do have is akin to the logical memory possessed by normal children of the same intelligence level. The difference is one of degree rather than of kind or quality. This statement probably applies to any other mental trait."

---


QUALITATIVE VS QUANTITATIVE DIFFERENCES

Hollingsworth\textsuperscript{10} in 1920 held that a child, regardless of his chronological age, with a mental age of seven would be able to compete successfully on tasks which any other child with a mental age of seven would be able to do. She suggests that mental age assumes the properties of some sort of absolute measure of mental capability.

Because of the heterogeneity of the research, the writer has selected only those studies which have matched the retarded with normals on the basis of mental age. A helpful suggestion which minimizes the problems of identifying learning deficits in samples of retarded children is offered by Denny\textsuperscript{11}. It is possible to observe a low-IQ deficit in the mentally retarded, when subjects of similar mental ages are compared.

Many of the early investigators, used the 1916 Stanford-Binet Scale. A group of younger normal children would be equated to a group of older retarded children having similar mental ages. These early researchers compared performance by identifying the items of the Stanford-Binet which discriminated between the two groups. The item analysis data obtained were presented as evidence of differences in mental abilities of the older retarded children and younger children.


Merrill\textsuperscript{12} using this procedure conducted one of the first investigations of differential responses of bright and dull children. She concluded that the retarded do better on items which are acquired in the course of experience. The items the bright children did better on were those functions which generally have shown the highest correlation with IQ. She states that "maturity and experience are factors in the successes of the retarded group as immaturity and lack of experience are factors in the failures of the superior group."\textsuperscript{13}

McFadden\textsuperscript{14} found that children with similar mental ages were more alike in ability than were children of similar chronological ages. He also found the retarded to have a larger vocabulary than the normal of similar mental age.

Wallen\textsuperscript{15} in comparing the different test responses of bright and dull children found at the year VIII level of the 1916 Stanford-Binet Scale the dull group did better than the normal group on vocabulary and counting backwards. At the IX year level, the retarded did better in making change.

\textsuperscript{12}Maud A. Merrill, "On the Relation of Intelligence to Achievement in Cases of Mentally Retarded Children", \textit{Comparative Psychology Monographs}, Vol. 2 (September, 1924).

\textsuperscript{13}Ibid., p. 47


An investigation by Doll\textsuperscript{16} using the Stanford-Binet Scale showed that the retarded surpassed the normals in items involving vocabulary and definitions.

Laycock and Clark\textsuperscript{17} in their study found that bright children surpassed the retarded in Paper Cutting, Repeating Digits, Memory for Design, and Memory for Stories. The retarded did better on the Stanford-Binet items which were reproductive. They proposed that the retarded did better in "reproductive" tasks which depends more on training and experience and that the bright do better in "educutive" tasks which depend upon reasoning ability.

Rautman's\textsuperscript{18} study compared mentally retarded in institutions and normal subjects. He found normals superior in the Stanford-Binet subtest of Identifying Parts of the Body, Memory for Designs, Repeating Digits and Picture Absurdities, while the retarded were better than the normals in vocabulary and definitions. His conclusions were that increased life age and experience appear to have a differential influence upon certain test items.


\textsuperscript{17}Samuel R. Laycock and Stanley Clark, "The Comparative Performance of a Group of Old-Dull and Young-Bright Children on Some Items of the Revised Stanford-Binet Scale of Intelligence, Form L," The Journal of Educational Psychology, Vol. 33, (January, 1942), pp. 1-12.

Thompson and Margaret in a very extensive study, also used the Stanford-Binet to compare children with similar mental ages and different chronological ages. After reviewing the literature, they stated:

An assumption is implicit in much of the work of clinicians, who diagnose mental deficiency, that the behavior of mentally deficient subjects is different qualitatively from that of normal subjects of like mental age. The defective is generally considered to be superior in items depending upon rote memory, for example, or in items such as vocabulary or absurdities which might depend upon experience and therefore upon chronological age.

The Thompson and Margaret study repeated and extended the investigation of Laycock and Clark. They had more than thirteen hundred normal subjects and more than four hundred retarded subjects. The two groups were arranged so that retarded children could be compared to normal children at any given age.

From their replication of the Laycock and Clark study, Thompson and Margaret found fifteen items on which their results agreed with those of Laycock and Clark. On these fifteen items both studies showed a superiority of the normals over the dull on items having to do with rote memory.

Another purpose of the Thompson and Margaret study was to investigate the veracity of the theory advocated by earlier writers to account for differences between normal and retarded, this theory being the

---


20 Ibid., p. 285.
importance of past experience. They called attention to the fact that effective experience is assumed to be greater for retarded children by virtue of their having lived for a great number of years. They pointed out in this reasoning, the higher IQs of the younger, bright children are practically overlooked. To test the hypothesis that the dull are superior to the normal on items which are dependent on successful responses related to "effective experience," Thompson and Margaret had two experts, each working independently, rate the items on the Stanford-Binet Scale for degree of dependence on past experience. The mean rating for the items which were easier for the dull group was compared with the mean rating for the items which were more difficult for them. No significant difference was found. Thus, the investigators stated that the theory of effective experience does not explain differences between the performance of the dull and normal groups.

In a follow-up study, Margaret and Thompson compared the differential test responses, of a superior group and a normal group with equal mental ages and then compared the responses of the superior group with their original dull group.\(^{21}\) In this study, they found that the retarded had more difficulty on rote memory items than do either normal or superior subjects. They stated, "Apparently, superior rote memory

is considered a special ability of the mentally deficient. On the contrary, the deficient actually find such items more difficult than do either normal or superior subjects of equal mental age.\textsuperscript{22}

They also found that some seventy percent of the items which were easier for the mentally deficient than for the superior required manual manipulation. They concluded, "It seems likely that the greater success of mentally defectives with manual items may be more closely related to a difference in chronological age than to the differing intellectual levels of the subjects used.\textsuperscript{23}

In conclusion these studies using the Stanford-Binet did not reveal any clear cut results, however, some evidence can be found to differentiate between retarded and normal subjects. The mentally retarded do better on tasks such as Vocabulary, Comprehension and Making Change. Several investigators indicated the retarded do better in situations where chronological age helped test performance. The young normal children usually showed superior ability in Definitions, Construction of Sentences, Repeating five digits and four digits and Rhymes. These the investigators labeled as visual perception and memory.

\textsuperscript{22}Ibid., p. 167.

\textsuperscript{23}Ibid., p. 167.
Most of the preceding writers may be criticized for their procedure. First, they matched their groups on mental ages scores obtained from the Stanford-Binet. Then, they used item analysis of the same test as proof of differences in the mental characteristics of normal and retarded subjects. As a result of their procedures, the criteria measures were not independent of those used for selecting and matching the two groups. When the selection and criteria measures are not independent of one another then any differences should be evaluated by a technique in which the sources of differences are independent of the measures used for selection and matching.

The use of the Stanford-Binet Scale as a tool for comparing the retarded with normal children is questioned by Sarason. He suggests that the retarded do poorly in face to face interviews because of the similarity to "school-like" situation.

According to Sarason, eight of the twenty Binet items on which normals surpassed the mentally retarded involved memory. Sarason suggests that Binet items may not be good indicators to use in comparing the mentally retarded and the normal, as studies have shown memory to be adversely affected by fear and anxiety.

Numerous investigators have used standardized tests, other than the Stanford-Binet Scale, and/or tests devised for a particular

---

situation to compare normal and retarded children of similar mental age.

Unsicker used the Kuhlman-Anderson Intelligence Test and the California Test of Mental Maturity in his investigation. First, scores on the Kuhlman-Anderson Test were used to match 30 bright 3rd and 4th grade children with 30 dull seventh and eighth grade pupils for comparable mental age. Next, he compared the two groups on mental age and subtest performance on the California Tests of Mental Maturity. He found that instead of being matched for mental age, the bright group exceeded the dull by almost 17 months mental age as measured by the California test.

He concluded, "The reasons for these marked discrepancies are not known but are probably caused by the differences in traits sampled by the two tests and by differences in standardization procedures."26

Unsicker next matched dull and bright pupils for mental age based on the California Test of Mental Maturity. He reported, based upon observed differences in performance on the subtests, that:

2. Bright children exceed dull in the reasoning factor. . .
3. Dull children exceed bright children in special relations. . .
4. The mental factor, numerical reasoning, favors the older dull children. . . 27

26 Ibid., p. 73.
27 Ibid., p. 74.
House and Zeeman\textsuperscript{28} conducted a study on discrimination learning in normal and mentally retarded children. They compared thirty normal nursery school children with thirty retarded children. The two groups had similar mental ages. They reported that normal children at mental age four learned to discriminate significantly faster than mentally retarded children at the same mental age.

Martin and Blum\textsuperscript{29} compared the abilities of normal and retarded children to comprehend an oddity learning task. The groups were matched for similar mental age. They reported that normal and retarded children did not differ significantly either in doing the eight oddity learning problems nor in the way in which they attacked the problems.

Plenderleith\textsuperscript{30} matched a retarded group with a normal group on the basis of comparable mental age. He hypothesized that retardates, as compared to normals, will perform significantly lower on a discrimination reversal task. He found that both groups learned the discrimination problem equally well. After an intermission of six weeks, when pre-

\begin{flushright}

\textsuperscript{29}William E. Martin and Abraham Blum, "Interest Generalization and Learning in Mentally Normal and Subnormal Children", \textit{Journal of Comparative and Physiological Psychology}, LIV, (1961), 28-32.

\end{flushright}
resented with the problem again, the retarded took longer to reach the criterion than did the normal group. Both groups, however, showed considerable positive transfer from an original to the reversal learning task.

Griffith and Spitz\textsuperscript{31} in order to study the relationship between verbal abstraction and the ways in which nouns are defined, used a retarded group and a normal group equated on mental age. The normal group performed significantly better than the retarded group. The normals were able to use verbal mediators in order to extract the common property from a triad of nouns. They concluded that the retarded did not have the necessary verbal mediators at their command.

O'Connor and Hermelin\textsuperscript{32} matched normal and retarded children on mental age to investigate discrimination ability. They reported that on original learning the normals were superior to the retarded but not significantly so. On reversal learning, the retarded learned significantly faster than did the normal children.

Stevenson and Iscoe\textsuperscript{33} used institutionalized retardates in a study of characteristics in "preverbal" subjects. They used the discrimi-
ination between squares of two sizes. They found that the retarded sub-
jects learned to make size discrimination in a mean of 41.9 trials. A
previously tested normal group of similar mental age required a mean of
28.6 trials on the same task.

Woodrow compared abilities of normal and retarded children of the
same mental age. His task was one of speed in sorting and was a discrim-
ination learning problem. He concluded that there were no significant
differences between the transfer and the performance of the two groups.

