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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

PARTIAL VALIDATION OF THE SLOSSON INTELLIGENCE TEST

A DISSERTATION

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degree of

DOCTOR OF EDUCATION

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HUGH DANIEL O'NEILL, JR.

Norman, Oklahoma

1969

PARTIAL VALIDATION OF THE SLOSSON INTELLIGENCE TEST

APPROVED BY

DISSERTATION COMMITTEE

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TABLE OF CONTENTS

		Page
ACKNOWLEDGEMENTS		iii
LIST OF TABLES		vi
Chapter		
I.	INTRODUCTION	1
	Statement of Problem	
	Purpose of the Study	
	Limitations of the Study	
	Procedure of the Study	
II.	REVIEW OF RELATED LITERATURE	8
	Introduction	
	Period I - Early Theoretical Development	
	Period II - Early Development of Individual Measurement	
	Period III - Development of Group Measurement	
	Period IV - Development of Multiple Batteries	
	Survey of Selected Investigations	
	WISC - Short Forms	
III.	DESIGN OF THE STUDY	28
	The WISC	
	Organization of the Scale	
	Standardization Sample	
	Reliability and Related Data for the WISC Tests	
	The Slosson Intelligence Test (SIT) for Children and Adults	
	Organization of the Scale	
	Standardization Sample	

Page

IV. STATISTICAL ANALYSIS 39

Correlation Matrix
Factor Analysis

V. SUMMARY AND RECOMMENDATIONS. 45

Introduction
The Proposed Method

BIBLIOGRAPHY 48

LIST OF TABLES

Table		Page
1.	Short Form Correlations With WISC Full Scale	23
2.	Verbal Scale and Performance Scale of the WISC . . .	30
3.	Reliability and Standard Error of Measurement of the WISC Tests N=200 for Each Age Level	33
4.	Standardization Sample of SIT	36
5.	IQ Correlations Between the Stanford-Binet, L-M and SIT	37
6.	Intercorrelations of Raw Scored Means and Standard Deviations of Variables for Selected Population (N=94)	40
7.	Factor Matrix	43

CHAPTER I

INTRODUCTION

The early and accurate identification of the intellectual problem, the emotional problem, or the motor-skill problem of the scholastically retarded is considered basic if an effective remedial program for the individual student is to be established. In order to accomplish this identification, procedures are relatively uniform. With minor variations, the following is considered typical.

First, the teacher observes the student in a class room situation. Based upon this observation a referral form is completed. The form allows for the inclusion of the teacher's value judgment in that some question is included such as: "In your opinion, what is the cause of . . . . . ?"

Upon completing the referral, the teacher submits the form to the administrator for further comment and opinion. From the administrator the referral is given to the school nurse, the supervising teachers, the speech and reading specialists, all of whom submit judgments and opinions. Finally, the referral comes to the attention of the school psychologist who has the problem of sifting and evaluating the submitted information and opinions and subsequently recommending an operable and remedial program to the teacher.

The psychologist is limited, in some instances by law, as to the extent of his investigation of the student referred. The current (1968) Education Code of the State of California contains the following:

> Act 10901. No test, questionnaire, survey, or examination containing any question about the pupil's personal beliefs or practices in sex, family life, morality and religion, or any question about his parents' or guardians' beliefs and practices in sex, family life, morality and religion, shall be administered to any pupil in kindergarten or Grade 1 through Grade 12, inclusive, unless the parent or guardian of the pupil is notified in writing that such test, questionnaire, survey, or examination is to be administered and the parent or guardian of the pupil gives written permission for the pupil to take such test, questionnaire, survey, or examination.

Further, the State of California[1] currently authorizes only the following tests for diagnostic purposes:

1. Stanford Binet Scale, form L-M
2. Wechsler Adult Intelligence Scale
3. Wechsler Intelligence Scale for Children
4. Wechsler Pre-school and Primary Scale of Intelligence
5. California Tests of Mental Ability
6. Henman-Nelson Tests of Mental Ability, revised
7. Lorge-Thorndike Intelligence Test, Full Scale
8. SRA Tests of Educational Ability
9. School and College Ability Tests

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[1]Paul D. Plowman, Changes in Regulations of the Mentally Gifted Minor Programs, State of California, Department of Education, Sacramento, California, November 21, 1967.

Tests 1-4 are individual tests of mental ability and Tests 5-8 are group tests. The above tests are authorized for use in the identification of the mentally retarded, both educable and trainable, and the educationally handicapped or physically handicapped minor.

In general then, the amount of test information available to the school psychologist is restricted by the amount and type of data he is allowed to gather. Considering the foregoing, combined with the extreme difficulty encountered in obtaining parental approval for testing in some instances, the psychologist is on occasion restricted from using projective devices and accordingly restricted to the information available in the standard tests listed. It is granted that every testing session reveals pertinent information over and above that contained in the test. But this yield is random and as a result the usefulness of the added information is unpredictable.

In actual practice, the permitted individual tests require a minimum time of forty-five minutes to an hour or more to properly administer. While this is not prohibiting, the pressing need for a more rapid screening device which will furnish information equivalent to that furnished by the listed instruments is outlined by the following:

The School Psychologist in Nevada County, California, is attached to the County Superintendent of School's office. He has no staff, nor do the various schools for which he is responsible have a staff qualified under state regulations to test for placement in an exceptional program. Accordingly, this single individual is responsible for testing arising from teacher or administrative referrals from a total student population of approximately 4,000 individuals. During the period December 1, 1967, to March 1, 1968, some sixty cases were referred for

individual testing. Of these cases identified by their teachers or administrators as academically retarded, only three were subsequently identified as true retardates and placed in special classes. Meanwhile, a minimum of sixty plus hours were spent in individual testing by the single school psychologist. During this period, identification of the gifted was suspended. Further, individual curriculum development work with teachers leading to the advancement of those cases identified as not retarded sufficiently for special class placement, had to await completion of the individual testing. Similarly, retesting of the Special Education student was delayed. Granted, the present unhappy condition of the rural school psychologist could be alleviated by an expanded staff, it is considered improbable, in view of local attitudes and corresponding budgetary limitations, that this staff will be made available in the immediate future. The situation described is not considered unusual for a person working in the rural school areas.

Enburg, Rowley and Stone[1] make the following observation which in effect adequately summarizes the individual evaluation problem as interpreted by a good percentage of school psychologists as well as clinical psychologists.

> ". . . the psychologist is frequently faced with the problem of obtaining the maximum amount of information in the minimum amount of time. Often information is desired regarding the intellectual functioning of the child as well as his personality dynamics. Particularly with the emotionally disturbed child, a question about his intellectual ability may arise, as the presenting problem frequently centers on his inability to adjust

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[1] Richard Enburg, Vinton N. Rowley, and Beth Stone, "Short Forms of the WISC For Use With Emotionally Disturbed Children," Journal of Clinical Psychology: III (1961), pp. 280-84.

> in the school situation. This raises the problem of determining whether the child is having academic difficulty associated with intellectual factors, emotional factors, or both. If consideration of time enters into the selection of testing materials, the psychologist must select a relatively brief test of intellectual functioning in order to devote more time to personality evaluation."

There can be no doubt that "time" is a factor to be considered in the selection and administration of testing materials.

As a practical solution to the above, a search was made for a reasonably quick, reliable, screening instrument. The Slosson Intelligence Test for Children and Adults[1] apparently answered the requirements.