Kirk surveyed reading patterns and progress of 10 retarded
children in institutions. He reported good reading achievement for these
retardates. Average mental age slightly over ten years of age and the
reading level was an average of grade level 4.3.

MacIntyre also stated that mentally retarded children can per-
form at a level at least equal to their mental age.

---

34 H. Woodrow, "Practice and Transference in Normal and Feeble-


DeSanctis matched 12 retarded children and two normal groups. One normal group had approximately the same mental age and the other normal group approximately the same chronological age as the retarded. The study was based upon a maze problem. The results were the retarded behaved more like the older normals in demonstrating visual apprehension (a sizing up of the maze before starting the trail). This was characteristic of the older but not the younger normals. There was little, if any, evidence of the retarded being slower than either of the normal groups.

Johnson matched two groups of 36 normal and 36 retarded children on the basis of mental age. Both groups were then divided into subgroups of 18 children. The four groups can be identified as 1. control normals, 2. experimental normals, 3. control retardates and 4. experimental retardates. The purpose of his study was to compare the abilities of the four groups to transfer an applicable principle learned on one task to a second unique task. All the subjects were trained to disassemble and reassemble an assembly task. The two control groups received additional practice, while, the two experimental groups were given instruction in a principle which would facilitate assembly and then given practice. A unique assembly task was then administered to all 36 children to test the transfer of a principle.


38G. Orville Johnson, Comparative Studies of Some Learning Characteristics in Mentally Retarded and Normal Children of the Same Mental Age, (Syracuse: Syracuse University Press, 1958), pp. 75-98.
Johnson found that the performance of both retarded and normal experimental groups was superior to that of the control groups on the new task. Also, that the mentally retarded experimental group showed a significantly greater degree of transfer than the normal group.

Dunn in a study on reading compared normal and retarded children with similar mental ages. He found that the retarded did not do as well in silent or oral reading. Also, that the mentally retarded had more reading errors such as faulty vowels, sound omission and words added and refused.

Cruickshank compared normal and retarded children in a study based upon mental age. He wanted to find out if there were differences in ability to solve arithmetic problems and understanding various arithmetical processes. He found the retarded had greater difficulty in actually solving problems; in naming the arithmetic process involved; less able to use pertinent facts; and less able to solve the problem when necessary facts were printed in verbal form.

A study by Johnson and Blake was one of the few found by this writer which used public school retardates as well as institutionalized retardates.

---


retardates as subjects. They conducted a number of separate but related investigations to compare normal subjects and retardates, who were similar in terms of mental age, as they performed in situations designed to involve direct learning, retention of learning and transfer of learning. Their results are shown below:

On the serial learning of a six-item list of easily pronounced nonsense syllables, there was no significant differences. When the task involved direct sensorimotor learning, the retardates performed better than intellectually normal subjects of similar mental ages. When matched on a paired associate nonsense syllable task, normal subjects tended to perform significantly better than the retarded subjects. However, the public school retardates learned a letter-digit substitution task better than the normals. On reasoning tasks, there was no significant differences between the two groups of subjects.

It is very difficult to make general statements comparing the learning ability of mentally retarded and the intellectually normal. Many investigations have not been adequately designed. Common mistakes have been in delineating the mentally retarded group, mixing etiology, using institutionalized retardates, number in the sample population, and conditions under which the performance is evaluated.

Children not only learn at a different rate with each other, but within themselves tend to exhibit different capabilities at different tasks. Every individual is associated with his own unique internal and external milieu. An individual's performance is based, to a certain extent, on his environment, the way he has been reared, his own values
and his perception of what is important to the groups with whom he identifies. The level of intrinsic and extrinsic motivation concerning the need to achieve is an area in which wide differences exist between individuals.

With the mentally retarded large differences often exist between a person's predicted individual level of ability and his level of performance. When a child's mental age is used as a general indicator of his expected performance level in school and he is evaluated on achievement tests, all too often it is found that the child is not only retarded but he is underachieving.

Johnson and Blake comment:

... no prior expectations about intellectual performance should be based upon mental age alone. Instead, it is necessary to weigh both intellectual level and chronological age in relationship to mental age, the task and the aspect of performance under consideration. When compared with their intellectually normal counterparts, intellectually retarded individuals can be expected to perform more adequately, or with equivalent adequacy depending upon the type of response required by the situation in question.

PRIMARY MENTAL ABILITIES

Kelley's study, published in 1928, started the movement of testing for differential abilities by Thurstone and others. His pioneer study used seven tests with one hundred and seven children. These children had a chronological age span of from three and one-half years old to

\[^{42}\text{Ibid.}, \text{ pp. 153-154.}\]

\[^{43}\text{Truman Kelley, Crossroads in the Mind of Man, (Palo Alto, California, Stanford University Press, 1928).}\]
over six years old. With the seven tests, Kelley identified six factors. These factors he named (1) general maturity and heterogeneity, (2) verbal, (3) control of meaningless content, (4) memory, (5) sensing and retention of geometric forms (Spatial, No. I), and (6) manipulation of spatial relationships (Spatial, No. II).

Thurstones' Test of Primary Mental Abilities, published in 1953, advanced the theory that intelligence was not merely an intelligence quotient nor a mental age. They write:

As a result of multiple-factor analysis studies intelligence is not a unitary trait, but is composed of several abilities that can be described and measured. The term "Primary Mental Abilities (PMA) refers to separate factors that comprise intelligence, and separate measurements of these factors generally provide the teacher with a more meaningful analysis of the child's intelligence."

The Thurstones have defined a primary mental ability as a "... functional unit that is strongly present in some tests and almost completely absent in many others." Primary mental abilities are extracted from specific combinations of intellectual operations. Each combination or group of mental operations has its own specific primary, or unifying factor. Each primary factor is independent of all other factors.

---


The Thurstones developed batteries measuring different collections of factors for various chronological ages. The battery for this study covers the five factors of verbal meaning, Perceptual Speed, Quantitative Ability, Motor Ability, and the ability to visualize and to think about objects in two or three dimensions. This last ability is called Space by the Thurstones.

When tests based upon primary mental abilities are grouped into batteries, they often tend to show patterns of interrelationships with each other. Whenever statistical methods of factoral analysis have been applied to these batteries, general factors have invariably appeared. Their consistent presence tends to support to Spearman's two-factor theory. His theory advocates the existence of one General and an unspecified number of Specific factors of intelligence. The General factor is described as common to all mental activity, while the Specific factors are independent of the general factor and of each other.

The serious limitation of the IQ as an estimate of mental endowment is that two individuals may have the same IQ and yet be totally different in the mental abilities that they possess. The fundamental problem in appraising the mental endowment of children and adults is to isolate and to describe the distinct mental abilities which constitute mental endowment.

The multiple-factor methods have been developed as scientific methods especially for the solution of this problem. In the experimental and analytical work with the factorial methods a number of the basic or primary mental abilities have been isolated. The tendency now is to describe an individual's intelligence in terms of a profile that shows his rating in each of the distinct mental abilities. The mental profile is much more useful than any single index in describing the abilities of each person.\textsuperscript{47}

One of the earliest studies using the Primary Mental Abilities Test was by Shanner\textsuperscript{48}. He studied the reliability and intercorrelation of primary ability scores and their correlation with other measures. His investigation was on data obtained from a private school for boys. His conclusions were very favorable toward the testing of primary mental abilities.

Since the first appearance of the tests for Primary Mental Abilities, it became apparent that they present definite advantages hitherto inaccessible yet highly important to the people and the institutions confronted with the problems of educational and vocational prediction and guidance. ...it is quite possible that an individual may be very slow in his single composite index of intelligence and still be of average rating or reasonable above in respect to one or more of his primary mental abilities. Hence he can be guided along the line that best fits.\textsuperscript{49}


\textsuperscript{49} K. S. Yum, Primary Mental Abilities and Scholastic Achievements in the Divisional Studies at the University of Chicago. \textit{Journal of Applied Psychology}, 25, (December, 1941), p. 712.
Goodman has reported several studies that have been done to determine the possibilities of using Thurstone's Primary Mental Ability Tests to predict scholastic achievement at Pennsylvania State University for College students.

These investigations have been done to predict academic success for freshman liberal arts students, home economics students, and chemistry and physics students. He also included in his report a study done on the predictive possibilities of the Primary Mental Abilities Tests and a battery of vocational guidance tests.

Goodman concluded that on the basis of these studies, the following conclusions appear to be justified:

1. The Thurstone Primary Abilities Tests correlate, on the whole, as well as most standardized intelligence tests with criteria of college success.
2. The Thurstone Primary Abilities correlate with individual college courses to some degree and can be used for prediction of success in these courses.
3. Verbal ability correlates higher than any other of the abilities with semester point average and individual college courses.
4. Multiple correlations obtained by using various combinations of the primary abilities yield some increase in correlation over those obtained by using single abilities, when correlated with semester point average.  

Mukherjee conducted a study to determine the degree a semester grade in a beginning college psychology course can be predicted on the

---


51 Ibid., p. 138.

basis of certain selected tests of the Primary Mental Abilities Tests. The problem was to select from a battery of Primary Mental Ability Tests those variables which would yield the optimum estimate of the total grade points for the entire semester.

The author concluded that at least two tests of PMA can be used to predict academic performance in psychology at the introductory level. Mukherjee says: "The tests are vocabulary and sound grouping. The vocabulary tests turned out to be the best single predictor of all the tests of PMA. The Sound Grouping Test has been found to be a good measure of perceptual (Auditory) speed."\(^5\)

Shaw\(^5\) designed a study which called for the measurement of primary mental abilities and the measurement of academic achievement for high school students. Some 600 beginning ninth-grade students were administered The Chicago Tests of Primary Mental Abilities for Ages 11 to 17. After the subjects' scores were obtained, they were analyzed statistically to determine the relationship between:

(1) each primary mental ability and each achievement measure
(2) combinations of primary mental abilities and each achievement measure
(3) predicted achievement scores and each primary mental ability

\(^5\) Ibid., p. 560.

According to Shaw, the data obtained in this study appeared to support the following conclusions:

1. Verbal-Meaning ability is highly related to every high school achievement, measure used in the present investigation. This primary mental ability makes a significant contribution, and accounts for a considerable share of the prediction of every achievement scores.

2. Reasoning ability stands in moderately high relationship with several of the measures of achievement used in this investigation.

3. Combinations of selected primary mental abilities were found to be highly related to achievement scores.55

The division of a test score into a number of parts appealed to Bond and Clymer56. They were interested in the idea that by using a multiple-measure intelligence test more information would be available to predict achievement. They felt that factor analyzed tests, when used for school testing, must be judged on the degree to which they correspond to outside criteria and not on the number of correlations computed in building a battery.

The purpose of their study was to investigate the interrelationships of the following tests: The Primary Mental Abilities Test, Ages 7-11; The Durrell-Sullivan Intermediate Reading Capacity Test; and general reading ability of fourth-grade pupils. They set up a procedure to measure the independence of The Primary Mental Abilities Test and also to evaluate its relationship to two outside criteria: general reading ability and the Durrell-Sullivan Reading Capacity Test.

55Ibid., p. 248.

The eighty-seven fourth grade children in their sample were administered The Durrell-Sullivan Reading Capacity Test. This test gives two measures of comprehension of spoken language. One measure is Word Meaning and the other is Paragraph Meaning.

The Primary Mental Abilities Test, Ages 7-11 was next administered. This battery has tests to measure Verbal Words, Verbal Pictures, Space, Reasoning Words, Reasoning Figures, Perception and Numbers.

Their findings bring out the following points:

1. All the tests of the SRA Primary Mental Abilities gave significant correlations with the two measures of reading ability.

2. The two SRA Primary Mental Abilities Tests which involved reading (Verbal Words and Reasoning Words) gave high correlations with the measures of reading ability.

3. The intercorrelations of the Primary Mental Abilities were essentially those presented in the test's manual.57

A study was conducted by Weise, Meyers and Tuel58 to determine an efficient method of nominating kindergarten children for expensive Stanford-Binet testing when they have been recommended for placement in special program for the gifted.

The criterion for admission, to this special program, was a Binet IQ score of 130. Initially, this criterion was reached by only 70 per cent.

57 Ibid., p. 135.

of the teacher-nominated children. Those responsible for the selection were also concerned about missing non-nominated children who otherwise qualified for the program.

To reduce both risks was the purpose of the study. The authors were concerned with making the selection for individual testing more efficient by adding to the teacher nomination the information gained by group factor tests.

Subjects were drawn from a pool of 470 children in 19 classes under 10 experienced teachers. The initial selection of nominees for individual testing was made by teachers, who were free to name as few or as many as they believed might earn the privilege of special programming. The teachers nominated 57.

The 1953 form of the SRA Primary Mental Abilities for ages 5 to 7 was administered to the total pool of 470 children in small groups of 3 to 5. Only the verbal, Perceptual, Quantitative and Spatial subtests were employed. The Stanford-Binet was then administered to all children nominated by teachers, as well as to those children who received high scores on the PMA.

The investigators found that 28 per cent of the boys and 35 per cent of the girls, who qualified for gifted classes, had not been nominated by the teachers. Even children with Binet IQ scores of over 150, especially boys, had not been nominated by teachers.

The authors feel that time and effort can be saved and predictions of Binet test results may be made by "plugging in" the teacher nomination,
(either yes or no) the Verbal subtest score, and either the Quantitative subtest for boys or the Perceptual subtests for girls. They concluded that within a reasonable range of possible PMA scores, it is possible to predict probably Binet scores with or without teacher nomination on the basis of just two PMA subtest scores.

Chambers\(^{59}\) reviewed the attempts by the Psychological Service Division of the Lansing, Michigan, Public Schools, to cope with the problem of efficiently and effectively identifying children of superior intellectual abilities for placement in an enriched education program.

It was decided, as only limited funds were available, to admit only the upper 5 per cent of children into a special program. The criterion for admission was IQ score of 125 or more on the Wechsler Intelligence Scale for Children. It was believed that this was a more objective single measure of learning ability or potential than school grades or any other measure.

With a WISC score of 125 or better as the criterion, screening was begun on children referred by teachers, principals and/or parents. After two years of such testing, a survey was made and it was found that for each child who was referred, tested and scored at or above the minimum admission score of 125, four others were referred, tested and failed to meet this requirement.

As teacher, principal and parent recommendations were only successful in identifying one of five candidates, it became apparent that some additional pre-screening devices were needed. Group intelligence tests were considered and it was decided to design a study to investigate the relationship between the Wechsler Intelligence Scale for Children and various group tests of intelligence.

The tests used in the study were:

1. The Wechsler Intelligence Scale for Children
2. The SRA Primary Mental Abilities, elementary form
3. The Kuhlman-Anderson, Form D and F
4. The IPAT (Cattell's Test of G: Culture Free), Scale 2, Form A
5. The California Mental Maturity Test, Primary and Elementary Forms

Thirty-nine subjects were administered all of the above named tests. The tests were alternated and in reverse order to eliminate any bias.

By examining the results, it was found that The Primary Mental Abilities Test, Elementary Form, was the test most worthy of consideration for the described purpose. It was found to result in the most desirable combination of effectiveness and efficiency.

Chambers points out the amount of time that can be saved through use of these pre-screening methods and noted that this saved testing time could be used to provide psychological services to more pupils than would otherwise be possible.

A major criticism of tests concerned with developmental changes in the structure of intelligence has been the lack, at each age level of
comparable test batteries. Meyer and Bendig\textsuperscript{60} conducted a longitudinal study using \textit{The Primary Mental Abilities Test}. The purpose of their investigation was to analyze data on the following issues: consistency of factorial structure, developmental changes in the magnitude of $g$, rates of growth on each of the primary abilities and accuracy of long range predictions of achievement.

The investigation administered \textit{The Primary Mental Abilities Test}, Intermediate Form (age 11-17), to all the eight graders in one junior high school. Approximately three and one-half years later the same form of the test was re-administered. These students were homogeneous with respect to socioeconomic background (lower middle class) and education.

The authors reported that although the purpose of their study did not include an evaluation of \textit{The Primary Mental Abilities Test}, such a statement is warranted. The test-re-test correlations for the factors verbal meaning, reasoning, and numerical are sufficiently high to permit cautious long term counseling. This is important because these factors correlate most highly with achievement. Meyer and Bendig also reported that the verbal meaning sub-test is a good predictor of achievement and very stable over time. Long term consistency in relative position is fairly well maintained over time and little evidence was found to support an increased differentiation of abilities from Grade 8 to Grade 11.

\textsuperscript{60}William J. Meyer and A. W. Bendig, \textit{A Longitudinal Study of the Primary Mental Abilities Test}, \textit{Journal of Educational Psychology}, (1961, Vol. 52, No. 1), pp. 50-60.
The Chicago Tests of Primary Mental Abilities was used by Clarke to investigate changes in primary mental abilities of three hundred and twenty adolescent boys in three different age groups. These subjects were considered as representative of New York City, where all attended public schools. The age groups were of comparable measured intelligence. The mean scores on subtest components of the test increased significantly with age. There was a consistent tendency for variability of the scores in each subtest to increase with age, except for memory. It was concluded that, excepting the memory component, the noted changes in organization of primary mental abilities with age were not noticeably influenced by the general intelligence level of the subjects as reflected by intelligence quotients.

Tyler administered the SRA Primary Mental Abilities Test (PMA) Form Ages 5 to 7, to first graders from different socioeconomic backgrounds. Three years later eighty-three of the above first-graders were given the Form Age 7 to 11 of the PMA along with other fourth-graders. Four years later one hundred and twenty-seven of these children, who were now eighth graders, were given the SRA Primary Mental Abilities Test for Ages 11 to 17. When the data from the first and fourth grade testings were examined, total scores correlated with subscores about the same at each age level. When intra-individual patterns were studied at

---

61 Mamie Phipps Clarke, Changes in Primary Mental Ability with Age. (Achieves of Psychology, XLI, No. 291, 1944), pp. 208-212.
these levels, only chance relationships appeared to exist. Comparing fourth and eight grade data, scores for the Number subtest correlated much higher in both grades that did any or not scores at the earlier levels. Tyler states:

"Correlations between scores for the same special abilities are higher for older than for younger age levels suggesting increasing stability of subscores with age.

"Patterns of relatively high or relatively low subscores at the fourth-grade level are not significantly related to patterns shown in the first grade. The relationship between fourth and eighth grade patterns is clearly significant, again suggesting increasing stability of individual mental ability patterns as age progresses."

Meyer presented data in his study similar to that of Tyler. In his investigation, The Primary Mental Abilities Test Age 11 to 17, was administered to one hundred children as they began the eighth grade. The test was readministered as the subjects concluded the eleventh grade.

Meyer's results were consistent with Tyler's. The two studies demonstrated that the patterns of performance on the various subtests of the PMA become more consistent over time. The two studies also permit the generalization that with increasing development specific abilities emerge, particularly in the case of numerical and spatial, which predict performance on the primary abilities somewhat better than a measure of general intellectual ability.

---

63 Ibid., p. 774.

Few investigations have been reported utilizing the SRA Primary Mental Abilities Tests (PMA) with retarded subjects as a means of determining whether or not qualitative differences exist for this group.

One investigation using the **Primary Mental Abilities Tests (PMA)** with retarded subjects has been done by Clausen. The purpose of his study was to compare: (1) subtest patterns in normal and institutionalized retarded subjects; (2) the subtest patterns in etiological subgroups of retardates; (3) the scatter of subtests in the two populations; (4) the intercorrelations between subtests; and (5) the relationship of Porteus Maze Test and Raven's Progressive Matrices to the various subtests of the PMA.

The **SRA Primary Mental Abilities Test**, either the form for ages 5 to 7 or the form for ages 7 to 11, was given to two hundred and seventy-three institutionalized retardates. These retardates varied in age from eight to twenty-four years of age. One hundred and twelve normal children were recruited from local schools. These subjects were in the eight to ten years old range. All of the normal subjects were given the PMA Form for ages 7 to 11. Also, **The Porteus Maze Test** and **Raven's Progressive Matrices** were given to the subjects in both groups.

---

Clausen concluded from his investigation that:

1. The data for the 5-7 Form are more consistent than data from the 7-11 Form.

2. The 5-7 data indicated Perception and Motor to be the easiest subtests Verbal-Meaning and Quantitative in-between and space the most difficult for the mentally retarded. When compared to the means of the normal, the retarded, on the form for ages 7 to 11, showed the Numerical subtest to be the easiest, Perception and Verbal in between and Space Reason to be the most difficult.

3. While subtest pattern in retardates differ from normals, the significance of these patterns is not quite clear.

4. Scatter as indicated by range of subscores is smaller in retardates than in normals.

5. Intercorrelations between subscores seem to decrease with increasing chronological age and mental age.

6. For the 5-7 age Form, etiological subgroups do not differ for pattern. Essentially the same is found for the 7-11 age Form.

7. Raven and Porteus are found to have the highest correlations with Space and lowest with Verbal.

Cassel and Danenhower used SRA Primary Mental Abilities Form ages 5 to 7 to compare endogenous and exogenous retardates of like mental ages. They found that while the endogenous retardates had little difference between subtests, the exogenous had high scores for Verbal and low scores for Motor and, particularly Space. They also reported higher coefficients of variation for the exogenous, particularly for Space and Motor.