Statement of the Problem

The problem of this study was an attempt to establish partial validity of the Slosson Intelligence Test for Children and Adults as a screening instrument for children. More specifically, answers to the following questions were sought:

(1) What abilities does the Slosson Intelligence Test measure?

(2) What specific practical application can be made as a result of administering this test?

(3) Does the Slosson Intelligence Test (hereafter referred to as SIT) reveal areas of differentiation equivalent to those revealed by the Wechsler Intelligence Scale for Children (hereafter referred to as WISC)?

The problem, therefore, consisted in the isolation and comparison of the

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[1] Richard L. Slosson, Slosson Intelligence Test For Children and Adults, (East Aurora, New York: Slosson Educational Publications, 1963).

factors yielded by the scores obtained on the two standardized instruments in this investigation.

Purpose of the Study

Experience as a school psychologist in the field indicates that there is no available intelligence test which can be quickly and easily administered by a school administrator, a teacher, a psychologist, or other interest adult, which sufficiently identifies areas of deficiency and remediation for a particular student. Nevertheless, psychologists continue to use the WISC extensively upon the assumption that this test contradicts the foregoing and does in fact identify specific remedial problems. This dichotomy gives rise to the need to undertake an analysis of the WISC as it refers to a specific population. Because the administration of the WISC is generally restricted to trained individuals, i.e., school psychologists, the purpose of this study, therefore, was the investigation of the adequacy of the more simple SIT to reveal similar information revealed by the administration of the two tests to a population established by teacher referrals.

Limitations of the Study

The investigations were necessarily limited by a number of factors. In order to keep the data within the limits of the instruments generally utilized by the working school psychologist, only two standard tests were employed in the analysis. These tests, with the subtests of one of them, the WISC, yielded a controlled total of thirteen variables. The sample was relatively small (N-94). Other restrictive factors characterized the sample in that it was comprised of males who were referred by

their various teachers for academic difficulties. Finally, the technique of multiple factor analysis achieves no more than to yield data which are indicative of the use of one or more abilities in a given test performance by the specific sample under consideration.

Procedure of the Study

The thirteen variables used as the basis for the computation of the coefficients of correlation in this study were derived from the scores on eleven of the twelve subtests of the WISC, the full scale score of the WISC and the score of the SIT. The specific subtests of the WISC employed were: General Information, General Comprehension, Arithmetic, Similarities, Vocabulary, Digit Span, Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Coding. The tests were administered with strict adherence to the directions for administration found in the respective manuals. Both the WISC and the SIT were administered at the same setting with a ten minute interval between tests. All tests were administered by the same individual and all tests were hand scored by him. The WISC raw scores obtained were translated into equivalent test ages by the administrator in accordance with the instructions contained in Appendix E of the WISC test manual. These test ages were used with the test age of the SIT to establish a table of correlations and a matrix of intercorrelations which was factor analyzed. The original coefficients of correlations of the raw data were obtained from the Computer Center of the University of California at Davis. The factor analysis of this table of coefficients of correlation was performed by the Computer Center of the University of Oklahoma at Norman.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

An extensive literature concerning the nature and structure of human abilities has accumulated during the past several decades. For explanatory purposes this information can be divided into several periods. A brief summary of the contributions during a period is presented. For an extensive coverage of the more important developments, the reader is referred to the recent publication by Nunnally.[1]

Period I - Early Theoretical Development

Charles Darwin was of primary importance in the development of all studies relating to living organisms. The question of the survival value of various actions to the individual, to the group, and/or to the species was raised by his work. Of psychological importance was his concept that if individual differences among the various sub-human species relate to the differences in survival rate, individual differences in human beings may relate to the survival rate of the human species. These differences should be identifiable and measurable.

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[1] J. C. Nunnally, Psychometric Theory (New York: McGraw Hill Book Co., 1967).

Francis Galton was influenced by the work of Darwin. Galton became convinced that most human traits were inherited, including abilities and personality characteristics. He theorized that the human speeies could be improved through selective mating.

Galton attempted to measure human attributes and to accomplish this, developed mental tests, and test standardization procedures. In Galton's time the concept was present that all knowledge comes through the senses. Accordingly, the conclusion was made that the person with the most acute senses would be the most knowledgeable. Because of this orientation he developed a variety of physiological tests, and because of a generated need he developed the first steps leading toward correlation of analysis.

Working concurrently with Galton, Karl Pearson developed the statistical methodology required for the study of individual differences. He was responsible for the parametric correlation coefficient, multiple correlation, partial correlation and also was responsible for the early development of multivariate analysis including factor analysis.

James McKeen Cattell was prominent in the establishment and development of psychological testing in the United States. In an 1890 article[1] he described a series of tests which were administered to college students in an effort to determine intellectual ability. The individually administered tests followed Galton's view that a measure of intellectual function could be measured through tests of sensory discrimination and reaction time. The concept that these functions could be

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[1]Ann Anastasi, Psychological Testing (New York: The MacMillan Co., 1961).

measured with precision and accuracy was a determining factor in their choice.

Period II - Early Development of Individual Measurement

Alfred Binet's early work in the area of human abilities followed the lead of Galton in that he was concerned with the variations among individuals of sensory discrimination and physical attributes. Faced with the problem of defining subnormal children in the French Schools, Binet departed from the investigations of the specific differences in abilities and proceeded to investigate over-all intellectual ability. In collaboration with Theodore Simon, Binet completed his first global measure of over-all intellectual ability in 1905 which he revised in 1908 and again in 1911.

Binet's work was of primary importance in that he utilized previous experience to develop his evidence. With Binet's work the subsequent development of practical measures of intelligence was rapid.

Binet's work was established in the United States with the development of the Stanford-Binet[1] developed under the direction of L. M. Terman. In his test Terman introduced the ratio between mental age and chronological age as IQ. The latest revision of the Stanford-Binet still enjoys widespread popularity.

Period III - Development of Group Measurement

The advent of World War I generated a demand for a practical rapid classification of the million and a half military recruits. The

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[1] L. M. Terman, The Measurement of Intelligence (Boston: Houghton Mifflin, 1916).

Binet tests, requiring oral responses, or individual manipulation of materials, were basically individual clinical instruments and as such were not suited for group administration. Because of the existing demand, a committee of the American Psychological Association was established under the direction of Robert M. Yerkes to arrive at a solution. The committee, drawing upon all available information, was especially indebted to Arthur S. Otis, who made his unpublished group intelligence test available. As a result of the work of this group, the Army Alpha and the Army Beta tests were developed. The Alpha test was designed for routine testing and the non-language Beta test was designed for language deficient recruits. Both tests were designed for large scale group administration.

As a result of the Army tests, subsequent to World War I, the testing movement experienced a tremendous growth. Because the tests were crude, and because they were used randomly and produced random results, there was as much dissatisfaction as satisfaction which generated during the 20's regarding the utility of psychological testing.

Period IV - Development of Multiple Batteries

Following the rapid and indiscriminate use of both individual and group tests of intelligence during the twenties, it became apparent that the existing tests were limited in their utility. The problems facing the testors then, as now, included prediction of success in school at all levels or success in specific occupations. Even though the intelligence tests developed during this period were designed to estimate an individual's general intellectual level, the tests were limited in their

coverage[1]. More precise information than that required for global measurement was needed. The question arose regarding the precise type of information an individual test was able to yield. As a partial answer to this question, combined with the recognition that many of the intelligence tests developed during the period were measuring a combination of special abilities demanded by academic work, the practice of using differential aptitude tests to supplement the existing intelligence tests became prevalent.

Coincidentally with the demonstrated need for differential aptitude tests, a "parallel development in the study of trait organizations was gradually providing the means for constructing such tests."[2]

Charles Spearman in England, like Binet, was concerned with the nature of human abilities. Nunnally[3] states:

> . . . Implicit in Binet's efforts to measure intelligence was the assumption that either there is only one factor of intelligence or intelligence is dominated by one factor.

Following this assumption, Spearman developed a mathematics to test the hypothesis of a general factor. His book The Abilities of Man summarizes his work.[4]

In his early work Spearman attributed individual differences in tests of ability to two factors. The first, a general factor g, and

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[1]Anne Anastasi, Psychological Testing (New York: The McMillan Company, 1961).

[2]Anne Anastasi, Psychological Testing (New York: The McMillan Company, 1954).

[3]Nunnally, op. cit.

[4]C. Spearman, The Abilities of Man (New York: The McMillan Company, 1927).

the second, a specific factor, s. He later modified his concept that the general factor g was sufficient to explain the correlation among various tests, and that s was able to explain the variance, and recognized the need for more detailed exploration of the specific factors, especially if the activities compared were very similar. In this case, a certain amount of correlation might exist over and above that explained by the g factor.

Spearman pioneered in the development of mathematical models for studying the general factor g, and the specific factors. His Two-Factor Theory became the basis of further studies and finally led to the development of factor analysis.

Primarily through the work of L. L. Thurstone, the development of factor analysis during the 1930's went beyond Spearman's limited model. Thurstone considered that general intelligence was too vague and heterogenous a construct to be worth measuring. He theorized that g should be broken into components which would result in a measurable profile of factors.[1] Following the lead of Kelly[2], Thurstone asked the question: How many and what kind of factors are needed to account for observed correlations among tests of ability?[3] He then proceeded to develop a methodology to answer his question.

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[1]Phillip E. Vernon, "Ability Factors and Environmental Influences," American Psychologist (1965), pp. 723-33.

[2]T. L. Kelly, Essential Traits of Mental Life (Cambridge, Mass., Harvard University Press, 1928).

[3]Nunnally, op. cit.

Thorough coverage of Thurstone's methodology was contained in several publications, including his book Multiple Factor Analysis.[1] In addition, an excellent presentation of the problems faced by factor analysts during the 1940's was contained in the article Primary Mental Abilities of Children.[2]

In general, Thurstone concluded that several group factors existed which could be identified as primary mental abilities. Those most frequently corroborated are quoted from Anastasi:[3]

> V. Verbal Comprehension: The principal factor in such tests as reading comprehension, verbal analogies, disarranged sentences, verbal reasoning, and proverb matching. It is most adequately measured by vocabulary tests.
>
> W. Word Fluency: Found in such tests as anagrams, rhyming, or naming words in a given category (e.g. boys' names or words beginning with the same letter).
>
> N. Number: Most closely identified with speed and accuracy of simple arithmetic computations.
>
> S. Space: It is possible that the factor may represent two distinct factors, one covering perception of fixed spatial or geometric relations, the other manipulatory visualizations, in which changed positions or transformations must be visualized. There is also evidence of a third factor of "kinaesthetic imagery."
>
> M. Associative Memory: Found principally in tests demanding rote memory for paired associates. There is some evidence to suggest

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[1]L. L. Thurstone, Multiple Factor Analysis (Chicago, Ill., University of Chicago Press, 1947).

[2]Thelma G. Thurstone, Primary Mental Abilities of Children. Reprinted in Jim C. Nunnally, Psychometric Theory, p. 436, from Educational and Psychological Measurement (1941), pp. 105-116.

[3]Anastasi, op. cit., pp. 344-54.

that this factor may reflect the extent to which memory crutches are utilized. The evidence is against the presence of a broader factor through all memory tests. Other restricted memory factors, such as memory for temporal sequences and for spatial position, have been suggested by some investigations.

P. Perceptual Speed: Quick and accurate grasping of visual details, similarities, and differences. This factor may be the same as the speed factor identified by earlier investigators. This is one of several factors subsequently identified in perceptual tasks.

I (or R) Induction (or General Reasoning): The identification of this factor was least clear. Thurstone originally proposed an inductive and a deductive factor. The latter was best measured by tests of syllogistic reasoning and the former by tests requiring the subject to find a rule, as in a number series completion test. Evidence for the deductive factor, however, was much weaker than for the inductive. Moreover, other investigators suggest a general reasoning factor best measured by arithmetic reasoning tests.

The further identification of factors was given impetus by World War II and through the war and post war periods, advanced from the dozen or so proposed by Thurstone to forty well identified factors described by French in 1951.[1] Guilford in 1956 listed some fifty factors and proposed a model for the structure of intellect which yields a possible 120 factors. In Guilford's 4x5x6 model, intellectual activities were defined by contents, products, and operations. Operations was composed of evaluation, convergent thinking, divergent thinking, memory, and cognition. Products contained units, classes, relations, systems,

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[1] J. W. French, "The Description of Aptitude and Achievement Tests in Terms of Rotated Factors." Psychometric Monographs No. 5 (Chicago, Ill.: University of Chicago Press, 1951).

transformations, and implications, while contents enclosed figural, symbolic, and semantic, and behavioral operations. Guilford's article contained a detailed presentation of modern thinking about human abilities.[1]

The advent of the computer established a growing interest in factor analysis. Pre-computer techniques of factor analysis have been rigorously examined for statistical efficiency and have been replaced by mathematically elegant procedures. Nunnally concludes:

> . . . Because of the opportunities for developing elegant, highly complex methods related to factor analysis, there has been a tendency to overdo the mathematical requirements of factor analysis and underdo the requirements of factor analysis for empirical research. This is a bad case of the 'tail wagging the dog.'
>
> In judging the usefulness of a particular method of analysis, the experimentor should ask himself, 'How much will this help my program of research?' Looking at it in this way, one will see that many of the mathematical issues in the literature of factor analysis concern inconsequential problems for empirical research are frequently subverted by Rube Goldberg mathematical developments. This book will argue that some of the simpler approaches are not only more practical, but also more commensurate with the strategies of empirical research.[2]

Despite the above, the methodology of factor analysis was becoming the domain of the specialist. Nunnally recognized this trend and made the following statement later in his text:

> . . . Whereas almost anyone can understand the mathematics of the centroid method, few nonspecialists will fully understand the mathematics of principal axis. Consequently,

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[1] J. P. Guilford, "The Three Faces of Intellect," American Psychologist, XIV (1959), pp. 469-79.

[2] Nunnally, op. cit., p. 290.

> investigators will, in many cases, have to work with methods whose mathematical innards are something of a mystery.[1]

Kaiser, who has "carried out more factor analysis calculations of the theoretical sort on electronic computers than anyone walking on earth" observes:

> . . . Back in the Dark Ages before computers, a researcher would do some very serious psychologizing before he increased the scope of his study---nowadays, unfortunately, he can add unrationalized variables to his matrices without blinking an eye. This seems undesirable, of course.[2]

The current status of factor analytical methodology may be summarized by a further quotation from Kaiser:

> . . . the implication of computers to factor analysis is still on the horizon. Through their use, we will in the future, more fully be able to capitalize on the before-his-time mathematical and scientific genius of Louis Guttman, the before-his-time statistical genius of Harold Hotelling, and perhaps most important, allow us to translate and interpret the inspired intuitive scientific genius of L. L. Thurstone.[3]

Despite the current inconclusiveness of the best methodology to utilize in studies involving factor analysis, several tentative conclusions can be formed from the investigations completed to date.