---

66 Ibid., p. 246.

Scatter found that while retardates tend to have more scatter than normals on the Stanford-Binet Form L, Vineland Social Maturity Scale and California Achievement Test, they have less scatter for SRA Primary Mental Abilities Test. He found higher subtest intercorrelations in retarded than in normals and interpreted this as lack of, or delay in, individuation of skills in retardates.

Junkala designed a study to investigate the possibility of the existence of a qualitative difference between the organization of intelligence of normal individuals and non-institutionalized retardates. He administered the SRA Primary Mental Abilities Tests to 79 mongoloid subjects. The subjects were grouped by chronological age, mental age, intelligence quotient, and sex. For each group defined by these variables, intercorrelations were computed between subtests, and between subtests and total mental age equivalency scores on the Primary Mental Abilities Test.

Junkala made two general conclusions from the result of his study.

"The first is that the organization of intellectual behavior in mongoloids shows differences from the organization of intellectual behavior in normal individuals—and the second conclusion is that as mongoloids grow older there are no general changes in the manner in which their primary mental abilities are interrelated."

---


70 Ibid, p. 121.
Kolstoe\textsuperscript{71} investigated the nature of systematic intellectual differences between two groups of children of approximately equal mental age but markedly different in chronological age and IQ. One group consisted of 29 third and fourth grade pupils with estimated true Stanford-Binet IQ's of 84 or below.

All subjects were given the \textbf{Wechsler Intelligence Scale for Children}, the \textbf{Benton Test of Visual Retention}, an original \textbf{Speed of Symbol Copying test}, and the \textbf{Chicago Tests of Primary Mental Abilities}.

The dull group was superior to the bright on the WISC subtests of Comprehension and Coding on the Symbol Copying test scored for speed and on the PMA subtest, Number.

The bright group was superior to the dull on the WISC subtests Digits and on the Symbol Copying Test scored for accuracy.

On the \textbf{Primary Mental Abilities Test} the only test which showed a significant difference between the scores of the two groups was the subtest number on this test; Kolstoe suggests that the superiority of the dull group may have been due to the fact that this group, being made up of eighth and ninth grade pupils, had received instruction in certain arithmetic operations to which the bright children, who were in lower grades, had not been introduced. Thus, the superior performance of the dull group appears to reflect no qualitative intellectual difference, but rather, a curricula one.

\textsuperscript{71}Oliver Paul Kolstoe, "A Comparison of Mental Abilities of Bright and Dull Children Having the same Mental Ages", (Unpublished Ph.D. Dissertation).
Kolstoe feels that:

"the results of his study support to a very considerable extent the generality of the mental age concept. No evidence was found to support the claims of some writers that the bright are superior in such mental tasks as vocabulary, reasoning, and a general memory ability. Nor does the evidence from the study indicate superiority of the dull older children in general performance, or manual manipulation."72

Summary: A primary mental ability is a combination of intellectual operations that has within itself a unifying factor differentiating it from all other combinations of mental operations. Interrelations found between various primary mental abilities are attributed to a general factor extending through all intellectual activity. The unifying factor of each primary mental ability is described as a specific factor of intelligence, independent of the general factor and of all the other specific factors.

"The working form in the education and training of mentally retarded must be derived from intensive study of the individual child. It must provide for him the setting and the climate in which he can grow and develop his capacities, whatever their limitations. The successful achievement of this end is a great challenge to the teacher and other workers. It requires not only ingenuity but also the humility to acknowledge what we do not know and the dedication to value the results."73

72 Ibid., pp. 88-89.

CHAPTER III

PROCEDURES

The purpose of this study was to investigate the possibility of the existence of a qualitative difference among the organization of intelligence of trainable mentally retarded children, educable mentally retarded children, and children of normal intelligence.

Utilizing The Science Research Associates Primary Mental Abilities Test for Ages 5 to 7, comparisons were made of the interrelationships among the five abilities, as described in the test manual by Thurstone, with trainable, educable and normal children. This examination and comparison has been done with trainable mentally retarded, educable mentally retarded, and children of normal intelligence having equivalent mental ages.

EXPERIMENTAL DESIGN

The SRA Primary Mental Abilities Test for Ages 5 to 7 was administered to ninety subjects from three different types of educational placements. The first group consisted of trainable mentally retarded children in community classes. The second group was composed of educable mentally retarded children in special classes for the mentally retarded. The third group were normal children of approximately the
same mental age as the trainable in Group I and the educable in Group II.
Thirty subjects were in each group.

The standardized procedure, as described in the examiner's manual was adhered to throughout each test administration.

Sex, social class status, and physical and motor conditions have been controlled in this investigation.

Each group had fifteen boys and fifteen girls. Social class was controlled by using father's education and a part of the Warner, Meeker and Eells "measurement" - The Index of Status Characteristics. The part that was used evaluates father's occupations. The subjects selected in all three groups were free of gross physical and motor impairments. This was done by asking teachers, examining school medical records and by observing subjects.

The range of mental test scores on each individual within each group, and between groups was done by converting raw scores into standard scores. For each group, intercorrelations were computed between subtests, and between total mental age equivalency scores on The SRA Primary Mental Abilities Test for Ages 5 to 7.

It was hypothesized that the interrelationships of primary mental abilities of trainable mentally retarded children would not be significantly different from the patterns of normal children of the same mental age. It was further hypothesized that the interrelationships of primary mental abilities of educable mentally retarded children would not be significantly different from the patterns of normal children of the same mental age. A third hypothesis stated that the interrelationships
of primary mental abilities of trainable mentally retarded children
would not be significantly different from the patterns of educable
mentally retarded children of the same mental age.

SELECTION OF SUBJECTS

Selection and testing of the ninety subjects in the research
population was conducted in school districts in Franklin County, Ohio.
Subjects were required to have a mental age of not less than five
years or more than a mental age of seven years. Chronological ages of
the subjects varied from five and one-half years to fourteen years
and eleven months.

The trainable group was selected from the Franklin County Program
for Trainable Mentally Retarded Children. In order for a child to be
admitted into the program, it is necessary that a school psychologist
administer an individual standardized intelligence test and the child
receive an intelligence quotient score between 25 and 50. In order to
be sure the subjects were a representative sample, they were picked
from twelve classes in five different schools.

The educable mentally retarded children were selected from educable
mentally retarded (EMR) classes in Franklin County. In order for a
child to be admitted into an EMR class, it is necessary that a school
psychologist administer an individual standardized test and the child
receive an intelligence quotient score between 50 and 75. In order to
be sure a representative sample were included in this group, the subjects
were selected from six classes in four different schools.
The normal children in this sample were selected from kindergarten and first grade classes. Each child in this group was identified as being average by his teacher. As the testing took place in the Spring, each teacher was very familiar with her students. In order to be sure the subjects were a representative sample, they were picked from eight classes in five different schools.

SEX

This investigation in order to provide for this variable had fifteen boys and fifteen girls in each group.

PHYSICAL CHARACTERISTICS

All ninety subjects in this research population were free from gross physical and motor impairments. This was done by asking teachers, examining school medical records, and by observing the subjects.

SOCIAL CLASS STATUS

Social class enters into almost every aspect of our lives. It is an important determinant of personality development and is a factor in the kinds of skills, abilities, and intelligence an individual uses to solve his problems. This investigation eliminated any social class inequities. Each of the ninety subjects lived in a home where both parents were present. The father in all cases was a high school graduate, who had not attended college. Social class status was also controlled by using a part of the Warner, Meeker, and Eell's measure-
ment - The part of their Index of Status Characteristics that has been used is the Scale for Rating Occupations, (Appendix I).

The various occupations of all the fathers fell into the categories of manual workers or protective or service workers. Ratings assigned to their occupations varied from five to seven.

DESCRIPTION OF THE INSTRUMENT

Factorial studies of test batteries measuring mental abilities have resulted in the isolation of separate mental abilities.

The Science Research Associates Primary Mental Abilities Tests are group instruments designed to measure primary mental abilities in children ranging from five to seventeen years of age. This investigation used only The SRA Primary Mental Abilities Test for Ages 5 to 7. At this age level, the statistical technique of multiple-factor analysis has identified five abilities inherent in the traditional concept of intelligence. The five abilities on which separate scores can be obtained are: (1) Verbal Meaning; (2) Perceptual Speed; (3) Quantitative; (4) Motor; and (5) Space.

The SRA Primary Mental Abilities Test for Ages 5 to 7 was standarized on 1200 children. The authors have reported high-order reliability coefficients. Raw scores on each of the subtests have been con-

verted into mental age equivalents through a weighting process. This test is a group paper and pencil test which requires simple manipulative responses from the subjects. It does not require the ability to read as instructions are given orally.

Each subtest consists of series of pictures or geometric forms arranged in rows, each row representing a separate task. Examinees are helped in finding and keeping their place by small pictures at the tops of pages and next to test items. The examinee uses a marker to underline the row of pictures representing the problems. Markers are not used in the timed subtests.

RATIONALE FOR USING THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 TO 7

This test was chosen because, according to Thurstone's factor analytical studies, each subtest represents an intellectual factor. The test furnishes a profile of mental age scores for five different mental abilities. Each of the five mental abilities are relatively independent of each other and can be regarded as being the fundamental abilities involved in more complex tasks.

This instrument carries the inference that a study of separate and presumably independent scores for the different abilities may yield clues helpful in planning a proper program for every child.

The use of this test, which is based upon factor analysis, raises problems of interpretation different from those encountered with the more traditional type of intelligence test. It is quite possible that an individual may be low in his single composite index of intelligence and still be of average rating or even above in respect to one or more of his primary mental abilities.

For many years psychologists have been accustomed to the problems of special abilities and disabilities. These are, in fact, the principal concern of school psychologists who deal with children who cannot read, have a blind spot for numbers, or do one thing remarkably well and other things poorly. It seems strange with all this experience in differential psychology that we have clung so long to the practice of summarizing a child's mental endowment by a single index, such as the mental age, the intelligence quotient, the percentile rank in general intelligence, and other single average measures. An average index of mental endowment should be useful for many many educational purposes, but it should not be regarded as more than the average of several tests. Two children with the same mental age can be entirely different persons, as is well known. There is nothing wrong about using a mental age or an intelligence quotient if it is understood as an average of several tests. The error that is frequently made is interpreting it as measuring some basic functional unity when it is known to be nothing more than a composite of many functional unities.\(^3\)

---

An important consideration in tests for young children is that they should not depend too heavily on reading. The Primary Mental Abilities Tests used in this study is not dependent on a child's reading ability. Tasks on this form of the primary mental abilities are designed to: (1) indicate ability to coordinate eye and hand movements; (2) indicate ability to visualize and think about symbols in 2 or 3 dimensions; (3) indicate understandings of numerical concepts ranging from those of size and position through grouping and simple problem solving; (4) indicate ability to understand ideas expressed in words; and (5) indicate ability to recognize likenesses and differences between pictures of objects. An investigation of the mental abilities of retarded children with the P, M, A. test would appear to be quite promising since it is not subject to many of the limitations common to other intelligence tests.