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[1] Nunnally, op. cit., p. 317.

[2] Henry F. Kaiser, "The Application of Electronic Computers to Factor Analysis," Educational and Psychological Measurement, XX, No. 1 (1960), pp. 141-51.

[3] Ibid., p. 151.

The three domains hypothesized by Bloom, the cognitive, the affective, and the psychomotor domains do exist and human abilities appear to reflect an interaction of these domains.[1] Cognitive factors have been tentatively identified as verbal and mathematical which, in turn, have sub factors tentatively identified as spatial, memory, perceptual speed, and reasoning.

Affective factors had only recently come under investigation and as yet were in the descriptive stage rather than the analytical stage. However, the work of the neo-behavior psychologists can be expected to produce identifiable factors in this area.

The manipulative or motor-skill area had been investigated by Robert E. Vallett.[2] His work identified fifty-four learning disorders in the area with practical suggestions for remediation.

French summarized the conclusions of the factor analyst through 1951 with the statement:

> . . . The most parsimonious hypothesis for mental structure is that it contains a rather large number of frequently overlapping, causally unrelated factors, which vary greatly in comprehensiveness and which are produced by units of experience, by hereditary mechanisms, or by any combination of these two types of influences.[3]

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[1]Benjamin S. Bloom, Taxonomy of Educational Objectives (New York: Longmans, Green and Co., 1956).

[2]Robert E. Valett, The Remediation of Learning Disabilities (Palo Alto, California: Feron Publishers, 1967).

[3]French, op. cit.

While there was substantial agreement with this statement, total agreement was lacking. Current thinking as exemplified by Guilford[1] and Vernon[2] indicated that there was a relationship between the factors and that this relationship argued for the acceptance of a "hierarchic" model as best describing the structure of human abilities.

Survey of Selected Investigations

The factor analytical studies reported herein were considered representative of investigations of the WISC since 1950. No similar study of the SIT was uncovered. The relevancy of the findings of the several investigations were considered in Chapter Four when an attempt was made to isolate and identify the factors operating in the population selected for this investigation.

In 1952 Hagen investigated the factor patterns of the WISC utilizing the six verbal subtests of the instrument and five of the six performance subtests.[3] Coding was omitted for two reasons: (1) because it was a speed test and, accordingly, it was not possible to complete its reliability, and (2) a different type of coding test was administered to different age groups. The subjects of the investigation were one hundred boys and one hundred girls at each of the age levels

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[1]J. P. Guilford, Fundamental Statistics in Psychology and Education (New York: McGraw Hill Book Co., 1956), p. 219.

[2]Phillip E. Vernon, "Ability Factors and Environmental Influences," American Psychologist: XX (1965), pp. 723-33.

[3]Slizabeth Pauline Hagen, A Factor Analysis of the Wechsler Intelligence Scale for Children, No. 4189 (New York: Columbia University Press, 1952).

of 5, 7, 10, 13, and 15, selected from a total of 2200 boys and girls between the ages of 5-15, inclusive, who were used to standardize the WISC.

Two sets of intercorrelations were computed from the scales scores of the subjects. The two matrices were subjected to Thurstone's method of multiple factor analysis. The general factor was studied by comparing its contribution to the total test variance at each age level. The analysis indicated that at all age levels the general factor accounted for the greatest proportion of test variance. There was no consistent increase in the contribution of the group factors as age increased.

All age levels produced a general factor and a non-verbal factor. The non-verbal factor did not include the same tests for all age groups. The factors beyond the second were unstable and accounted for a very small percentage of the variance.

In 1954, Gault[1] reported a factor analysis of the intercorrlations printed in the WISC Manual, at both the $10\frac{1}{2}$ and $13\frac{1}{2}$ year levels, and found the same general pattern of factors in the WISC as was reported by Hammar[2] for the adult scales. The correlation matrices for the WISC subtests were factorized by Thurstone's centroid method. The highest correlation in each column was assumed as communality. McNemar's test for the maximum number of significant factors was utilized and analysis was concluded after the derivation of the third factor in the analysis of

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[1]Una Gault, "Factorial Patterns of the Wechsler Intelligence Scales," Australian Journal of Psychology, VI (1954), 85.

[2]A. C. Hammar, "A Factor Analysis of Bellevue Tests," Australian Journal of Psychology, I (1950), 108-114.

both matrices. Gault concluded that there was no new evidence to contradict Hammar's arguments for interpreting the four factors as a general eductive factor, a verbal comprehension factor, a spatial-perceptual factor and a memory factor. The verbal comprehension factor and the spatial-perceptual factor corresponded roughly with the Verbal and Performance Scales.

Littell[1] reported a 1958 study by Lotsof, Comrey, Bogartz, and Arnsfield involving a factor analysis of WISC and Rorschach scores of seventy-two under-achieving children with reading disabilities. Four factors were found which the authors called verbal, intelligence, productivity, perceptual movement, and performance speed. The Verbal and Performance Scales were not factorially pure. Block Design was loaded significantly with the verbal intelligence factor and comprehension and arithmetic were loaded with the performance speed factor. The authors concluded that the verbal and performance aspects of the WISC were not independent of each other.

WISC - Short Forms

The search for a valid short form test of intelligence was generally motivated by heavy case loads and limitations of time. If a valid IQ can be obtained with only fifteen or twenty minutes investment of testing time, the psychologist can be freed to work with more cases or do additional work in other areas currently excluded by the time factor. Some research had been devoted to this problem with varied results.

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[1]William M. Littell, "The Wechsler Intelligence Scale for Children: Review of a Decade of Research," Psychological Bulletin, LVII, No. 2 (1960).

Table 1 is a summary of available information regarding the search for a short form of the WISC. Some of the results appeared encouraging, others less so. Yalowitz and Armstrong[1] found correlation ranging from .55-.61 for a heterogeneous group of Child Guidance Clinic referrals. They concluded, because of these low correlations, that their selected subtest combinations were invalid to measure the intelligence of their sample. Thompson and Finley[2] showed a correlation of .75 and concluded that an abbreviated WISC is a valid indicator of the full scale IQ of gifted children.

Mumpower[3] with a duad-WISC correlation of .95 concluded that the duad did not adequately provide results valid enough to substitute with a high degree of confidence for the whole test. Schwartz and Levitt[4] in a study of non-institutionalized, mentally retarded children obtained correlations between the Full Scale WISC score and the individual subtests, and all possible duads, triads, tetrads, pentads, and hexads of subtests for a group of such children. They concluded that only pentad and hexad short forms can be substituted for the Full Scale WISC with relatively small loss in accuracy of prediction.

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[1] J. M. Yalowitz and R. G. Armstrong, "Validity of Short Forms of the Wechsler Intelligence Scale for Children (WISC)," Journal of Clinical Psychology, XI (1955), pp. 275-277.

[2] Jack M. Thompson and Carmen J. Finley, "An Abbreviated WISC for Use With Gifted Elementary School Children," California Journal of Educational Research, XIV, No. 4 (1963), pp. 167-177.

[3] Daniel M. Mumpower, "The Fallacy of the Short Form," Journal of Clinical Psychology, XX, No. 1 (1964), pp. 111-113.

[4] Lewis Schwartz and Eugene E. Levitt, "Short Forms of the Wechsler Intelligence Scale for Children in the Educable Non-Institutionalized, Mentally Retarded," Journal of Educational Psychology, LI, No. 4 (1960), pp. 187-190.

TABLE 1

SHORT FORM CORRELATIONS WITH WISC FULL SCALE

Author	N	Year	Subtests	Subjects	Correlation
Carleton and Stacey	365	1954	21 Short Forms Duads Through Pentads	Mental Defectives	.64-.88
Yalowitz and Armstrong	229	1955	Tetrads and Pentads	Heterogeneous Child Guidance Clinic Ref.	.55-.57
Smith	133	1956	Duads-triads Tetrads-Pentads	Age 13.5	.87-.96
Finley and Thompson	309	1958	Best Predictor	Mentally Retarded	.896
Simpson and Bridges	120	1959	Duads	Guidance Clinic Ref.	.874
Hilman and Fisher	145	1960	All Possible Duads Through Hexads	Mentally Retarded	.789-.936
Sosulski	80	1961	Abbreviated Scale	Special Class Matched Pairs	.84-.90
Enburg, et al	145	1961	Duads, Triads Tetrads	Emotionally Disturbed	.91-.96
Wight	83	1962	Duad	Physically Disabled	.91
Osborne and Allen	60	1962	Triads	Retardates	.800-.919
Thompson and Finley		1962	Best Predictor	Mentally Retarded	.892
Thompson and Finley	151 400	1963	Pentad	Gifted Gifted	.84 .75
Mumpower		1964	Duad	Special Ed.	.95

TABLE 1--Continued

Author	N	Year	Subtests	Subjects	Correlation
Jastak and Jastak	600	1964	Vocabulary	Pupils, age 9-15	.883-.895
Clements	92	1954	Tetrads, Pentads	Reading Disability	.947-.95
Yudin	147	1966	Selected Items	Emotionally Disturbed	.75-.98
Cole, et al	165	1967	Tetrads	Special Education	.929
Silverstein		1967	Duads Through Pentads	WISC Standardization sample	.93-.98
Silverstein		1967	Duad	WISC Standardization sample	.878
Erikson	100	1967	Abbreviated Scale	Mental Health Referrals	.80-.98

Silverstein[1] agrees with Mumfort that the best duads misclassify more than one individual in three, and even the best pentads misclassify more than one in five. This conclusion was based upon the argument that the correlational measure of validity was not as meaningful as the agreement between the short form and Full Scale in actually classifying individuals.

Wechsler and Silverstein concurred that no one would seriously advocate the use of a short form to obtain a comprehensive assessment of intellectual functions, but to obtain an IQ for screening purposes, there were combinations of duads or triads that may suffice.[2] The deciding factor must be the specific use to which the results will be put.

Thompson and Finley[3] concluded that the use of a short form of the WISC is practical with gifted children. In their study, with an N of 400 in the standardization group, the predicted IQ was within 8 points in all but three percent of the cases. Similarly, with an N of 151 in the validation group, the predicted IQ was within eight points in all but two percent of the cases. The standard error of estimate in this study was 5.11 scaled score units of 3.70 IQ points.

Thus, if a cutting score of 125 was to be used as a criterion for selection of the gifted and those with scores below two standard

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[1]A. B. Silverstein, "Validity of WISC Short Forms at Three Age Levels," Journal of Consulting Psychology, XXXI, No. 6 (1967), pp. 635-36.

[2]A. D. Silverstein, "A Short Form of the WISC and WAIS for Screening Purposes," Psychological Reports, XX (1967), p. 682.

[3]Jack M. Thompson and Carmen J. Finley, "An Abbreviated WISC for Use With Gifted Elementary School Children," Journal of Educational Research, XIV, No. 4 (1963), pp. 167-177.

errors of estimate (above 132) were included, only two or three non-gifted children in 100 would be included. The questionable range, according to Thompson and Finley, then was between 117 and 132. For children coming within these limits, the complete WISC should be administered.

Baumeister and Bartlett[1] reported a factor analytical study of the WISC records of normal children, institutionalized retardates, and non-institutionalized retardates. Factors uncovered in the study include: (1) A strong general factor (2) A verbal factor (3) A performance factor, and (4) In the case of the retardates, a weak but reliable factor consisting of Digit Span, Arithmetic, and Picture Arrangement. Included in their conclusions also was the concept that the WISC performance of the retardates is factorially more complex than that of the normals. Baumeister tentatively interpreted the fourth factor as short term memory or stimulus trace which may not persist as long in retardates as in normals.

R. Travis Osborne[2] reviewed pertinent factor analytical studies of the WISC through 1966 in the several introductions to his five-year

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[1]Alfred A. Baumeister and Claude J. Bartlett, "A Comparison of the Factor Structure of Normals and Retardates on the WISC," American Journal of Mental Deficiency, LXVI (1962), pp. 641-656.

[2]R. T. Osborne, "Factorial Composition of the Wechsler Intelligence Scale for Children at the Pre-school Level," Psychological Reports, XIII (1963), pp. 443-448.

R. T. Osborne, "WISC Factor Structures for Normal Negro Preschool Children," Psychological Reports, XV(1964), pp. 543-548.

R. T. Osborne, "Factor Structure of the Wechsler Intelligence Scale for Children at Pre-school Level and After First Grade: A Longitudinal Analysis," Psychological Reports (1965), pp. 637-644.

R. T. Osborne, "Stability of Factor Structure of the WISC for Normal Negro Children from Pre-school Level to First Grade," Psychological Reports, XIII (1963), pp. 443-448.

longitudinal study of mental factor structure change ascribed to increasing age and educational maturity. In 1961 Osborne examined 163 pre-school children with the WISC and four reference tests. One year later this test battery was repeated with 153 of the same children. The ten standard WISC subtests, except coding, were split into two, three, and four parts to yield as many variables as possible. Kaiser's Varimax rotation was applied to the resulting 30x30 matrix. Evidence was uncovered supporting eight statistically significant uncorrelated factors at the pre-school level and ten factors after one year of school. Osborne asserted that at least six factors were readily identified by WISC subtests, or by combination of WISC subtests. He further stated that by age six differential mental abilities were clearly discernible.

In a second study by Osborne commencing in 1961, 111 Negro children were examined with the same test battery and the tests were repeated one year later with 103 of the same children. In this study, evidence was presented to support nine statistically significant, uncorrelated factors at both the pre-school level and after one year of school. Osborne stated that at least eight factors are readily identified by WISC subtests or combinations of WISC subtests.

CHAPTER III

DESIGN OF THE STUDY

An interpretation of the findings of this investigation requires as thorough an understanding of the sources of the data analyzed as possible. This chapter, therefore, provides information regarding the selection of the sample and tests by which they were measured.

The primary criteria for inclusion in the sample was teachers' judgment. If in the opinion of the individual teacher, a student could not perform substantially at grade level, the student was referred for psychological evaluation. During the course of this investigation, extending from October, 1967 to January, 1969, 122 such students were referred. The 122 included 16 girls and 106 boys. Each student was administered a WISC and a SIT. Upon conclusion of the testing, the sample was reduced to 94 males. The 16 females were eliminated because their population was not considered numerous enough to warrant inclusion of a possible variance based upon sex. One boy was eliminated because he was non-Caucasian and English was not his native language. The remaining 11 boys were eliminated because their individual tests were not administered personally by the investigator and their inclusion could conceivable contribute an undeterminable quantity of invalid variance to the results since no stability of administrative method could be determined.