By means of multiple-correlation techniques the multiple-correlation between total score in The Primary Mental Abilities Tests Ages 5 to 7 and The Stanford-Binet, Form L, 1937 Revision has been determined by Thurstone and Thurstone to be .829. Other studies have shown that there is a close correspondence between studies obtained on the P, M, A. batteries and other standard intelligence tests.

\[4^{\text{Thurstone and Thurstone, op. cit., p. 3.}}\]

\[5^{\text{See Chapter II.}}\]
The purpose of using the P M. A. is to determine if a distinctness of mental abilities exists between the three groups in this study.

ADMINISTRATION OF THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 TO 7

The test was administered to all ninety subjects in the study. In order to be consistent, this examiner tested the subjects in groups of five. This procedure was maintained with all three groups. Without exception, all of the testing was done in the morning. The teachers, who furnished the subjects, felt that they scheduled the most intensive parts of their program in the morning. They expressed the opinion that their children were more receptive and productive prior to lunch.

All the testing was done by the investigator. Working with groups of five children, it was possible to adjust the giving of the test to the working speed of the subjects. This was done in all groups except for the timed parts of the instrument.

The investigator studied the examiner's manual thoroughly prior to the testing and followed its instructions implicitly. The facilities provided by the schools were very helpful in that the rooms were large and the five subjects could be scattered. This prevented any one subject from seeing another one's answers.

The writer is sure that the instructions in the examiner's manual were adhered to rigidly in the administration of the test.
STATISTICAL TREATMENT OF DATA:
BETWEEN GROUPS

For each group of subjects designated at trainable mentally (TMR), educable mentally retarded (EMR), and normals, raw scores were obtained for performance in each of five subtests, namely, Verbal-Meaning (V), Perception (P), Quantitative (Q), Motor (Mo), and Space (S). For each subtest, a total score was obtained by summing raw scores in each of the five subtests. A grand total score was obtained by summing the total scores earned by each of the fifteen subjects. This resulted in three sets of scores, separate for each sex and group: TMR, boys and girls; EMR, boys and girls; and Normals, boys and girls. Means were obtained by dividing the grand total score for each group by fifteen, the number of subjects per group.

To determine if one group excelled another group in total performance, a t test formula was employed. This formula was as follows:
\[ t = \sigma \sqrt{\frac{1}{N_1} + \frac{1}{N_2}} \]

- where \( \sigma \sqrt{\frac{N_1 S_1 + N_2 S_2^2}{N_1 + N_2 - 2}} \)

\[ \bar{X}_1 = \text{Mean of one group} \]
\[ \bar{X}_2 = \text{Mean of a second group} \]
\[ N_1 = \text{Number of subjects in group one} \]
\[ N_2 = \text{Number of subjects in group two} \]
\[ S_{1}^2 = \text{Variance of one group} \]
\[ S_{2}^2 = \text{Variance of second group} \]
\[ \sigma = \text{The pooled variance of both groups} \]

---

ANALYSIS OF DATA:
WITHIN GROUPS

In analyzing scores made by the same subjects within a particular group, the following procedure was used. For each subtest the mean score was found. This mean raw score was then converted to a mental age by referring to the *Examiner Manual for the SRA Primary Mental Abilities for Ages 5 to 7* and locating the mental age that corresponded to the mean raw score in each of the five subtests. A profile of each group's performance has been made and is explained in Chapter IV. The profiles allow a direct interpretation of relative performance for five subtests within each of the separate groups.
CHAPTER IV

RESULTS OF THE STUDY

This study attempted to compare the organization of primary mental abilities in trainable mentally retarded, educable mentally retarded and normal children with similar mental ages.

In the present study the SRA Primary Mental Abilities Test for Ages 5 to 7 was administered to ninety subjects. Subjects had been identified as TMR, EMR or Normals and each group had fifteen boys and fifteen girls. All ninety subjects attended public schools in Franklin County, Ohio. None of the subjects were nor had ever been institutionalized.

Description of the Subjects

Tables 1 through 6 describe the subjects. Raw scores were obtained by testing the subjects and their performances were reported for each of the five subtests. For each subject a total score was obtained by summing raw scores in each of the five subtests. A grand total score was obtained for the group by summing the total scores earned by each of the fifteen subjects. This resulted in three sets of scores, separate for each sex and group: TMR, boys and girls; EMR, boys and girls; and Normals, boys and girls. Means were obtained by dividing the grand.
total score for each group by 15, the number of subjects per group. These means were rounded off to the nearest whole number. The mean raw score was then converted to a mental age by referring to the Examiner Manual for the SRA Primary Mental Abilities for Ages 5 to 7.
# TABLE 1

TMR BOYS SCORES ON THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 to 7.

<table>
<thead>
<tr>
<th>N</th>
<th>Raw Scores on Variables</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>31</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>33</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td>31</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>39</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>36</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>38</td>
<td>17</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
<td>13</td>
</tr>
<tr>
<td>10</td>
<td>35</td>
<td>16</td>
</tr>
<tr>
<td>11</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>25</td>
<td>16</td>
</tr>
<tr>
<td>13</td>
<td>21</td>
<td>7</td>
</tr>
<tr>
<td>14</td>
<td>27</td>
<td>14</td>
</tr>
<tr>
<td>15</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>463</td>
<td>219</td>
</tr>
<tr>
<td>Mean</td>
<td>30.86</td>
<td>14.60</td>
</tr>
<tr>
<td>Mental Age</td>
<td>5-8</td>
<td>6-0</td>
</tr>
</tbody>
</table>
### TABLE 2

**EMR BOYS SCORES ON THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 to 7.**

<table>
<thead>
<tr>
<th>Subject</th>
<th>V</th>
<th>P</th>
<th>Q</th>
<th>M</th>
<th>S</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>15</td>
<td>101</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>15</td>
<td>25</td>
<td>18</td>
<td>10</td>
<td>108</td>
</tr>
<tr>
<td>3</td>
<td>41</td>
<td>15</td>
<td>21</td>
<td>25</td>
<td>11</td>
<td>113</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
<td>26</td>
<td>21</td>
<td>35</td>
<td>20</td>
<td>147</td>
</tr>
<tr>
<td>5</td>
<td>38</td>
<td>20</td>
<td>17</td>
<td>33</td>
<td>12</td>
<td>120</td>
</tr>
<tr>
<td>6</td>
<td>41</td>
<td>8</td>
<td>20</td>
<td>20</td>
<td>14</td>
<td>103</td>
</tr>
<tr>
<td>7</td>
<td>37</td>
<td>12</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>89</td>
</tr>
<tr>
<td>8</td>
<td>45</td>
<td>27</td>
<td>23</td>
<td>36</td>
<td>17</td>
<td>148</td>
</tr>
<tr>
<td>9</td>
<td>34</td>
<td>24</td>
<td>13</td>
<td>14</td>
<td>16</td>
<td>101</td>
</tr>
<tr>
<td>10</td>
<td>32</td>
<td>13</td>
<td>14</td>
<td>21</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>11</td>
<td>41</td>
<td>12</td>
<td>11</td>
<td>16</td>
<td>6</td>
<td>86</td>
</tr>
<tr>
<td>12</td>
<td>29</td>
<td>16</td>
<td>15</td>
<td>11</td>
<td>10</td>
<td>81</td>
</tr>
<tr>
<td>13</td>
<td>30</td>
<td>17</td>
<td>18</td>
<td>16</td>
<td>11</td>
<td>92</td>
</tr>
<tr>
<td>14</td>
<td>29</td>
<td>14</td>
<td>12</td>
<td>14</td>
<td>9</td>
<td>78</td>
</tr>
<tr>
<td>15</td>
<td>27</td>
<td>13</td>
<td>12</td>
<td>17</td>
<td>9</td>
<td>78</td>
</tr>
<tr>
<td>Total</td>
<td>547</td>
<td>246</td>
<td>252</td>
<td>308</td>
<td>182</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>36.46</td>
<td>16.40</td>
<td>16.80</td>
<td>20.03</td>
<td>12.13</td>
<td></td>
</tr>
<tr>
<td>Mean Rounded</td>
<td>36</td>
<td>16</td>
<td>17</td>
<td>21</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Mental Age</td>
<td>6-2</td>
<td>6-2</td>
<td>6-6</td>
<td>6-0</td>
<td>5-6</td>
<td></td>
</tr>
</tbody>
</table>
**TABLE 3**

NORMAL BOYS SCORES ON THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 to 7.

<table>
<thead>
<tr>
<th>N</th>
<th>Subject V</th>
<th>P</th>
<th>Q</th>
<th>M</th>
<th>S</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37</td>
<td>12</td>
<td>14</td>
<td>19</td>
<td>11</td>
<td>93</td>
</tr>
<tr>
<td>2</td>
<td>38</td>
<td>25</td>
<td>19</td>
<td>14</td>
<td>12</td>
<td>108</td>
</tr>
<tr>
<td>3</td>
<td>43</td>
<td>29</td>
<td>25</td>
<td>16</td>
<td>12</td>
<td>125</td>
</tr>
<tr>
<td>4</td>
<td>39</td>
<td>15</td>
<td>10</td>
<td>27</td>
<td>24</td>
<td>115</td>
</tr>
<tr>
<td>5</td>
<td>38</td>
<td>26</td>
<td>19</td>
<td>13</td>
<td>10</td>
<td>106</td>
</tr>
<tr>
<td>6</td>
<td>43</td>
<td>18</td>
<td>20</td>
<td>21</td>
<td>19</td>
<td>121</td>
</tr>
<tr>
<td>7</td>
<td>34</td>
<td>17</td>
<td>14</td>
<td>21</td>
<td>13</td>
<td>99</td>
</tr>
<tr>
<td>8</td>
<td>33</td>
<td>19</td>
<td>14</td>
<td>25</td>
<td>15</td>
<td>106</td>
</tr>
<tr>
<td>9</td>
<td>37</td>
<td>18</td>
<td>16</td>
<td>30</td>
<td>14</td>
<td>115</td>
</tr>
<tr>
<td>10</td>
<td>38</td>
<td>15</td>
<td>16</td>
<td>27</td>
<td>16</td>
<td>112</td>
</tr>
<tr>
<td>11</td>
<td>41</td>
<td>20</td>
<td>18</td>
<td>16</td>
<td>13</td>
<td>108</td>
</tr>
<tr>
<td>12</td>
<td>36</td>
<td>15</td>
<td>13</td>
<td>27</td>
<td>17</td>
<td>108</td>
</tr>
<tr>
<td>13</td>
<td>30</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>80</td>
</tr>
<tr>
<td>14</td>
<td>32</td>
<td>21</td>
<td>16</td>
<td>18</td>
<td>14</td>
<td>101</td>
</tr>
<tr>
<td>15</td>
<td>30</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>12</td>
<td>87</td>
</tr>
</tbody>
</table>