The students included in the sample, as a result of teacher referrals, represented all grade levels in the Nevada County school, California. Thirty (31%) of those finally selected came from grades one, two, and three. Twenty-five (26%) came from grades four, five, and six. Forty-one (43%) came from grades seven and eight. Thirty-six (38%) lived within city limits, and sixty (62%) lived in the outlying rural areas. Six were referred by teachers of a one-teacher school, ten (10%) by teachers of a two-teacher school, and the remaining eighty (84%) by teachers of a normal eight grade grammar school. These referrals were considered reasonably representative of the rural-urban distribution of students within Nevada County, California, where one, two, or three teacher schools account for six percent of the total enrollment, and where approximately 40% of the county population live within city limits and the remaining 60% live in the outlying rural areas.

The socio-economic background of those examined was reasonably comparable. Eight-four, or 88%, came from families in which the family income was derived from "blue collar" unskilled or semiskilled positions in such industries as logging, farming, construction, or subordinate store help positions, such as stock boy, minor clerical positions, or janitorial services. Ten, or roughly 10%, came from "white collar" positions, such as grocery clerk, appliance and electrical sales and repair, shoe clerk, or serving the public in some similar capacity. Two, or 2%, could be classified professional or proprietary.

The WISC

Wechsler[1] states that the WISC was developed as a downward extension of the Wechsler-Bellevue Intelligence Scales. Most of the items contained in the WISC are from Form II of the adult scales. Easier items have been added to the low end of the subtests to make it suitable for use with young children.

Organization of the Scale

The WISC consists of twelve subtests grouped into a Verbal Scale and a Performance Scale. Table 2 is a breakdown of this grouping.

TABLE 2

VERBAL SCALE AND PERFORMANCE SCALE OF THE WISC

Verbal Scale	Performance Scale
1. Information	1. Picture Completion
2. Comprehension	2. Picture Arrangement
3. Arithmetic	3. Block Design
4. Similarities	4. Object Assembly
5. Vocabulary	5. Coding
6. Digit Span	6. Mazes

[1] David Wechsler, Wechsler Intelligence Scale for Children, Manual (New York: The Psychological Corporation, 1949).

In the standardization of the WISC all twelve subtests were administered although only ten were used to establish the IQ tables. Digit Span and Mazes were considered supplementary tests "to be added when time permits" or "to be used as alternate tests when some other test is invalidated." The use of Digit Span and Mazes is made "primarily because of their relatively low correlation with the other subtests of the Scale and also, in the case of Mazes, the time factor."[1] Wechsler strongly advised that, in clinical situations, all twelve tests be administered because of the "qualitative and diagnostic date" they add.

Standardization Sample

The WISC was standardized on a selected sample of 2200 white American boys and girls. One hundred boys and one hundred girls were chosen at each of eleven age levels, ages five through fifteen. All children were within one and one-half months of their mid years. The single exception to this procedure occurred in the case of the fifty-five mentally deficient children included in the sample. This group was drawn primarily from institutions in Illinois, Michigan, and New York and more lenient age standards were observed. Only a few selected cases from "special classes" of two public schools were included. The standardization tests were administered by 17 field examiners working in 85 different communities. Although more cases were tested, the 2200 used in the final sample were selected as being representative of the 1940 census with respect to geographic area, urban-rural residence, and

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[1] Wechsler, op. cit., p. 6.

parental occupation. Some adjustment was made to allow for the recent shift of population to the West.

The WISC Full Scale IQ, the Performance,IQ, and the Verbal IQ, were based on norms from other children of the same age. Accordingly, they were deviation scores. The raw scores obtained from the subtests were converted into Scaled Scores by separate tables for each four-month age span and then into IQ's with a mean of 100 and a standard deviation of 15. The Full Scale Score was the sum of the Verbal Score and the Performance Score. It was based on ten tests. The Verbal Score was the sum of the scaled scores of the five tests which have been administered. The Performance Score was the sum of the five Scaled Scores also of the tests administered. In the event that more than five or less than five tests were administered in either the Verbal or Performance areas, prorating was necessary. If six tests had been given, the sum of the six tests must be multiplied by five-sixth to reduce it to the equivalent of five tests. If four tests had been given, the four scores must be multiplied by five-fourths (5/4) to expand it to the equivalent of five tests. It was expected that WISC IQ's will always be based upon at least four Verbal and four Performance tests.

Reliability and Related Data for the WISC Tests

The reliabilities and related data are reported in Table 3 for ages $7\frac{1}{2}$, $10\frac{1}{2}$, and $13\frac{1}{2}$. These three ages were considered most representative of the age range for which the WISC was designed.[1]

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[1]Wechsler, op. cit., p. 13.

TABLE 3

RELIABILITY AND STANDARD ERROR OF MEASUREMENT OF THE WISC TESTS N=200 FOR EACH AGE LEVEL[a]

	Age 7½		Age 10½		Age 13½	
	r	SE_m	r	SE_m	r	SE_m
Information	.66	1.75	.80	1.34	.82	1.27
Comprehension	.59	1.92	.73	1.56	.71	1.62
Arithmetic	.63	1.82	.84	1.20	.77	1.44
Comparison	.66	1.75	.81	1.31	.79	1.37
Vocabulary	.77	1.44	.91	.90	.90	.95
Digit Span	.60	2.45	.59	1.92	.50	2.12
Verbal Score (Without Digit Span	.88	5.19	.96	3.00	.96	3.00
Picture Completion	.59	1.92	.66	1.75	.68	1.70
Picture Arrangement	.72	1.59	.71	1.62	.72	1.59
Block Design	.84	1.20	.87	1.08	.88	1.04
Object Assembly	.63	1.82	.63	1.82	.71	1.62
Coding[b]	.60	1.90	--	--	--	--
Mazes	.79	1.37	.81	1.31	.75	1.50
Performance Score (Without Coding and Mazes)	.86	5.61	.89	4.98	.90	4.74
Full Scale Score (Without Digit Span, Coding and Mazes)	.92	4.25	.95	3.36	.94	3.68

[a] The SE_m is in Scaled Score units for the tests and in IQ units for the Verbal, Performance and Full Scale Scores.

[b] Based on correlating Coding A and Coding B, 115 cases.

Except in the cases of Digit Span and Coding A and B, all reliabilities were determined by the split half technique, with appropriate correction for full length of the test by the Spearman-Brown formula. The Coding test, which was essentially a speed test, did not lend itself to this technique. However, the reliability coefficients for Coding were made possible because, for ages 7½ and 8½, many of the children were

given both Coding A and Coding B. Thus the values reported were based on an alternate test situation. It was considered probable that the scores would be a little higher if the scores on Coding A were correlated with scores on a strict alternate form.

The Digit Span test was administered as two separate tools: Digits Forward and Digits Backward. Accordingly, the reliability coefficients for this test were based on the correlation between scores on Digits Forward and scores on Digits Backward corrected according to the Spearman-Brown formula.

Both Wechsler[1] and Seashore[2] warned the user to take into account the fairly low reliabilities of some of the subtests in interpreting either the absolute subtest scores or relations between them. For instance, the internal consistency of Digit Span decreased with age from a high of .60 at $7\frac{1}{2}$ to a low of .50 at $13\frac{1}{2}$. Only the Verbal Score, the Performance Score, the Full Scale Score, and the Block Design Score had coefficients of internal consistency above .80 at the three age levels. In general, however, the reliability of the test tended to increase with age so that at age level $13\frac{1}{2}$ all subtests except Digit Span (.50) and Picture Completion (.68) were above .70.