Total Mean Rounded Mental Age
---
549 36.6 37 6-2
278 18.53 19 6-6
242 16.13 16 5-10
302 20.13 20 6-4
213 14.20 14 5-10

1584 = \( \sum X_T \)
105.60 = \( X \)
### TABLE 4

**TMR GIRLS SCORES ON THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 to 7.**

<table>
<thead>
<tr>
<th>Subject</th>
<th>V</th>
<th>P</th>
<th>Q</th>
<th>M</th>
<th>S</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
<td>12</td>
<td>5</td>
<td>18</td>
<td>8</td>
<td>74</td>
</tr>
<tr>
<td>2</td>
<td>34</td>
<td>17</td>
<td>14</td>
<td>28</td>
<td>18</td>
<td>111</td>
</tr>
<tr>
<td>3</td>
<td>41</td>
<td>24</td>
<td>14</td>
<td>29</td>
<td>9</td>
<td>117</td>
</tr>
<tr>
<td>4</td>
<td>36</td>
<td>19</td>
<td>17</td>
<td>20</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>7</td>
<td>14</td>
<td>27</td>
<td>8</td>
<td>88</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td>4</td>
<td>10</td>
<td>2</td>
<td>6</td>
<td>52</td>
</tr>
<tr>
<td>7</td>
<td>30</td>
<td>23</td>
<td>15</td>
<td>32</td>
<td>20</td>
<td>120</td>
</tr>
<tr>
<td>8</td>
<td>35</td>
<td>16</td>
<td>11</td>
<td>19</td>
<td>13</td>
<td>94</td>
</tr>
<tr>
<td>9</td>
<td>26</td>
<td>8</td>
<td>5</td>
<td>8</td>
<td>7</td>
<td>54</td>
</tr>
<tr>
<td>10</td>
<td>23</td>
<td>13</td>
<td>12</td>
<td>14</td>
<td>9</td>
<td>71</td>
</tr>
<tr>
<td>11</td>
<td>31</td>
<td>9</td>
<td>9</td>
<td>22</td>
<td>10</td>
<td>81</td>
</tr>
<tr>
<td>12</td>
<td>30</td>
<td>11</td>
<td>4</td>
<td>14</td>
<td>8</td>
<td>67</td>
</tr>
<tr>
<td>13</td>
<td>34</td>
<td>20</td>
<td>3</td>
<td>8</td>
<td>8</td>
<td>73</td>
</tr>
<tr>
<td>14</td>
<td>23</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>15</td>
<td>28</td>
<td>14</td>
<td>8</td>
<td>9</td>
<td>5</td>
<td>64</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>464</td>
<td>204</td>
<td>150</td>
<td>261</td>
<td>142</td>
<td>1221</td>
</tr>
</tbody>
</table>

Mean: 30.93, 13.60, 17.4, 9.46
Mean Rounded: 31, 14, 17, 9
Mental Age: 5-8, 5-10, 5-6, 4-10
TABLE 5
EMR GIRLS SCORES ON THE SRA PRIMARY MENTAL ABILITIES
TEST FOR AGES 5 to 7.

<table>
<thead>
<tr>
<th>N</th>
<th>Raw Scores on Variables</th>
<th>Subject</th>
<th>V</th>
<th>P</th>
<th>Q</th>
<th>M</th>
<th>S</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>40</td>
<td>14</td>
<td>20</td>
<td>23</td>
<td>9</td>
<td>106</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>39</td>
<td>14</td>
<td>24</td>
<td>18</td>
<td>18</td>
<td>113</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>39</td>
<td>22</td>
<td>19</td>
<td>23</td>
<td>16</td>
<td>119</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>36</td>
<td>12</td>
<td>15</td>
<td>12</td>
<td>16</td>
<td>91</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>39</td>
<td>15</td>
<td>10</td>
<td>13</td>
<td>11</td>
<td>88</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>47</td>
<td>21</td>
<td>19</td>
<td>30</td>
<td>19</td>
<td>136</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>43</td>
<td>28</td>
<td>20</td>
<td>33</td>
<td>16</td>
<td>140</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>38</td>
<td>14</td>
<td>15</td>
<td>13</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>30</td>
<td>13</td>
<td>16</td>
<td>10</td>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>43</td>
<td>12</td>
<td>23</td>
<td>17</td>
<td>9</td>
<td>104</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td>34</td>
<td>25</td>
<td>9</td>
<td>16</td>
<td>13</td>
<td>97</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td>37</td>
<td>12</td>
<td>22</td>
<td>14</td>
<td>11</td>
<td>96</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td>41</td>
<td>12</td>
<td>18</td>
<td>16</td>
<td>11</td>
<td>98</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td>29</td>
<td>16</td>
<td>16</td>
<td>15</td>
<td>8</td>
<td>84</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>40</td>
<td>18</td>
<td>24</td>
<td>14</td>
<td>14</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>575</td>
<td>248</td>
<td>270</td>
<td>267</td>
<td>187</td>
<td>1547=\sum x_T</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td></td>
<td>38.33</td>
<td>16.53</td>
<td>18</td>
<td>17.80</td>
<td>12.46</td>
<td>103.13= \bar x</td>
</tr>
<tr>
<td></td>
<td>Mean Rounded Mental Age</td>
<td></td>
<td>38</td>
<td>17</td>
<td>18</td>
<td>18</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td></td>
<td>6-4</td>
<td>6-4</td>
<td>6-8</td>
<td>5-8</td>
<td>5-6</td>
<td></td>
</tr>
<tr>
<td>Subject</td>
<td>V</td>
<td>P</td>
<td>Q</td>
<td>M</td>
<td>S</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>36</td>
<td>27</td>
<td>18</td>
<td>30</td>
<td>14</td>
<td>125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>14</td>
<td>20</td>
<td>25</td>
<td>16</td>
<td>115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>41</td>
<td>13</td>
<td>15</td>
<td>19</td>
<td>18</td>
<td>106</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>46</td>
<td>25</td>
<td>20</td>
<td>26</td>
<td>19</td>
<td>136</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>43</td>
<td>23</td>
<td>23</td>
<td>18</td>
<td>22</td>
<td>129</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>38</td>
<td>24</td>
<td>18</td>
<td>14</td>
<td>11</td>
<td>105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>33</td>
<td>20</td>
<td>15</td>
<td>20</td>
<td>12</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>41</td>
<td>20</td>
<td>18</td>
<td>15</td>
<td>12</td>
<td>106</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>38</td>
<td>15</td>
<td>18</td>
<td>25</td>
<td>15</td>
<td>111</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>41</td>
<td>18</td>
<td>20</td>
<td>16</td>
<td>13</td>
<td>108</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>37</td>
<td>14</td>
<td>14</td>
<td>27</td>
<td>17</td>
<td>109</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>37</td>
<td>14</td>
<td>15</td>
<td>20</td>
<td>17</td>
<td>103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>30</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>12</td>
<td>87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>32</td>
<td>21</td>
<td>16</td>
<td>18</td>
<td>14</td>
<td>101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>31</td>
<td>13</td>
<td>12</td>
<td>13</td>
<td>10</td>
<td>79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>564</td>
<td>275</td>
<td>257</td>
<td>302</td>
<td>222</td>
<td>1620 = \sum X_T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>37.60</td>
<td>18.33</td>
<td>17.13</td>
<td>20.13</td>
<td>14.80</td>
<td>108.00 = X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rounded</td>
<td>38</td>
<td>18</td>
<td>17</td>
<td>20</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mental Age</td>
<td>6-4</td>
<td>6-6</td>
<td>6-6</td>
<td>5-10</td>
<td>6-0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Group Comparisons

To determine if one group excelled another group in total performance, the following procedures were used. A formula for determining the significance of the difference between independent means for two different groups of subjects, matched for mental age, was employed. The formula used was:

\[ t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{1}{N_1} + \frac{1}{N_2}}} \]

where

\[ s = \sqrt{\frac{N_1 S_1^2 + N_2 S_2^2}{N_1 + N_2 - 2}} \]

\( \bar{X} \) = Mean of one group

\( \bar{X}_2 \) = Mean of a second group

\( N_1 \) = Number of subjects in group one

\( N_2 \) = Number of subjects in group two

\( S_1^2 \) = Variance of one group

\( S_2^2 \) = Variance of a second group

\( s \) = The pooled variance of both groups

The above formula is a t test; it yields information as to real differences between scores obtained by any two groups of subjects.

Table 7 presents this information for boys and Table 8 gives the information for girls.
TABLE 7
MEANS, t SCORES, AND LEVEL OF SIGNIFICANCE FOR COMPARISON GROUPS OF TMR, EMR, AND NORMAL BOYS Matched According to Mental Age for Total Score on the SRA Primary Mental Abilities Test for Ages 5 to 7.

<table>
<thead>
<tr>
<th>Comparison Groups</th>
<th>N</th>
<th>Means</th>
<th></th>
<th>t Score</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TMR</td>
<td>EMR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TMR vs EMR</td>
<td>30</td>
<td>79.80</td>
<td>102.33</td>
<td>2.76</td>
<td>.05</td>
</tr>
<tr>
<td>EMR vs Normals</td>
<td>30</td>
<td>102.33</td>
<td>105.60</td>
<td>.48</td>
<td>n.s.</td>
</tr>
<tr>
<td>TMR vs Normals</td>
<td>30</td>
<td>79.80</td>
<td>105.60</td>
<td>3.97</td>
<td>.001</td>
</tr>
</tbody>
</table>
TABLE 8
MEANS, t SCORES, AND LEVEL OF SIGNIFICANCE FOR COMPARISON GROUPS OF TMR, EMR, AND NORMAL GIRLS MATCHED ACCORDING TO MENTAL AGE FOR TOTAL SCORE ON THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 to 7.

<table>
<thead>
<tr>
<th>Comparison Groups</th>
<th>N</th>
<th>Means</th>
<th>t Scores</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TMR</td>
<td>EMR</td>
<td>Normals</td>
</tr>
<tr>
<td>TMR vs EMR</td>
<td>30</td>
<td>81.40</td>
<td>103.13</td>
<td>2.79</td>
</tr>
<tr>
<td>EMR vs Normals</td>
<td>30</td>
<td>103.13</td>
<td>108.0</td>
<td>.78</td>
</tr>
<tr>
<td>TMR vs Normals</td>
<td>30</td>
<td>81.40</td>
<td>108.0</td>
<td>3.68</td>
</tr>
</tbody>
</table>
As shown in Table 7, a comparison between TMR boys and EMR boys yielded a t score difference of 2.76. This is significant beyond the .05 level. TMR boys and EMR boys differ significantly on their total scores for the five variables. A comparison between EMR boys and Normal boys gave a t score difference of .48. This difference is not significant. The difference obtained was so slight that it indicated there was no real difference in their abilities. When TMR boys and Normal boys were compared the t score difference was 3.97. This is significant at the .001 level. These two groups differ markedly in ability and the difference is highly significant.