The test user was advised not to be confused by the discrepancy between the size of the SE_m for the individual tests as compared to

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[1]D. Wechsler, Wechsler Intelligence Scale for Children (New York: Psychological Corp., 1949).

[2]H. Seashore, A. Wesman, and J. Doppolt, "Standardization of Wechsler Intelligence Scale for Children," Journal of Consulting Psychology, XIV (1950, pp. 99-110.

the SE_m for the Verbal, Performance, and Full Scale IQ's. For the individual tests, the SE_m was in Scaled Score Units for the IQ's, the SE_m was in IQ units.

The Slosson Intelligence Test (SIT) for Children and Adults

Slosson constructed the SIT (Short Intelligence Test) as an abbreviated and simplified form of the Stanford-Binet Intelligence Scale, Form L-M. (S-B)[1] which could be administered by "school teachers, principals, psychometrists, psychologists, guidance counselors, social workers, school nurses, and other responsible persons who, in their professional work, often need to evaluate an individual's mental ability."[2]

Organization of the Scale

The SIT was organized around a series of observations or tasks extending from the age of six months (0-0.5) to twenty-seven years (27-0). Each observation or task represented a six-month interval. The items and tasks used in the infant and early childhood section of the test were taken directly or adapted from the Gesell Developmental Schedules. A great many of the items beyond infancy and early childhood were adapted from the Stanford-Binet insert. As compared to the Stanford-Binet, the Slosson has a higher ceiling for adults and a lower base for children.

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[1]Lewis M. Terman and Maud Al Merrill, Stanford-Binet Intelligence Scale, Form L-M (Boston, Mass.: Houghton Mifflin Co., 1937).

[2]Richard L. Slosson, Slosson Intelligence Test (SIT) for Children and Adults (East Aurora, New York: Slosson Educational Publications, 1963).

Standardization Sample

The population chosen for obtaining comparative results between the SIT and the S-B, Form L-M came from both the urban and rural populations in New York state. Referrals were received from the following:

Children:
1. Cooperative nursery schools
2. Public schools
3. Parochial and private schools
4. Junior and senior high schools
5. Gifted and retarded classes (White, Negro, and American Indian)
6. The City Youth Bureau
7. A home for boys
8. An infant home

Adults:
1. General population
2. Various professional groups
3. A university graduate school
4. A state school for the retarded
5. A county jail

Many of those tested were negativistic or withdrawn. Some had reading difficulties and others were physiologically or neurologically disordered. Two samples were reported in the manual giving a specific source and number. These are summarized in Table 4.

TABLE 4

STANDARDIZATION SAMPLE OF SIT

Source	Sample	Ages	N
State School	Retarded Women	18-54	11
A University	Gifted Adults	22-31	10

Concurrent validity only is reported in the manual. Correlations between the Stanford-Binet, Form L-M, and the SIT are shown in Table 5.

TABLE 5

IQ CORRELATIONS BETWEEN THE STANFORD-BINET, L-M AND SIT

Age	Number	r	Mean		Standard Deviation		Average Difference
			SB-LM	SIT	SB-LM	SIT	
4	27	.90	116.6	114.6	19.7	18.7	6.7
5	23	.93	102.1	101.5	20.7	18.0	5.6
6	61	.98	100.7	101.3	20.7	20.2	4.4
7	71	.98	98.9	98.4	23.5	20.9	5.9
8	44	.94	95.5	95.5	17.6	17.0	5.3
9	45	.97	100.7	100.6	25.1	23.7	5.1
10	40	.94	96.1	97.2	23.9	24.6	6.1
11	51	.96	93.1	92.6	21.4	22.0	4.9
12	36	.97	94.0	94.1	22.4	24.6	4.6
13	57	.96	96.3	97.0	23.4	24.9	5.0
14	66	.97	92.7	92.4	20.4	21.5	4.4
15	56	.94	92.7	91.7	18.8	18.2	5.1
16	39	.96	97.6	97.5	23.7	24.0	4.7
17	23	.94	106.0	106.6	16.9	16.7	5.0
18	62	.97	101.7	102.5	31.8	31.2	5.9

A reliability coefficient of .97 was reported for 139 individuals from age 4-50 years. The test-retest interval was within a period of two months. The mean IQ's of the initial test was 99.0. The mean IQ of the retest was 101.3. The standard deviations were 24.7 and 25.1, respectively. A standard error of measurement of 4.3 was reported.

Infants and young children under four years of age were not retested. Most of the items used to test these youngsters were either adapted or taken directly from the Gesell Developmental Schedules and were considered to be as reliable as possible for this early age. The test user was cautioned to consider the test scored for these youngsters as tentative.

CHAPTER IV

STATISTICAL ANALYSIS

Raw scores were obtained through the administration of the Slosson Intelligence Test (SIT) for Children and Adults and the Wechsler Intelligence Scale for Children (WISC) to the sample comprised of 94 boys. The raw scores were converted to test age scores for each variable and intercorrelations computed for each set of variables. The computations were accomplished by the members of the computer staff at the University of Oklahoma and the University of California at Davis.

Correlation Matrix

The obtained 169 Pearson product-moment coefficients of correlation were arranged into a correlation matrix. These coefficients of correlation are presented in Table 6 along with the means and standard deviations for the respective variables.

TABLE 6

INTERCORRELATIONS OF RAW SCORED MEANS AND STANDARD DEVIATIONS OF VARIABLES FOR SELECTED POPULATION (N=94)[a]

	SMA	WMA	INF	COMP	ARITH	SIM	VOCAB	DIGIT	PICT. COMP.	PICT. ARR.	BLOCK DESIGN	OBJ. ASSEMB.	CODING
SMA		93	83	71	81	70	83	65	78	68	76	71	61
WMA	91		92	80	80	80	89	69	86	78	82	78	73
INF	83	92		77	66	79	87	58	78	72	72	67	59
COMP	71	80	77		63	62	71	45	61	53	64	57	60
ARITH	81	80	66	63		56	64	70	63	57	64	58	54
SIM	70	80	79	62	56		76	49	65	62	56	54	49
VOC	83	89	87	71	64	76		57	77	67	68	64	60
DIGIT	65	69	58	45	70	49	57		49	51	49	41	45
PICT. COMP.	78	88	78	61	63	65	77	49		67	70	67	59
PICT. ARR.	68	78	72	53	57	62	67	51	67		55	56	53
BLOCK DESIGN	76	82	72	64	64	56	68	49	70	55		71	56
OBJ. ASSEMB.	71	78	67	57	58	50	64	41	67	56	71		61
CODING	61	73	50	60	54	49	60	45	59	53	56	61	
Means	10.84	10.62	10.15	9.96	9.46	11.38	11.07	9.53	11.08	11.98	11.02	11.51	10.44
St. Dev.	2.75	2.56	2.68	3.15	2.52	3.56	3.17	3.44	3.73	3.41	3.31	3.35	2.66

[a]Decimals omitted

The t test was used to determine the significance of the coefficients of correlation. In testing the null hypothesis for a coefficient of correlation, the required t is estimated by the formula:

$$t=r\sqrt{\frac{N-2}{1-r^2}}$$

were r = obtained coefficient of correlation and N = number of pairs of observations.[1]

Thus in this sample of 94, an r of approximately .28 or greater proved to be significant at the one percent level of significance in terms of zero-order correlations.

$$t= .28\sqrt{\frac{94-2}{1-(.28)^2}}$$

This is verified by Kerlinger with the following statement:

> . . . With about 100 pairs of measures the problem (of the significance of the coefficient of correlation) is less acute. To carry the .05 day, an r of about .20 is sufficient; to carry the .01 day, an r of about .25 does it.[2]

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[1] J. P. Guilford, Fundamental Statistics in Psychology and Education (New York: McGraw Hill Book Co., 1956), p. 219.

[2] Fred N. Kerlinger, Foundations of Behavioral Research, (New York: Holt, Rinehart and Winston, Inc., 1964), p. 171.

Wechsler, in preparing the WISC subtests, utilized items which correlated well with other measures of intelligence. Wechsler has stated that the subtests are to be regarded as different measures of intelligence, not measures of different intelligence.[1]

> . . . The grouping of subtests into Verbal and Performance Scales, while intending to emphasize a dichotomy as regards possible types of ability called for by the individual tests does not imply that these are the only abilities involved in the tests. Nor does it imply that these are different kinds of intelligence, e.g. verbal, manipulative, etc. It merely implies that there are different ways in which intelligence can manifest itself.[2]

Inspection of the table of correlations confirms the expection that a high degree of inter-test correlation of the SIT with the subtests of the WISC leads to a further expectation that the items will measure a common factor.

Factor Analysis

The final statistical analysis of the data consisted of submitting the correlation matrix to factor analysis using Kaiser's Varimax methodology which is adapted to computer processing.[3] The factor loadings projected by the process of factorization were arranged as shown in Table 7 with the cumulative proportion of total variance indicated. No rotation was possible. Accordingly, only one factor was extracted from these data which indicated that all variables measured a common ability.

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[1]Sheila Jones, "The Wechsler Intelligence Scale for Children Applied to a Sample of London Primary School Children," British Journal of Educational Psychology (1962), pp. 32(2), 119-133.

[2]D. Wechsler, The Measurement and Appraisal of Adult Intelligence (London Bailiere: Tundall and Cox, 1958).

[3]W. R. Drapee and H. Smith, Applied Regression Analysis (New York: John Wiley and Sons, 1967).

TABLE 7

FACTOR MATRIX[a]

Variables	Factors 1	2	3	4	5	6	7	8	9	10	11	12	13
Slosson MA	926	093	044	-017	-125	-012	-045	-083	016	179	-232	-143	-000
WISC MA	999	-004	-006	014	014	007	009	015	-001	-031	016	022	001
Info.	919	-062	-214	-062	-035	-005	044	068	-105	021	184	-221	-000
Comp.	802	-146	-021	-456	089	-284	042	031	-105	-133	-072	046	-000
Arith.	808	366	221	-095	-076	-141	-062	-289	144	041	133	039	-000
Simil.	792	-017	-450	-096	041	236	132	-099	252	-098	-037	031	-000
Vocab.	900	-060	-209	-049	-017	104	-045	022	-190	262	040	169	-000
Digit Span	687	649	105	027	078	142	079	182	-132	-108	-033	014	-000
Pic. Comp.	856	-143	-038	181	-119	085	359	-091	-115	-203	-020	010	-000
Pic. Arr.	777	031	-221	445	144	-336	062	071	069	007	-018	033	-000
Blk. Assem.	818	-148	239	-045	-302	009	-053	314	233	020	028	037	-000
Obj. Assem.	780	-284	330	180	-143	084	324	-138	-120	-060	-005	022	-000
Coding	728	-194	308	-002	552	121	-083	020	081	050	012	-030	-000
Cum. Pro. of Tot. Var.	695	793	805	843	881	906	928	949	968	983	992	1.000	1.000

[a]Decimals omitted

All tests, full scale and subtests, showed consistently high first factor saturation which accounted for approximately 70 percent of the total variance. This finding tended to support Wechsler's notion that the main function of the test as a whole was the measurement of a general factor. The sufficiently high loading on the Slosson indicated that it was a valid measure of general intelligence, which covered the same general area of behavior as the WISC, although the abilities measured by the two instruments were not identical. No other factors emerged on the Slosson MA and WISC full scale. However, on the WISC several single factors have emerged which appeared on the following subtests: Digit Span, Similarities, Comprehension, Picture Arrangement, Coding. All factor loadings exceeded .40 values. Perhaps these could be identified as factors of verbal comprehension, perceptual speed, eduction of conceptual relations, and visualization. These factors accounted for approximately an additional 20 percent of the total variance. This might be expected since the subtests of the WISC were reported as being factorially complex. However, these findings could have come about because of the small sample and the relative homogeneity of the group.

Because of the heavy loadings on the first factor it was concluded that the Slosson could serve as well as a screening instrument as the WISC since it did not pick up the small specific or minor factors. Perhaps, it might be considered a better instrument to use in practical situations for the school psychologist because of this and because of its easy and rapid administration.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

Efforts to reduce the time involved in the administration of existing intelligence tests has long been of concern to psychologists. Increasing student populations, without a corresponding increase in the number of psychological workers has emphasized the need for a short reliable, valid intelligence test. Efforts to locate such a test have generally been restricted to the area of abbreviating existing tests. Short forms of the WISC have been thoroughly investigated; however, the results were inconclusive. Although the shortened version may have practical utility, it would appear that it should be restricted to the use of the highly trained individual.

The Slosson Intelligence Test for Children and Adults (SIT) was developed admittedly as a shortened version of the Stanford-Binet Tests of Intelligence (S-B). The test was published and found immediate popularity among private school guidance personnel. Even though the test is easily administered and easily understood, it had received limited use in the public school systems compared to the WISC and the Stanford-Binet. A factor which may have reduced the use of the SIT in public schools was the fact that in some states, pupil personnel workers were limited by legislative action regarding the particular tests they may utilize.

This study was designed to approach the problem posed by attempting to determine the adequacy of the SIT to perform the same function as the WISC. An attempt was made to establish partial validity of the SIT as a screening instrument in practical situations through a factorial study of both instruments.

The tests were administered to a sample of 94 male students who were referred for psychological testing by their respective teachers during the period November 10, 1968, to January 10, 1969. The subjects were a substantially homogeneous group in terms of sex, socio-economic background and the fact that all were identified as poor academic achievers.

The SIT and the WISC yielded a total of 13 variables. The means, standard deviations, standard error of the means and Pearson product-moment correlations were determined for these variables.

The correlation matrix was submitted to factorial analysis by the Kaiser's Varimax method. One highly verbal factor was extracted. No rotation of the factor matrix was attained.

The analysis made in this study warranted the following conclusions:

(1) The SIT has highly significant concurrent validity when compared to the Full Scale WISC.

(2) While selected WISC short forms are highly correlated with the WISC full scale, the necessity for highly trained personnel to interpret the results of these short forms would appear to make the short forms of less practical utility than the simple, easy to understand SIT, at least until such a time as adequate manuals for these forms are developed.

(3) Both the WISC full scale and the SIT measure a basic general intelligence to a highly significant degree.

(4) To paraphrase Wechsler, the SIT may reasonably be included with the WISC individual tests as a "different measure of intelligence rather than as a measure of different intelligence."

Since only a single general factor was found in the factorial investigation it was concluded that this may have resulted from the smallness of the sample size as well as the relative homogeneity of the sample. A replication of this study, with revised WISC item weights and a larger sample of students representative of various geographical areas and socio-economic levels is, therefore, recommended.

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