As demonstrated in Table 8, a comparison between TMR girls and EMR girls yielded a t score difference of 2.79. This is significant at the .01 level. The two groups differ substantially in ability and the difference is highly significant. The t score difference between EMR girls and Normal girls was only .78. This difference is so slight that it indicated there was no real difference in their abilities. When TMR girls and Normal girls were contrasted the t score difference was 3.68. This is significant at the .001 level. TMR girls and Normal girls differ markedly in ability on total scores for the five variables and this difference is highly significant.

Tables 7 and 8 presented the total mean mental age performance of the six groups. The purpose of Table 9 is to identify the subtests on which the six groups differed. This table shows mean mental age performance for each group on the five subtests. A difference of 12 mental age months or more in performance on any subtest can be considered
as real differences in the abilities of two groups; differences between groups of at least 6 months or more show a moderate difference in ability.
# TABLE 9

**MEAN MENTAL AGE PERFORMANCE FOR THE SIX GROUPS BY SUBTESTS**

<table>
<thead>
<tr>
<th>SUBTEST</th>
<th>TMR BOYS</th>
<th>EMR BOYS</th>
<th>NORMAL BOYS</th>
<th>TMR GIRLS</th>
<th>EMR GIRLS</th>
<th>NORMAL GIRLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Meaning</td>
<td>5.8</td>
<td>6.2</td>
<td>6.2</td>
<td>5.8</td>
<td>6.4</td>
<td>6.4</td>
</tr>
<tr>
<td>Perceptual Speech</td>
<td>6.0</td>
<td>6.2</td>
<td>6.6</td>
<td>5.10</td>
<td>6.4</td>
<td>6.6</td>
</tr>
<tr>
<td>Quantitative</td>
<td>5.6</td>
<td>6.6</td>
<td>6.4</td>
<td>5.6</td>
<td>6.8</td>
<td>6.6</td>
</tr>
<tr>
<td>Motor</td>
<td>5.4</td>
<td>6.0</td>
<td>5.10</td>
<td>5.6</td>
<td>5.8</td>
<td>5.10</td>
</tr>
<tr>
<td>Space</td>
<td>4.10</td>
<td>5.6</td>
<td>5.10</td>
<td>4.10</td>
<td>5.6</td>
<td>6.0</td>
</tr>
</tbody>
</table>
Both EMR groups and the two Normal groups averaged some six months higher than the TMR groups in verbal meaning. This indicates that both EMR's and Normals have a moderate advantage over Trainables in this ability. On the perceptual speed subtest, EMR boys and Normal girls scored the highest. These two groups were six months higher than TMR boys and eight months higher than TMR girls. An inspection of Table 9 shows a real difference between the EMR groups and the TMR groups in quantitative ability. The EMR girls have 14 months edge over both TMR groups and EMR boys have 12 months advantage. Normal girls also had the same advantage as EMR boys over the TMR groups. EMR boys had more success in the motor subtest than any other group. They averaged 8 months higher than TMR boys and 6 months higher than TMR girls. Both Normal groups also scored 6 months above TMR boys. It appears EMR boys and both Normal groups have more ability than TMR boys and TMR girls in this category. Both Normal groups showed a considerable difference in ability over the Trainables in space ability. Normal girls had 14 months and Normal boys had 12 months advantages over both TMR groups. Normal boys had 12 months advantages over both TMR groups. Normal girls had 6 months over EMR groups and the EMR groups had 6 months over the trainables. These 6 months differences indicate a moderate difference in space ability.
ANALYSIS OF DATA-WITHIN GROUPS

Figure 1 through 6 shows a profile of performance for each of the six groups. In analyzing scores made by the same subjects in a particular group, the following procedure was used. The mean raw score was found for each subtest from Tables 1 through 6. The raw scores were rounded off and converted to a mental age by referring to Table 21 of the Examiner Manual for the SRA Primary Mental Abilities Test for Ages 5 to 7. This gives the mental age that corresponds with the raw score in each of the five subtests. The profile figures have been constructed from this data.

Each profile allows a direct interpretation of relative performance for the five subtests with each of the separate groups. To interpret the profile, in terms of differences between performances from subtest to subtest, the following rationale was used: a difference of 12 months of mental age months between any two subtests can be considered as real differences in ability for each sample of subjects; differences between subtests of at least 6 months and less than 12 months show a moderate difference in ability.
FIGURE 1
PROFILE OF 15 TMR BOYS FOR MEAN MENTAL AGE PERFORMANCE ON FIVE SUBTESTS OF THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 to 7.
FIGURE 2
PROFILE OF 15 EMR BOYS FOR MEAN MENTAL AGE PERFORMANCE ON FIVE SUBTESTS OF THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 to 7
FIGURE 3
PROFILE OF 15 NORMAL BOYS FOR MEAN
MENTAL AGE PERFORMANCE OF FIVE
SUBTESTS OF THE SRA PRIMARY
MENTAL ABILITIES TEST
FOR AGES 5 to 7
Figure 1 shows that trainable boys mental age performance was highest in Perceptual Speed and lowest in Space. The variation between these two subtests is 14 months. This much difference is marked and demonstrates differences in levels of ability for the group as a whole. Trainable boys also show a moderate difference between Perceptual Speed and Motor and Perceptual Speed and Quantitative abilities. Trainable boys appear to be similar in their Verbal, Quantitative, and Motor abilities.

Figure 2 demonstrates that EMR boys obtained their highest performance in Quantitative abilities and their lowest in Space. The difference is 12 months. This is a real difference and demonstrates different levels of ability for the group. EMR boys have a moderate difference in level of abilities between Quantitative and Motor and between Motor and Space. Figure 2 also shows that their abilities in Verbal, Perceptual Speed and Motor are approximately the same.

Figure 3 explains that the normal boys mental age performance was highest in Perceptual Speed and lowest in Motor and Space. The difference is 8 months. This shows a moderate level of difference in ability between Perceptual Speed and Motor and between Perceptual Speed and Space. Mental age performance by normal boys is about the same in Verbal Meaning, Perceptual Speed, and Quantitative abilities and also in Verbal, Motor and Space abilities.
FIGURE 4
PROFILE OF 15 TMR GIRLS FOR MEAN MENTAL AGE PERFORMANCE ON FIVE SUBTESTS OF THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 to 7.
FIGURE 5
PROFILE OF 15 EMR GIRLS FOR MEAN MENTAL AGE PERFORMANCE ON FIVE SUBTESTS OF THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 to 7
FIGURE 6
PROFILE OF 15 NORMAL GIRLS FOR MEAN MENTAL AGE PERFORMANCE ON FIVE SUBTESTS OF THE SRA PRIMARY MENTAL ABILITIES TEST FOR AGES 5 to 7
Figure 4 explains mean mental age performance for TMR girls. This group did their best on Perceptual Speed and their poorest on Space. Between these two subtests, this group varied 12 months. This suggests a real difference in ability. TMR girls also had 10 months difference between Verbal Meaning and Space; 8 months difference between Quantitative and Space and 8 months between Motor and Space. These differences indicate that a moderate difference exists between Verbal, Quantitative, and Motor abilities and Space abilities. Verbal Meaning, Quantitative, and Motor abilities appear to be about equal in TMR girls.

Figure 5 shows that EMR girls mental age abilities are highest in Quantitative, where average is 6.8, and lowest 5.6 in Space and 5.8 in Motor. The first difference is 14 months and the second is 12 months. It appears a real difference exists between Quantitative and Space abilities and between Quantitative and Motor abilities. Verbal Meaning and Perceptual Speed abilities are 10 months above Space and 8 months higher than Motor. This points out moderate differences in these abilities. Verbal Meaning, Perceptual Speed, and Quantitative Abilities appear to be about equal.

Figure 6 gives a profile of mean mental age scores for normal girls. According to this profile, Perceptual Speed and Quantitative abilities of Normal girls are 8 months better than their Motor abilities. Perceptual Speed and Quantitative abilities are also 6 months better than Space and Verbal Meaning is 6 months higher than Motor. These suggest
moderate differences of levels of abilities of Normal girls. Verbal Meaning, Perceptual Speed and Quantitative abilities appear to be about the same for this group.

GROUP SEX DIFFERENCES

An inspection of mean mental age scores on each of the PMA variables revealed no apparent differences attributable to sex.

TABLE 10
A COMPARISON OR SEX DIFFERENCES ON PRIMARY MENTAL ABILITIES TEST VARIABLES BY MEAN MENTAL AGE SCORES

<table>
<thead>
<tr>
<th>Variable</th>
<th>TMR boys</th>
<th>TMR girls</th>
<th>EMR boys</th>
<th>EMR girls</th>
<th>Normal boys</th>
<th>Normal girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Meaning</td>
<td>5.8</td>
<td>5.8</td>
<td>6.2</td>
<td>6.4</td>
<td>6.2</td>
<td>6.4</td>
</tr>
<tr>
<td>Perceptual Speed</td>
<td>6.0</td>
<td>5.10</td>
<td>6.2</td>
<td>6.4</td>
<td>6.2</td>
<td>6.6</td>
</tr>
<tr>
<td>Quantitative</td>
<td>5.6</td>
<td>5.6</td>
<td>6.6</td>
<td>6.8</td>
<td>6.4</td>
<td>6.6</td>
</tr>
<tr>
<td>Motor</td>
<td>5.4</td>
<td>5.6</td>
<td>6.0</td>
<td>5.8</td>
<td>5.10</td>
<td>5.10</td>
</tr>
<tr>
<td>Space</td>
<td>4.10</td>
<td>4.10</td>
<td>5.6</td>
<td>5.6</td>
<td>5.10</td>
<td>6.0</td>
</tr>
</tbody>
</table>

As can be seen by Table 10, between-sex differences on each of the variables are all less than six months. In many cases, both sexes earned exactly the same mean mental age score.
The hypotheses of the study are restated here, together with statements as to their acceptance or rejection in light of statistical results. A full discussion will follow in the next Chapter of this study.

$H_1$: The interrelations of primary mental abilities of trainable mentally retarded children will not be significantly different from the patterns of normal children of the same mental age. (Rejected).

$H_2$: The interrelationships of primary mental abilities of educable mentally retarded children will not be significantly different from the patterns of normal children of the same mental age. (Accepted).

$H_3$: The interrelations of primary mental abilities of trainable mentally retarded children will not be significantly different from the patterns of educable mentally retarded children of the same mental age. (Rejected).
CHAPTER V
SUMMARY, DISCUSSION AND CONCLUSIONS

SUMMARY

Since Binet's time, mental age scores have been used to signify levels of intellectual performance. For example, when a child achieves a mental age of 6 on a mental age scale, it is often assumed that his performance equals the average performance of six-year-old children in the general population. The value of this assumption is the extent to which children who achieve the same mental age score are alike in their mental abilities.

The purpose of this study was to investigate the possibility of the existence of a qualitative difference among the organization of intelligence of trainable mentally retarded children, educable mentally retarded children and/or children of normal intelligence of similar mental ages.

This study has attempted to find out if children with similar mental ages but varying chronological ages have the same mental abilities. Does a MA of 6, for example, earned by a group of six-year-old children of normal intelligence differ qualitatively from a mental age of six achieved by a group of nine-year-old educable mentally retarded children or by a group of thirteen-year-old trainable mentally retarded children?
To provide data for this purpose, the SRA Primary Mental Abilities Test for Ages 5 to 7 was employed. This instrument provides scores on five separate mental abilities. Comparisons were made of the interrelationships among and within groups of TMR, EMR, and Normal children on the five mental abilities.

The test was administered to ninety children. Thirty were TMR children in community classes; thirty were EMR children in special classes for the mentally retarded; and thirty were children of normal intelligence in kindergarten and first grade classes. Each group had fifteen boys and fifteen girls. All ninety subjects had approximately the same mental age. All the testing was done by the investigator. Social class status and physical condition were also controlled in this study. Children with gross motor disabilities were excluded. The range of mental test scores within each group and among groups was done by converting raw scores into standard scores. For each group, intercorrelations were computed among subtests and among total mental age equivalency scores on the test instrument.

The findings of this study were presented narratively and graphically. Comparisons of the scores on the five subtests by TMR, boys and girls; EMR, boys and girls; and Normal, boys and girls; were made. It was hypothesized that the interrelations of primary mental abilities of trainable mentally retarded children would not be significantly different from the patterns of EMR children of the same mental age. This hypothesis was rejected. A comparison between the mental age performance score of TMR boys and EMR boys yielded a t score differ-
ence of 2.76. This difference was statistically significant beyond the .05 level on total scores for the five variables. The t score difference of mental age performance of TMR girls and Normal girls was 2.79. This difference was statistically significant at the .01 level.

EMR boys' mental age performances were higher than TMR boys' on all five subtests. Higher scores for EMR boys varied from two months in Perceptual Speed to 12 months in Quantitative ability. EMR girls also had higher mental age performances than TMR girls on all five subtests. The higher scores varied from two months in motor to 14 months in Quantitative ability.

A second hypothesis was the interrelationships of primary mental abilities of trainable mentally retarded children would not be significantly different from the patterns of normal children of the same mental age. This hypothesis was also rejected. When TMR boys and Normal boys mean mental age performance scores were compared, the t score difference was 3.97. A comparison of performance scores of TMR girls and Normal girls yielded a t score difference of 3.68. Both these differences were statistically significant beyond the .001 level.

The Normal groups had higher mental age performance scores than their TMR counterparts on all five subtests. Normal boys' levels of performance over TMR boys' varied from six months in Verbal Meaning, Perceptual Speed and Motor abilities to twelve months in Space ability and Normal girls' levels of performance over TMR girls varied from four months in Motor to fourteen months in Space ability.
A third hypotheses was that the interrelationships of primary mental abilities of educable mentally retarded children would not be significantly different from the patterns of normal children of the same mental age. This hypotheses was accepted. The t score difference between the mean mental age performance of EMR boys and Normal boys on the five subtests was only .48. The t score difference between EMR girls and Normal girls was only .78. Neither difference is significant. In fact, the difference between EMR and Normal children is so slight that it indicated there were no real differences in ability. EMR boys' performances were slightly higher than normal boys in Quantitative and Motor, the same in Verbal Meaning, and slightly lower in Perceptual Speed and Space. EMR girls' performances were slightly higher than Normal girls in Quantitative, the same in Verbal, and slightly lower in Perceptual Speed, Motor, and Space abilities.

Profiles were made of each group. These profiles permitted a direct interpretation of relative performances on the subtests for each group. TMR and EMR subjects had more intra-group variability than normal children. The mental age performances of TMR boys had a spread of fourteen months, from 6.0 in Perceptual Speed to 4.10 in Space. TMR girls also had their largest variation in Perceptual Speed and Quantitative abilities. The difference was twelve months. EMR boys' subtests scores varied the most between Quantitative, 6.8 and Space, 5.6. EMR girls' scores also changed the most between Quantitative, 6.8 and Space, 5.6. The two Normal groups' largest difference between subtests
was only eight months. The boys' difference was between Perceptual Speed at 6.6 and Motor and Space abilities, both at 5.10. Normal girls performed highest in Perceptual Speed at 6.6 and lowest in Motor at 5.10.

Inspection of mean mental age performance scores on each of the PMA variables revealed no apparent sex differences. Between-sex differences were all less than six months on all five variables. In several cases, both sexes earned exactly the same mental age score in one or more of the subtest.

DISCUSSION

The results of this study suggest that measurement of differential mental abilities in normal and retarded children is possible. An investigation of the SRA intercorrelations indicated that separate abilities do exist and can be separately measured.

Significant differences were found between abilities of TMR children and EMR children and between TMR children and Normal children. The difference between TMR and EMR children was greatest in Quantitative ability. A possible explanation for this is the curriculum. TMR children were enrolled in programs which emphasized self-help activities. To the contrary, the curriculum for EMR children stressed the development of number and reading skills. It appeared to this investigator that the EMR children were very much interested in showing off their quantitative abilities. Possibly, most were enjoying their first successes with numbers and were highly motivated. This kind of "Hawthorne effect" did not hold true for the TMR. TMR children, when
compared to Normals, fared the poorest on Space ability. This, too may be a result of curriculum. Many teachers have been trained that the mentally retarded learn best when they are given concrete experiences and much repetition. Space ability is defined "as the ability to think about objects in two or three dimensions." Retarded children are not usually exposed to this kind of training.

While their performance is lower, TMR children were most like EMR and Normal children in motor ability. Numerous investigators have pointed to a superiority of the dull in tasks which require manual manipulation skills for successful performance.

This study also demonstrated that little, if any, differences existed in the level of performance between EMR and Normal children. The data suggests mental abilities in these two groups are very much alike. It appears the only difference between EMR children and normal children on the PMA subtests was their rate of mental development.

It seems justified to conclude that the TMR subjects showed more unevenness on intra-group variability than EMR or normal children. Perhaps, this can be explained by the fact that the TMR subjects are older. Garrett\(^1\) in his developmental theory of intelligence suggested that the relative dominance of Spearman's \(G\) decreases with age, resulting in the emergence of more specific factors. This suggests

that chronological age is more of an influence than this writer had hypothesized. Also, although there were no gross motor disabilities within the TMR group, it is probably safe to assume that organismity could account for some of the erratic profiles and qualitative differences from the other two groups.

CONCLUSIONS

It is curious that so few investigators have been concerned with the problems of subtest patterns in retardates. An appraisal of intelligence level and pattern would seem to be one of the prime functions of the psychologist in working with the mentally retarded. The curriculum is the responsibility of the teacher and educator. The teacher needs adequate diagnosis and prognosis to determine the experiences that will be of greatest value to the mentally retarded child. Teachers and educators need to be able to design a clinical educational program specifically planned for each individual based upon his strengths and weaknesses. It is this writer's hope, that in the future, there be more testing which goes beyond a single IQ score. Perhaps in thinking about practical applications, better planning lies in knowing a child's specific mental abilities.

It was hoped that the use of the PMA test would help to clarify some of the issues relating to the organization of mental abilities of children with varying intellectual abilities. In general, this hope was not realized. Although differences were found to exist between retarded and normal children, the specific findings were not consistent.
The writer also recognizes that much of his discussions assertions were highly speculative. This study does not offer valid enough answers to account for the poor showing of TMR children. One suggestion for future research is to extend the testing to children of older mental ages and use of the *PMA Test Battery for Ages 7 to 11.*
APPENDIX
## APPENDIX A

### SCALE FOR RATING OCCUPATIONS

<table>
<thead>
<tr>
<th>Rating Assigned to Occupation</th>
<th>Professions</th>
<th>Proprietors and Managers</th>
<th>Business Men</th>
<th>Clerks and Kindred Workers, Etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lawyers, doctors, dentists, engineers, judges, high-school superintendents, veterinarians, ministers (graduated from divinity school), chemists, etc. with post graduate training, architects.</td>
<td>Businesses valued at $75,000 and over</td>
<td>Regional and divisional managers of large financial and industrial enterprises.</td>
<td>Certified Public Accountants.</td>
</tr>
<tr>
<td>2</td>
<td>High-school teachers, trained nurses, chiropists, chiropractors, undertakers, ministers (some training) newspaper editors, librarians (graduate).</td>
<td>Businesses valued at $20,000 to $75,000.</td>
<td>Assistant managers and office and department managers of large businesses, assistants to executives, etc.</td>
<td>Accountants, salesmen of real estate, of insurance, post-pasters.</td>
</tr>
<tr>
<td>3</td>
<td>Social workers, grade-school teachers, optometrists, librarians (not graduate), undertaker's assistant, ministers (no training).</td>
<td>Businesses valued at $5,000 to $20,000.</td>
<td>All minor officials of businesses.</td>
<td>Auto salesmen, bank clerks and cashiers, postal clerks, secretaries to executives.</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Businesses valued at $2,000 to $5,000.</td>
<td></td>
<td>Stenographers, bookkeepers mail clerks</td>
</tr>
</tbody>
</table>

(CONTINUED)
## APPENDIX A
(CONT)

### SCALE FOR RATING OCCUPATIONS

<table>
<thead>
<tr>
<th>Rating Assigned to Occupations</th>
<th>Professions</th>
<th>Proprietors and Managers</th>
<th>Business Men</th>
<th>Clerks and Kindred Workers, Etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>Businesses valued at $500 to $2,000.</td>
<td></td>
<td>Dime store clerks, hardware salesmen, beauty operators.</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Business valued at less than $500.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>(Continued)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rating Assigned to Occupation</td>
<td>Manual Workers</td>
<td>Protective and Service Workers</td>
<td>Farmers</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------</td>
<td>--------------------------------</td>
<td>------------------------------</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Contractors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Electricians, Plumbers,</td>
<td>Dry cleaners, Butchers,</td>
<td>Tenant farmers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carpenters</td>
<td>Sheriffs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Time keepers, linemen,</td>
<td>Barbers, firemen, policemen:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>radio repairmen.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Moulders, semi-skilled workers.</td>
<td>Baggage men, truck drivers</td>
<td>Small tenant farmers</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Heavy labor, odd-job men.</td>
<td>Janitors, scrub women.</td>
<td>Migrant farm laborers.</td>
<td></td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY


