A COUNSELLING INTERNSHIP AT THE MEMORIAL UNIVERSITY DIAGNOSTIC AND REMEDIAL UNIT AND THE DEVELOPMENT OF A COMPUTER BASED WISC-R TEST ANALYSIS WORKSHEET AND PROGRAM

ARLENE R. JOHNSON

A COUNSELLING INTERNSHIP AT THE MEMORIAL UNIVERSITY DIAGNOSTIC AND REMEDIAL UNIT AND THE DEVELOPMENT OF A COMPUTER BASED WISC-R TEST ANALYSIS WORKSHEET AND PROGRAM

BY

Arlene R. Johnson, B.Sc.

A report submitted to the School of Graduate Studies in partial fulfillment of the requirements for the degree of

Master of Education

Department of Educational Psychology
Memorial University of Newfoundland

September 1985

St. John's, Newfoundland

Abstract

This report consists of two parts. The first is a description of an internship completed in the Diagnostic and Remedial Unit at Memorial University. The second part describes the project which was completed as the research component of the internship. The description of the internship consists of the rationale, a description of the setting, the activities which were performed during the internship to meet nine goals set by the intern and concluding evaluative remarks. The research project, its rationale, description, and limitations are provided in the second part of the report. The project consists of the development of two aids for the analysis of the Wechsler Intelligence Test for Children-Revised (WISC-R). A WISC-R Test Analysis Worksheet was designed to guide examiners through an individualized WISC-R analysis and record pertinent data for an individualized test interpretation. A computer program for the Texas Instrument TI-99 4A was also developed to accompany the WISC-R Test Analysis Worksheet and aid in the analysis. The primary method of analysis is based on the WISC-R analysis method of Alan Kaufman.

Acknowledgments

I am indebted to many people who have contributed time and effort to helping me complete this project. First, I wish to thank the Department of Educational Psychology, especially Dr. Glenn Sheppard, my department supervisor, who provided undiminishing encouragement, support and help.

Special thanks to Barbara Hopkins for her assistance throughout the internship and for greatly expanding my knowledge and experience. I am grateful to Jim Woodrow who aided in enriching the internship experiences.

The Graduate Student Fellowship received from the Memorial University of Newfoundland is also gratefully acknowledged.

Finally, I am indebted to my husband, Anker, for his substantial help in preparing this manuscript and to my son, Kevin, for sharing his valuable expertise in computer programming.

Table of Contents

List of Tables

CHAPTER 1

DESCRIPTION OF INTERNSHIP

Rationale for the Internship

An internship is an option available to graduate students in the master's degree program in Educational Psychology at Memorial University. Such a supervised professional experience is intended to provide an intern with the opportunity to develop competencies in areas based on his needs, previous experiences and future vocational plans. While the master's program in Educational Psychology provides both the theoretical and practical training necessary for placement as a school counsellor at all levels in the school system, the demands for psychoeducational assessment services is growing, at the elementary school level, in response to the increasing emphasis on the identification and programming for exceptional children. The internship option offered the opportunity for the intern to acquire the competency an elementary school counsellor requires in order to meet these growing demands.

Sattler (1982) stated that the assessment task is a complex activity. Gerkin (cited in Sattler, 1982) outlined the following steps which are usually needed in the assessment process.

1. Review referral information. Any material that is not clear should be checked with the referral source (e.g., physician, teacher, parent, or court).

2. Interview parent. Obtain information relevant to developmental, health, familial, and environmental factors that may be pertinent to the child's problem.
3. Obtain information from other agencies, including previous psychological evaluations.
4. Obtain current medical assessment.
5. Observe child in various settings, if at all possible.
6. Perform psychological evaluation.
7. Conduct interdisciplinary staff conference after all materials have been obtained (Sattler, 1982, p. 329).

According to Sattler (1982), in the United States "Public Law 94-142 stipulates that no single procedure shall be the sole criterion for determining an appropriate educational program for a child" (preface). A battery of tests should be given to assess the child's assets and limitations and develop a remedial plan. In order to do this the examiner must be knowledgeable in (a) child development (b) learning disabilities (c) a wide variety of test instruments, and (d) remediation-prevention strategies. The intern's experience as an elementary school counsellor has demonstrated a need for a high level of competence in the assessment of children, the integration of the child's identified pattern of relative strengths and weaknesses with his characteristic behaviors and the translation of these findings into practical suggestions for both teachers and parents.

McDermott (1981) reported that inconsistency exists in diagnostic style and is one source of error in the psychoeducational diagnosis of children. He stated that examiners vary in the amount and types of data considered and in the

amount of time given to the assessment. According to McDermott one factor which affects an assessment is the examiner's training.

The internship option was chosen by this student as an opportunity to develop further the competency needed for the ever demanding role of elementary school counsellor. In particular, the internship was undertaken to expand the intern's repertoire of competencies needed to conduct a comprehensive psychoeducational assessment.

Setting for the Internship

The Diagnostic and Remedial Unit, a division within the Faculty of Education at Memorial University, was chosen as the setting for the internship. This location meets the guidelines for internship settings provided by the Department of Educational Psychology.

The Unit is located on the Memorial University Campus in the G.A. Hickman Building. It was founded in 1972 to conduct research studies in the field of learning disabilities. Since 1975 the Diagnostic and Remedial Unit has also served as a diagnostic and remedial resource to children with school related problems in Newfoundland and Labrador.

The functions of the Diagnostic and Remedial Unit are:

1. To diagnose school problems of children who are referred to them.

2. To develop programs for teachers and parents to use in teaching children who have problems.

3. To give direct instruction to a limited number of children.

4. To serve as a practicum site for students in special education and educational psychology, as well as a field placement for students in other practicum programs such as clinical psychology and social work.

5. To offer inservice programs for teachers or other related professionals, i.e., social workers, nurses, and speech pathologists, on diagnosis and remediation of learning disabilities.

6. To provide counselling and support for parents and parent groups and to serve as a liaison with other agencies and professionals providing services to children and parents.

7. To participate in research studies.

In 1984, 227 children were seen at the Unit; 147 were seen for assessment and program suggestions. Of these 147 children, 80 returned for various periods of remedial programming. At the time of the internship, services were provided by a full-time staff of five, consisting of a director, three specialized teacher-diagnosticians and a secretary. The director, Mrs. Barbara Hopkins, provided the on-site supervision of the thirteen-week internship.

Internship Goals and Related Professional Activities

The purpose of the internship, as stated in the Department of Educational Psychology (1975) paper on the internship program, is to provide:

1. For the development of competencies for each trainee based on his needs,

previous experiences, and future vocational plans.

2. For practical experiences that will bring into focus the theoretical training received during the formal part of the program.
3. For practical experiences that will enable the trainee and the department to evaluate the trainee's ability to effectively work in his chosen field.
4. Opportunities for the trainee to evaluate his personal behavior modalities and work toward making any necessary changes.
5. For feedback from the internship setting to the department regarding strengths and weaknesses of its students so that program improvements can be implemented.
6. For the development of research and problem-solving skills appropriate to the needs of the student and the setting, considering the nature of his placement and his vocational plans.

The proposed internship program at the Diagnostic and Remedial Unit consisted of nine goals which were in keeping with the broad goals presented above. The nine goals and the activities performed to meet the goals are outlined below.

Goal 1: To become more knowledgeable in the area of learning disabilities.

The activities performed to meet this goal were:

1. Selected sessions were audited in Education 4540, *Communication for the Disabled*, presented by Mrs. Jane Green, a part-time sessional instructor in the Department of Educational Psychology and a teacher-diagnostician at the Diagnostic Unit.

2. Discussions were held with professionals who are knowledgable in the

area of learning disabilities. These professionals included the staff at the Diagnostic Unit as well as others at The Dr. Charles A Janeway Child Health Centre.

3. The intern observed a specialized teacher instruct a child with a severe language disorder.

4. The 1978 National Film Board film, "They Called Me Stupid", was viewed.

5. The following books and journal articles were read:

Butler, K.G., & Wallach, G.P. (1980). Topics in language disorders. *Language Disorders and Learning Disabilities, 1,* 5.

Harwell, J.M. (1982). *How to Diagnose and Correct Learning Difficulties in the Classroom.* West Nyack, New York: Parker Publishing Co. Inc.

Levine, M.D., Oberlaid, F. & Meltzer, L. (1981). Developmental output failure: A study of low productivity in school-aged children. *Pediatrics, 67* (1), 18-25.

Lewis, R.B. (1983, November). Learning disabilities and reading: Instructional recommendations from current research. *Exceptional Children, 50,* 230-283.

Mayron, L.W. (1979, January). Allergy, learning and behavior problems. *Journal of Learning Disabilities, 12,* 41-50.

Patterson, K.E. (1981). Neuropsychological approaches to the study of reading. *British Journal of Psychology, 72,* 151-174.

Senf, G.M. & Torgeson, J.K. (1983). *Annual Review of Learning Disabilities, 1.*

Goal 2: To become proficient at administering and interpreting a variety of instruments used in the psychoeducational assessment of disabilities and disorders which affect children's school performance and development.

The activities performed to meet this goal were:

1. The administration of the McCarthy Scales of Children's Abilities was observed.

2. The manuals of the tests administered were read and the intern became familiar with the test administration procedures, scoring and interpretation prior to administering the tests.

3. Tests in various areas of concern were administered. Selection was based on the individual assessment needs of each child assessed. The tests and the number of times administered are presented in Table 1-1.

Goal 3: To become familiar with some of the test instruments and the testing techniques used in neuropsychological assessments.

The activities performed to meet this goal were:

1. The administration of a battery of tests to a person with known brain damage was observed in the Neuropsychology department at the Health Sciences Centre.

2. Mr. Woodrow, neuropsychologist at the Health Sciences Centre, provided full explanations of the purpose, administration, scoring and interpretation for all the tests in his neuropsychological assessment battery.

3. Under the supervision of Mr. Woodrow, the intern administered, scored, and interpreted the battery of tests used in the neuropsychological assessment of two children with known brain injury at the Health Sciences Centre.

4. Readings were done from the following books.

Gardner, R.A. (1979). *The Objective Diagnosis of Minimal Brain Dysfunction.* Cresskill, New Jersey: Creative Therapeutics.

Lezak, M.D. (1976). *Neuropsychological Assessment. New York: Oxford* University Press.

Small, L. (1982). *The minimal brain dysfunctions.* New York: The Free Press.

Table 1-1

Tests Administered

Area	Tests	Times Administered
Mathematics	Key Math Diagnostic Arithmetic Test	7
Reading	Slosson Oral Reading Test	6
	Woodcock Reading Mastery Tests	4
	Durrell Analysis of Reading Difficulty	7
Language	Reynell Developmental Language Scales	1
	Test of Language Development-Intermediate	1
	Test of Language Development-Primary	1
	Peabody Picture Vocabulary Test-Revised	3
	Test of Written Language	1
	Assessment of Children's Language Comprehension	3
Academic Level	The Wide Range of Achievement Test	1
	Peabody Individual Achievement Test	1
General Ability	McCarthy Scales of Children's Abilities	9
	Weschler Intelligence Scale for Children-Revised	5
	Weschler Adult Intelligence Scale	1
Auditory	The Auditory Sequential Memory Test	1
	Auditory Memory Span Test	1
Visual	Motor-Free Visual Perception Test	5
	The Coloured Progressive Matrices Test	4
Visual-Motor	Developmental Test of Visual-Motor Integration	5

Goal 4: To gain competence in carrying out a comprehensive psychoeducational assessment which includes (a) collection of relevant information, (b) selection of assessment instruments, (c) comprehensive testing, (d) analysis of data and (e) translation of findings into suggestions for remediation.

The activities performed to meet this goal were:

1. Full psychoeducational assessments were carried out on fourteen children.

2. Each case was discussed with the field supervisor preceding, during and following the full assessment.

3. Outside agencies such as schools and health services were contacted in order to obtain information pertaining to the child's problem.

4. The following books and journal articles were read:

Banas, N. & Wills, I.H. (1978). *WISC-R prescription how to work creatively with individual learning styles.* Novato, California: Academic Therapy Publications.

Bush, W.J. & Waugh, K.W. (1982). *Diagnosing learning problems* (3rd Ed.). Columbus: Charles E. Merrill Publishing Co.

Dash, O.N., Dennis, S.S., Mueller, H.H., Mancini, G.J., Snart, F.D. & Short, R.H. (1983). WISC-R subtest variability in a clinic-referred sample of Canadian children. *Canadian Journal of Behavioral Science. 15* (3), 211-227.

Kaufman, A.S., & Kaufman, N.L. (1977). *Clinical evaluation of young children with the McCarthy scales.* New York: Grune & Stratton.

Kaufman, A.S. (1979). *Intelligent testing with the WISC-R.* New York: Wiley Interscience.

Kaufman, A.S. (1980). Issues in psychological assessment: Interpreting the WISC-R intelligently. *Advances in Clinical Child Psychology, 3,* 177-214.

Kaufman, A.S. (1981). The WISC-R and learning disabilities assessment: State of the art. *Journal of Learning Disabilities, 14,* 520-525.

Klas, L.D. (1984). A comparison of sub-test scoring patterns for males & females in various IQ groups on the WISC-R: A Newfoundland study. *The*

Newfoundland Psychologist, 6, 14-23.

McDermott, P.A. (1981). Sources of error in the psychoeducational diagnosis of children. *Journal of School Psychology, 19,* (1), 31-45.

Sattler, J.M. (1982). *Assessment of children's intelligence and special abilities* (2nd Ed.). Boston: Allyn & Bacon Inc.

Schooler, D.L., Beebe, M.C. & Koepke, T. (1978). Factor analysis of WISC-R scores for children identified as learning disabled, educable mentally impaired and emotionally impaired. *Psychology in the Schools, 15,* 478-485.

Snart, H., Dennis, S., & Brailsford, A. (1983). Concerns regarding the Wide Range Achievement Test. *Canadian Psychology, 24,* 99-103.

Vance, H., Wallbrown, F., & Blaha, J. (1978). Determining WISC-R profiles for reading disabled children. *Journal of Learning Disabilities, 11,* 657-661.

Wallbrown, F.H., Vance, H.B. & Blaha, J. (1979). Developing remedial hypotheses from ability (WISC-R) profiles. *Journal of Learning Disabilities, 12* (8), 59-63.

Goal 5: To become familiar with, and collect, a wide variety of remediation strategies which can be used with children with different types of problems.

The activities performed to meet this goal were:

1. Relevant information on diagnostic and remediation techniques was selected from readings and resource materials at the Diagnostic Unit. Emphasis was placed on collecting teacher and parent resource aids for different types of learning disabilities. The material was organized into resource binders under the following categories:

Behavior

Attention Span, Distractibility and Hyperactivity

Visual Perception and Perceptual-Motor

Reading

Language

Memory

Spelling

Goal 6: To become more proficient at disseminating information obtained and derived from assessments.

The activities performed to meet this goal were:

1. Copies of reports on file at the Diagnostic Unit were read with special attention paid to format and wording.

2. Detailed reports on 13 psychoeducational assessments were written and discussed with the field supervisor. Revisions were made where necessary.

3. The assessment results, interpretation and remediation suggestions were discussed with parents and pertinent outside agencies. Counselling techniques were used to help the parents and children gain a better understanding of the problem.

Goal 7: To become more aware of personal strengths and weaknesses in working effectively with children with learning problems, their parents, and professionals in this field.

The activities performed to meet this goal were:

1. The administration of the Reynell Development Language Scales was video-taped, viewed and discussed with the field supervisor.

2. Meetings were held with the field supervisor and university supervisor and feedback was provided regarding the intern's progress and performance.

Goal 8: To give remedial instruction to a child who was assessed as needing

specific remediation strategies and to evaluate the effects of the instruction.

The activities performed to meet this goal were:

1. A child was chosen to receive individualized remedial instruction based upon a psychoeducational assessment given by the intern.

2. The child came to the Diagnostic Unit seven times and spent a total of nine hours involved in specific reading and mathematics activities with the intern.

3. Reassessments in Mathematics and Reading were done at the end of the instructional period to evaluate the success of the strategies used.

Goal 9: To complete a project which would meet the research requirement of the internship and which would be useful to the intern in her role as an elementary school counsellor.

Activities performed to meet this goal were:

1. A Test Analysis Worksheet was developed for the analysis of the Wechsler Intelligence Scale for Children-Revised (WISC-R).

2. A computer program was developed to accompany the WISC-R Test Analysis Worksheet.

Details of the project are presented in a separate section of this report.

Conclusion

The Diagnostic and Remedial Unit was an excellent internship setting for an elementary school counsellor. This setting provided a working knowledge of an agency outside the school system which provides a valuable service to the schools. The internship supplemented the practicum and the course work provided in the Educational Psychology Masters Program. Knowledge and experience was gained which will better enable the intern to (a) carry out more comprehensive and accurate investigations of learning problems and (b) establish more effective intervention strategies.

The intern's skills in counselling and consultation, two other roles of the school counsellor, were also improved by the experiences during the internship. Experience was gained in working with community agencies, children with a variety of learning problems, parents, as well as with other professionals. Through counselling and consultation, the knowledge and experience the intern gained will help parents, school personnel and students gain a better understanding of children with learning problems and enable them to cope with the problems they encounter.

The internship took place largely while children were out of school for summer vacation. This presented a disadvantage to the internship. Contact with schools was minimal. There was no opportunity to observe the children in the school setting or base recommendations on the nature of their specific school environment. Fewer children were receiving remedial instruction so there were fewer opportunities for observations of instructional strategies.

The exposure to neuropsychological assessments at the Health Sciences Center provided a valuable supplement to the psychoeducational assessments carried out at the Diagnostic Unit. The two settings exposed the intern to a wide variety of disabilities in children which affect academic, social and emotional development.

Throughout the internship the intern participated as a professional member of the staff. Mrs. Barbara Hopkins, director of the Diagnostic and Remedial Unit, provided helpful ongoing assistance and guidance.

CHAPTER 2

PROJECT

One of the requirements of an internship, as determined by the Department of Educational Psychology, includes the expectation that the intern will design and conduct a research activity intended to demonstrate the appropriate application of research skills to some field-based problem. In order to fulfill this requirement this intern chose to undertake a project which was closely related to the activities performed at the internship setting and to the intern's interests, experience, and position as elementary school counsellor.

Introduction

Performing a psychoeducational evaluation is one step in the assessment process outlined in the previous chapter. It is one source of information which contributes to the development of hypotheses upon which remediation is based. Sattler (1982) stated that the Wechsler Intelligence Test for Children-Revised (WISC-R) "serves as one of the most important instruments for the evaluation of children's intelligence" (p. 169). It has excellent reliability , validity and standardization (Sattler, 1982).

Criticisms exist against the use of intelligence tests such as the WISC-R

(Kaufman, 1979). There are misconceptions about intelligence tests and testing which result in their misuse and abuse (Sattler, 1982). The criticisms center largely on the inappropriate interpretation and the educational consequences which might result from the misinterpretation of the test scores (Banas & Wills, 1978; Kaufman, 1979).

The WISC-R, however, is capable of providing more than just data for normative comparisons. The organization of the items on the WISC-R into twelve subtests, each involving a different set of abilities, and the division of these subtests into the two sections, Verbal and Performance, provide a basis for the assessment of individual differences in ability. The design of the WISC-R also allows for the statistical evaluation of differences within an individual child's performance.

The diversity of cognitive and brain-behavior functions tested by the twelve subtests has resulted in a widespread use of WISC-R and other Wechsler scales for psychoeducational, psychodiagnostic and neuropsychological testing (Small, 1982). Instead of relying on single scores and IQs, diagnosticians look for patterns of responses and for cognitive abilities represented by differences in subtest scores and factor scores (Small, 1982). The evaluation of the intraindividual differences in performance on the WISC-R is referred to as "profile analysis" by such authors as Kaufman (1979), and Sattler (1982). Sattler stated "Profile analysis is a useful tool for comparing intraindividual differences in various ability and achievement areas" (p. 199). Profile analysis is used as a general term to include the analysis of scores and the analysis of patterns of scores. It is one form and only one part of test interpretation. When accompanied by an awareness of

the limitations of the WISC-R, profile analysis helps to break the over-dependency on global IQ scores and normative comparisons, thereby reducing test misuse and abuse (Kaufman, 1979).

Although the WISC-R has the potential of providing extensive and valuable information on the child, a comprehensive individualized test interpretation requires a great deal of knowledge and effort. It is also very time consuming. Different methods have been proposed by authors such as Kaufman (1979) and Lutey (1977) to aid in the analysis of irregular performance on the WISC-R. Lutey designed a WISC-R Profile worksheet to help determine and record significant deviations in subtest scaled scores, factor scores, supplementary scores, and subtest specific scores. This author finds the following disadvantages with Lutey's method for the analysis of the WISC-R profile:

1. The use of tables and the need for many calculations using different precise values is time consuming and complicated. There is also a high chance of error.

2. The WISC-R Profile sheet is limited in the approaches used in analysis. For example, it does not examine the difference between the Verbal and Performance IQs.

3. Only a small number of patterns of subtest scores is examined; consequently there is no flexibility in the examiner's choice of systems for an individualized test interpretation.

4. The WISC-R Profile sheet does not aid in a thorough successive level approach to test interpretation. The information obtained is not put into perspective with other kinds of information, so it has limited value for the generation of

hypotheses and for report writing.

Worksheets which aid in the evaluation of patterns of subtests have also been developed. A worksheet presented by Bush and Waugh (1982, p. 179) has a comprehensive listing of subtest patterns. Different analytic methods can be applied and it is easy to use. Although helpful, worksheets such as this represent only one level of the overall analysis.

Computer programs have also been developed to aid in the scoring, generation of hypotheses and report-writing of the WISC-R. The functions of the programs vary from simply determining scaled scores and IQ scores to providing tentative hypotheses from the analyses of complex combinations of patterns of scores (Walker & Myrick, 1985). Walker and Myrick cited a study done by Myska and McCullough which found that the brief programs were of limited value and that the more complex programs generated too many tentative hypotheses, so misuse could result. Computer programs are available which attempt to write a report, but their hypotheses are not based on all the information from other sources such as behavioral observations, school achievement, home background, other test scores, or clinical impressions. According to Walker and Myrick, who reviewed the ethical considerations in the application of computers to test analysis, such programs should only be used to assist in the data interpretation. A computer program which assists in the analysis of WISC-R test data and which has empirically supported rationales could benefit the school counsellor. However, the majority of WISC-R computer programs available are expensive, and many elementary school counsellors do not have access to the more expensive computers, such as the Apple series, for which most of the programs are written.

The identification process of strengths and weaknesses is rigid in computer-assisted analysis programs. The identified strengths and weaknesses cannot be considered with respect to all the abilities and factors examined. An analytic process lacks the necessary flexibility when the examiner does not have any input into the evaluation of abilities or when input is difficult. Input is difficult when an examiner does not have an overview of all the abilities evaluated and their patterns of scores.

A need is indicated for a practical and comprehensive, computer-assisted WISC-R analysis worksheet to help increase and improve individualized WISC-R test interpretation. Since this writer's experience has shown that the elementary school counsellor frequently has heavy testing loads, this author has developed a WISC-R Test Analysis Worksheet and a corresponding computer WISC-R analysis program which is time-wise but speaks to some of the deficiencies of existing approaches.

Description of Project

The WISC-R Test Analysis Worksheet is presented in Appendix A. It contains the primary analytic approaches to profile analysis presented by Kaufman (1979), Lutey (1977), and Sattler (1982). The approaches are organized into the following four major parts:

Part I IQ Scores.

Part II Analysis of Difference between Verbal and Performance IQs.

Part III Analysis of Individual Subtest Scaled Scores.

Part IV Analysis of Subtest Patterns.

Each major part consists of selected components which contribute meaningful information toward the test interpretation. The order of the four parts follows a successive level approach to test interpretation (Sattler, 1982). The direction is from the general to the specific. It is a systematic method and provides a useful logic for writing WISC-R reports (Kaufman, 1979).

The WISC-R Test Analysis Worksheet is designed primarily for Kaufman's (1979) analytic method. It may be used with or without the assistance of the computer program; however, there are no instructions for analytic procedures provided on the worksheet. The Computer WISC-R Analysis Program is presented in Appendix B. It can be run on a Texas Instrument TI 99-4A (TI 99) Computer. The TI 99 was used because it is available to this author for use in the school and the program is readily adaptable to other inexpensive computers which have at least a 16K memory. The program is designed to carry out the analytic calculations of Parts II, III, and IV of the worksheet. Walker and Myrick (1985) included the "Analysis of Scores" from individual intelligence tests such as the Wechsler series, as one of their suggested areas of appropriate use of computers in the assessment process. The examinee's name, three IQ scores and subtest scaled scores are entered into the computer. Zero is entered for the subtests which are not administered. They do not enter into the evaluation. The analytic results for the components of the three parts can be recorded on the worksheet.

The WISC-R Test Analysis Worksheet and the Computer WISC-R Analysis

Program help obtain information which must be looked at in relation to the pattern of performance within each individual subtest and the content of the responses. The entire test performance should be integrated with other important sources of information such as observations of behavior, home background, achievement in school, and the scores on supplementary test instruments that provide purer measures of specific abilities. Each of the four parts of the analysis program will be examined in terms of (a) basic functions, (b) selected components, and (c) method of analysis.

Part 1 IQ Scores

The three IQs provide general information on a child's intellectual ability relative to other children of the same age in the general population, as represented by the standardization group. The examination of the IQ scores in the WISC-R analysis program includes the following:

1. Verbal, Performance and Full Scale IQs.
2. Confidence Intervals for Verbal, Performance and Full Scale IQs.
3. Percentile Rank of Full Scale IQ.
4. Intelligence Classification of Full Scale IQ.

Space has been provided on the WISC-R analysis worksheet for the IQ information so that the worksheet is complete for test interpretation purposes. Although time consuming, manual derivation of this information involves straight forward procedures. Calculating the IQs manually allows for the use of either the Coding or Mazes subtest in the performance IQ. The use of the Mazes subtest is

recommended in the computation of the Performance IQ of all children below eight years of age (Lutey, 1977). Since no analytic skills are required and flexibility is desirable, the components in Part I have not been included as functions of the computer program.

The WISC-R Test Analysis Worksheet provides confidence intervals at the 90% level of confidence for the three IQs. The band of error, along with the Percentile Rank and Intelligence Classification, helps the examiner put the IQs in better perspective (Kaufman 1979). Kaufman considered 85-90% to be an appropriate confidence level for this purpose. He used Sattler's (1974) data for the average confidence intervals for children in eleven age levels. The confidence intervals presented in Sattler (1982) have not changed. Table 1 in Appendix C presents the confidence intervals for the Verbal, Performance and Full Scale IQs at the 85 and 90 percent confidence levels.

Part II Analysis of Difference between Verbal and Performance IQs.

The discrepancy between the Verbal and Performance IQ scores reflects differences in a child's ability to perform those activities which are largely unique to each scale. There are a variety of factors which may lie behind disparities in functioning. Sattler (1982, p. 199) presented seven possibilities for a significant Verbal-Performance discrepancy. Factors such as interests, cognitive style, psychopathology, ability in processing information, ability in certain modes of expression, pressure, and sensory problems should be considered in respect to the child's overall performance and the background information. A more detailed

discussion of factors involved with Verbal-Performance IQ differences was presented by Kaufman (1979).

The following approaches are used in the WISC-R Test Analysis Worksheet to determine the extent to which there are significant differences between the two scales:

1. Probability of occurrence.
2. Analysis of level of significance.
3. Frequency of occurrence.

The first approach, probability of occurrence, examines the probability of obtaining an equal or greater discrepancy by chance. The average of the discrepancies for the different age levels (Sattler, 1982, p. 572) is used in the computer program to establish the probability of obtaining an equal or greater discrepancy by chance. The probability from .001 to .50 associated with the Verbal-Performance difference is determined. The probabilities for Verbal-Performance differences are shown in Table 2 of appendix C.

The second item in the analysis identifies significant V-P IQ discrepancies at a confidence level of .05 or below. Sattler (1982) recommended that a probability at or below the .05 level be considered as a significant difference and that the discrepancy be significant before formulating hypotheses about it. Kaufman (1979) also considered the 95% confidence an appropriate level for inferring a meaningful difference between a child's verbal and nonverbal abilities. The size of the V-P IQ difference required for statistical significance at the .05 level is 12 points (Sattler, 1982, p. 195).

The third approach used in the investigation of the V-P IQ difference deter-

mines the percent in the standardized population who obtained an equal or greater discrepancy. Sattler's (1982) data for the average of the age level discrepancies is used in the computer program to determine the extent to which a given discrepancy occurs in the standardization population. The percent in population from .1 to 50, is determined for the V-P discrepancy. The expectancy table is shown in Table 3 of Appendix C.

Kaufman (1979) emphasized the fact that Verbal-Performance discrepancies which may be statistically significant may actually occur in a large proportion of the standardization sample. Knowing how common or rare a discrepancy is aids in interpretation. Discrepancies which are statistically significant yet occur with some frequency in the population may indicate real discrepancies in a child's abilities and can be used in making remedial recommendations. However, differences should be significant and rare before forming diagnostic hypotheses (Kaufman, 1980). Intelligence level and parental occupation should also be related to the Verbal-Performance discrepancy (Sattler 1982) since patterns in discrepancy exist for these two factors.

Part III Analysis of Individual Subtest Scaled Scores.

The subtest scaled scores are the raw materials behind comparisons in the child's individual performance to a normative group and to the child's own personal norm. In the WISC-R Test Analysis Worksheet the analysis of the subtest scaled scores contains the following approaches:

1. Profile of scaled scores.

2. Analysis of deviation of subtest scaled scores from mean scaled scores.

A plotted profile of the subtest scaled scores presents an overall picture of the differences in the child's performance with respect to self and others. The WISC-R Test Analysis Worksheet provides (a) the important factors involved in each subtest, (b) a graph for plotting the subtest scores, and (c) space for indicating significant strengths and weaknesses. The factors used in the brief subtest descriptions were taken from Bush and Waugh (1982, pp. 406,407). Some modifications were made. The plotted profile of subtest scores provides a visual overview of the fluctuations in the subtest scaled scores. Comparisons between the child's individual abilities, as measured by each subtest, and the age group norm may be done by determining the percentile rank or test age equivalent for each subtest raw score. Sattler (1982) did not recommend the routine use of test-age scores because they have poor statistical properties and may be misleading. The subtest scaled scores can also be compared to a group mean of 10. However, as with all normative comparisons, it does not aid in the translation of test scores to educational suggestions because the strengths and weaknesses relative to the child's own level of ability is not examined.

Comparisons made within the subtest scaled scores provide an overview of a child's abilities with respect to his own relative strengths and weaknesses. Kaufman (1979) urged examiners to administer both alternate subtests to all children because they contribute significantly to the investigation of individual differences in a child's abilities. The analysis of the fluctuations in the subtest scaled scores, with respect to the child's own norm, is the beginning of an analytic process which leads to hypotheses from which remedial suggestions are derived. Howev-

er, as Sattler (1982) stated in his cardinal rule, "profile analysis is dependent upon the presence of statistically significant differences between the Verbal and Performance Scale IQs and between subtest scaled scores" (p. 193). Therefore, before comparative statements are made about one score or ability to another score or ability it is necessary to determine the presence of significant differences in performance.

Using only the subtest scaled scores, comparisons can be made in the following ways (Sattler, 1982):

1. Compare each Verbal subtest scaled score to the mean Verbal scaled score
2. Compare each Performance subtest scaled score to the mean Performance scaled score.
3. Compare each subtest scaled score to the mean subtest scaled score.
4. Compare sets of individual subtest scores.

The breakdown of the WISC-R into the two factors, Verbal and Performance, can be used for investigating fluctuation in the subtest scales scores because the mean Verbal scaled score and the mean Performance scaled score are estimates of a child's Verbal comprehension skills and perceptual organization ability, respectively. Significant deviations from the appropriate mean scaled score represent strengths or weaknesses relative to the child's own level of ability on each scale.

Different methods exist for determining the presence of significant differences between subtest scaled scores and mean scaled scores. The degree of statistical precision varies. The approach presented by Lutey (1977) uses precise standard errors of measurement for each subtest in each of the 11 age groups, to investi-

gate the difference between each subtest range-score and the range-scores for the Verbal, Performance and Full Scale averages. Sattler (1982) provided precise critical values for each subtest, depending on whether five or six Verbal or Performance subtests were administered, to determine significant discrepancies.

Kaufman (1979) proposed the use of an average value of ±3 for all subtests and all age levels. He justified the use of average values for the total sample by stating that he had "more confidence in data obtained on the entire standardization sample (N=2200) than in the data for each of the 11 age groups (N=200 per group)" (Kaufman, 1979, p. 192). Kaufman defended the use of an average value for all subtests for the following reasons:

1. The examiner's dependency on tables is reduced.

2. Mathematical computations are simpler so clerical work and errors are reduced.

3. A constant value is easily internalized and therefore can be applied routinely to every WISC-R assessment.

4. The use of precise values to the nearest decimal place for computations is not consistent with the lack of precision in other areas such as test administration, test scoring, and the low test-retest reliability coefficients of the WISC-R subtests.

5. The method proposed for the analysis of subtest fluctuations does not use the constant deviation value (±3) for interpreting specific subtests but for investigating abilities shared by two or more subtests.

6. The hypotheses do not stem from the profile analysis alone, but from the integration of information from the nature of the test responses, supplementary

tests and aspects of the child's background and behavior, as well.

Kaufman's choice of ±3 was based on the range of the differences required for significance, derived by Sattler (1974) for each of the twelve subtests at the .05 significance level. Both Kaufman and Sattler (1982) stated that the .05 significance level was adequate for investigating the fluctuations in the subtest scaled scores. The deviations of the subtest scaled scores from their relevant mean scaled scores, required for significance, ranged from 2.3 to 3.3. Since Kaufman's decision to use ±3, Sattler (1982) revised his data. He used the Bonferroni inequality to obtain a different figure for the critical ratio in the formula used to determine the significant deviations from average. The range of the revised figures at .05 significance level, is 2.8 - 4.0, which now makes Kaufman's choice of ±3, for the previous range of 2.3 - 3.3, low. Statistical precision helps to reduce chance errors pertaining to comparisons among subtests. If the constant value is not used for interpreting specific subtests and if the purpose of the analysis is primarily to help understand the child, in terms of what they do relatively well and relatively poorly, and how they learn best, then the continued use of ±3 is justified. Table 4 in Appendix C shows the precise deviations from the mean that are needed at the .05 significance level for comparisons involving five or six Verbal or Performance subtests.

Kaufman's (1979) method for profile analysis is used in this author's WISC-R analysis program. A constant of ±3 is used to determine the significantly strong and weak subtests because the determination of the subtests which deviate significantly from their respective mean is the beginning step to the profile analysis. The following steps are used in the analysis program to determine

significantly strong or weak subtests:

Step 1. Compute the mean scaled scores for both the Verbal and Performance subtests administered and round them off to the nearest whole number.

The mean of all the subtests (Full Scale Mean) is also determined to allow for other types of comparisons. The means can be recorded on the analysis worksheet.

Step 2. Compare each Verbal scaled score to the Verbal mean.

The subtests which are at least 3 points above the Verbal mean are significant strengths and the subtests that are 3 points or more below the Verbal mean are significant weaknesses. The strengths and weaknesses can be recorded on the analysis worksheet with "S" or "W" respectively under the 'SIG.' column.

Step 3. Compare each Performance scaled score to the Performance mean.

The subtests which are 3 or more points above or below the Performance mean are significant strengths and weaknesses, respectively. They can also be recorded on the worksheet.

The ± 3 approach used is not adequate for simply interpreting the unique abilities or influences that presumably are measured by significantly high or low subtests. Kaufman (1979) proposed the use of subtest-specific interpretations only after an analysis of profile fluctuations fails to uncover strengths and weaknesses. Since the unique variance or specificity varies for each subtest, the comparison of subtest scores with their relevant mean to determine unique abilities or influences should take into account the amount of specificity that each

subtest has. The groupings of subtests, according to the amount of specificity, is presented in Table 5 of Appendix C (Kaufman, 1979). Kaufman (1979) recommended that unique abilities for subtests be interpreted when there is the following deviations of the subtest scores from the average scaled score on the relevant scale:

1. Subtests with ample specificity: ±3.
2. Subtests with adequate specificity: ±4.
3. Subtests with inadequate specificity: ±6.

Comparisons of subtest scaled scores to the Full Scale mean can be carried out for each of the 12 subtests using Sattler's data in Table 6 of Appendix C. The method used in the analysis program does not investigate the difference between the subtest scores and the Full Scale average. The ±3 deviation value should not be used in this type of comparison because Sattler's (1982) data showed the range of deviations required for significance to be 3.3 - 4.6.

Kaufman (1979) stated that there is little value in methods of interpretation that use significant differences between pairs of subtest scores because the pairwise method provides separate statements about the child's abilities that are not integrated. Sattler (1982) showed how comparisons between planned pairs of subtests and multiple comparisons between individual subtest scores can be statistically analyzed. He stated that interpreting the meaning of differences is difficult. Comparisons of pairs and multiples of individual subtests have not been included in the analysis program. A large number of variables exist for each pair comparison, making translation of statistical findings into meaningful descriptions difficult and therefore subject to misuse (Kaufman, 1979).

Two approaches of comparing a child's performance with that of the normative group involve the scatter of the subtest scaled scores. The scaled-score range, which is the difference between the highest and lowest subtest scores, can be compared to the ranges for the standardization group. The second index of scatter looks at the number of scaled scores that deviate significantly from the child's own mean.

Interpretations of subtest scatter indices involve inferences between intersubtest variability and exceptionality. Kaufman cautioned against the use of scatter for categorizing children due to the lack of supporting empirical data. Comparisons of subtest scatter to a normative group does not provide the type of information about a child's abilities which aids in making meaningful remedial recommendations; therefore, it has not been included in the computer program.

Part IV Analysis of Subtest Patterns

When subtest scores deviate significantly from their respective Verbal or Performance mean, the V-P dichotomy presents an unsatisfactory description of the child's abilities, and examining the unique abilities has limited value; therefore a different system is needed to explain the profile data. One method is to take advantage of the commonalities that exist between several subtests (Kaufman, 1979). This section of the WISC-R analysis program is designed to assist the examiner in developing hypotheses regarding abilities and influences shared by two or more subtests that may have affected the test scores. The regrouping of subtests according to abilities and influences done by different psychologists has

resulted in a number of categorical systems (Kaufman, 1979). Kaufman supported the use of grouping and said that examiners should know and use all the systems in the search for explanations for the test data. He stated that it cannot be assumed that one particular method is better than another because "each method has its special uniqueness and utility for different individuals" (Kaufman, 1979, p. 131).

The anslysis program which has been designed includes a total of 48 subtest patterns for analysis. The groupings are taken from Kaufman (1979), Lutey (1977) and Bush and Waugh (1982). They are separated into the following three categories to aid in test interpretation:

1. Analysis of major factor scores.
2. Analysis of behavioral-background influences.
3. Analysis of shared cognitive abilities.

Kaufman (1975) identified three major factors in a factor analysis of the WISC-R, corresponding to Cohen's (1959) Verbal Comprehension I (VCI), Perceptual Organization (PO), and Freedom from Distractibility (FD). Table 7 in appendix C identifies the subtests which were found to have primary loading on each factor. Sattler (1982) gave the following descriptions of the three factor

The Verbal Comprehension (VC) factor score measures verbal knowledge and comprehension, knowledge obtained in part by formal education and reflecting the application of verbal skills to situations that are new to the child. The Perceptual Organization (PO) factor score is a nonverbal factor involving perceptual and organizational dimensions and reflects the ability to

> interpret and organize visually perceived material while working against a time limit. The Freedom from Distractibility (FD) factor score measures the ability to remain undistracted (to attend or concentrate), but also may involve numerical ability. Short-term memory may be an important component of the Freedom from Distractibility factor, but it is not certain to what extent this is so (pp. 155,156).

The VC and PO factors are useful because they are purer measures of verbal comprehension and perceptual organization than the Verbal and Performance IQ scores. They aid in the interpretation of the Verbal and Performance IQs when low scores in Arithmetic and Coding distort their meaning. The FD factor aids in evaluating attending and concentration ability.

Kaufman (1979), Lutey (1977), and Sattler (1982) used different methods to determine if significant discrepancies exist between the three factor scores. Lutey (1977) compared the mean factor scores to the overall mean scaled score. The composition of each factor score is provided in the Factor table (Lutey, 1977) for the appropriate age group. Kaufman (1979) and Sattler (1982) used a consistent subtest composition for the factor scores for all age levels. Since the FD factor contains two subtests, Arithmetic and Coding, belonging to the Verbal and Performance scales respectively, Kaufman (1979) and Sattler (1982) compared the factor scores to one another rather than to the Verbal and Performance mean scaled scores in order to prevent overlap of content. Sattler (1982) presented a method which examined the differences between sets of Deviation IQs on the factor scores that are needed to satisfy the .05 and .01 significance levels. According to Kaufman (1979), the computation of another type of IQ is unnecessary.

Kaufman's method is used in this writer's computer WISC-R Analysis Program to determine the presence of significant discrepancies between the three factor scores. In this method, the mean for each factor is compared to the means on the other two factors to determine if there is a discrepancy of three or more scaled-score points. Kaufman considered a difference of at least one standard deviation to be significant. If a significant discrepancy exists between the FD factor score and either of the other two factors, a check for consistency in the scaled scores of the FD factor's three subtests should be done by the examiner before the discrepancy is interpreted as meaningful. If the range between the three scaled scores is wide, then the FD factor is not a unitary ability. The means and the analysis of the three factors can be recorded in the corresponding Part 4(a) of the analysis worksheet. In order to have consistency in the overview of strengths and weaknesses, the three factors are also included in the following analysis of cognitive abilities and influences.

An individual's performance on subtests is affected by (a) cognitive abilities and (b) behavioral-background influences (Kaufman, 1979). Each subtest is a measure of a number of abilities and influences. When the subtests which share a specific ability or influence are grouped together, the many subtest groupings formed for all the abilities or influences allow for a systematic search for the ability or influence which is responsible for the significantly high or low subtest score.

As an aid to this search this author has organized the more common groupings of subtests. The subtest patterns are separated into two groups, those that are largely cognitive in nature, "abilities", and those that are in the behavioral-background domain, "influences". The two categories are not distinct, so some

overlapping exists. Within each category, the abilities and influences which are similar in nature are grouped together. The list of patterns is not complete. In order to interpret the test data, abilities other than those in the more popular systems may have to be considered.

Overlapping and interrelatedness also exists among the patterns. The same pattern may be explained by different abilities. For example, the Distractibility, Sequencing, Facility with Numbers and Anxiety factors contain the same three subtests: Coding, Arithmetic and Digit Span. The factor chosen to best explain the data would depend on information from supplementary testing, observable test behaviors, the nature of the test responses, scores on other subtests, achievement in different school subjects, specific factors unique to the person and other background information. Variations exist in psychologists' choice of subtests for some patterns. Kaufman's (1979) composition is used by this author when differences existed. The listing and organization of subtest patterns is meant as an aid to test interpretation and not for the purpose of classifying factors which affect test performance. Flexibility and logical thinking is required by the examiner in the use of the subtest patterns for profile interpretation.

The subtest patterns used in the computer program are presented in Tables 8 and 9 of Appendix C. The WISC-R analysis worksheet provides a list of the behavioral-background influences and cognitive abilities, as well as the subtest composition for each pattern. The profile of subtest groupings provides the examiner with the following:

1. An awareness that factors exist which affect test performance and that they should be considered in individualized interpretations of the WISC-R.

2. An overview of some of the most common identified shared abilities and noncognitive influences.

3. A guideline for expanding expertise in factors underlying test performance.

4. A comprehensive and organized visual format for logically identifying and interpreting strengths and weaknesses in abilities.

5. The composition of the subtest patterns so the influence of specific subtests on a factor can be taken into consideration or compared; flexibility in analysis is permitted.

6. A graphic display of the individual subtests comprising each subtest pattern for quickly carrying out a manual analysis of subtest patterns using Kaufman's (1979) method or methods proposed by other psychologists such as Bush and Waugh (1982).

Kaufman's method for the analysis of subtest patterns is used in this writer's WISC-R analysis program. The process consists of the following six steps:

Step 1. Determine Significant strengths and weaknesses on the Verbal and Performance Scales.

Part III of the WISC-R analysis program determines the subtests which deviate significantly from the appropriate Verbal or Performance mean scales score. The subtests which differ from their own mean score by ± 3 points represent the strengths or weaknesses relative to the child's own level of ability on each scale. If there are no significant strengths and weaknesses on the Verbal or Performance

Scales, the global IQ information and the differences in Verbal Comprehension and Perceptual Organization skills serve as the primary explanation of the child's WISC-R profile.

Step 2. Select a subtest which deviates significantly from the appropriate mean and refer to the tables of shared abilities and influences on the WISC-R analysis worksheet.

All the abilities and influences which have a subtest identified as significant in the subtest pattern are systematically evaluated to identify the grouping(s) which underly the strengths and weaknesses on the Verbal and Performance Scales.

Step 3. One by one, consider each ability or influence with the selected subtest in it and compare each score on the other subtests in the pattern to their appropriate Verbal or Performance mean.

A shared ability or influence can be considered as a strength if one subtest score is significantly above the corresponding mean and all of the other pertinent subtest scaled scores in the subtest pattern are above their own mean score. A weakness is indicated when one subtest score is significantly below the corresponding mean and the scaled scores on the remaining relevant subtests are below their respective mean score. In the evaluation process, as soon as a subtest scaled score in the subtest grouping is found to be inconsistent with the above guidelines, the ability or influence should be rejected as a possible strength or weakness and the next ability or influence examined.

There are some subtest patterns which have a subtest the examiner can check for support. These subtests are in brackets ( ) in the tables of abilities and influences. They are not included in the computer program.

Step 4. Repeat Steps 2 and 3 for each subtest which deviates significantly from their appropriate Verbal or Performance mean score.

Each ability or influence which has been identified as a possible strength or weakness should be marked with the appropriate "S" (strength) or "W" (weakness) on the analysis worksheet. When a strength or weakness is present the computer analysis program indicates the number of the influence and the ability so they can be marked on the analysis worksheet.

Step 5. Integrate the information attained from the profile analysis with information about the child's test behaviors, nature of test responses, background and supplementary test scores.

Any apparent strengths or weaknesses identified through the analysis of subtest scores should have support from supplementary observations and data before hypotheses are formed. An individualized WISC-R analysis may help direct the examiner to the areas of ability which need comprehensive assessment before educational and remedial recommendations are made.

Step 6. If the analysis of shared abilities and influences fails to uncover possible hypotheses to explain the significantly high or low subtests then the unique abilities of these subtests are investigated.

The amount of specificity for each subtest should be considered in the subtest-specific interpretations. Pair-wise interpretations may also be done to assist in evaluating subtest fluctuations. Banas and Wills (1978) provided patterns in paired subtests that may aid in developing hypotheses and instructional approaches.

Two other analytic procedures which may be applied to the WISC-R analysis worksheet are outlined below:

1. Relative weaknesses and strengths may be located by determining the subtest patterns which have all the subtest scaled scores below (relative weakness) or above (relative strength) their appropriate Verbal or Performance mean score.

2. The average of the total scaled scores for each pattern or selected groups can be determined and compared with each other or the mean subtest score of 10 on the WISC-R. To accomplish this quickly the scaled score for each subtest can be placed under the subtest, where indicated in a group, going down each column of subtests one at a time. The average of the total of each group may be placed at the end of each designated pattern (Bush & Waugh, 1982). If this method is used, the results have interpretable value only when (a) the subtests in a pattern vary together and (b) the average score differs significantly from other selected mean scores. (Lutey, 1977).

Kaufman's method for the analysis of subtest patterns lacks the precision present in Lutey's (1977) procedure. It is an extension of the ±3 method he used for determining significant subtest strengths and weaknesses. The six reasons

outlined in Part III for not using precise values holds true for this portion of the analysis as well. The use of precise values is also very limiting in the number and selection of subtest patterns that can be considered in a profile analysis. The opportunity to examine a large number of factors that are measured by subtest scores results in a more thorough and personalized investigation, and the development of useful hypotheses about the child's strengths and weaknesses. Instead of being largely a quantitative endeavour, this analytic process uses psychometric guidelines in combination with logic (Kaufman, 1979).

Unlike the methods proposed by Lutey (1977) and Bush and Waugh (1982), Kaufman's method takes into consideration the aspect of consistency among the subtest scaled scores in a group pattern. It is possible for the scaled scores in a subtest pattern to span a wide range. In such cases, analytic methods which use the computation and comparison of scaled scored means or the overlapping of subtest clusters may incorrectly identify abilities or influences as responsible for the high or low subtest scores. Kaufman (1979) stated that it was difficult to conceive that an ability or influence which is not "unitary" could be a primary determinant of a child's performance on the individual subtests in a group pattern. The built-in check against inconsistency within a subtest pattern therefore reduces the chance of error without increasing the examiner's work.

Conclusion

There are limitations and flaws in the use of subtest patterns for profile

analysis of which examiners should be aware. The analysis of fluctuations in a child's WISC-R profile has as its basis "factor analysis". Subtest patterns represent clusters of variables. Nunnally (1978) stated that "each such cluster consists of variables that tend to measure the same thing and to measure something different from what is measured by other clusters" (pp. 437-438). Factor analysis is used to examine patterns of correlations and to determine the legitimacy of forming particular combinations. However, it has not been determined that the subtests in each group pattern, for all the abilities and influences identified, correlate more with one another than with the other subtests.

Lutey (1977) stated that unlike the Major Factors, other groupings of subtests "either were not derived in the usual way from factor analytic studies or do not have extensive support from such studies" (p. 221). Lutey related studies which showed support for the inclusion of some of the specific subtests into the groups used in her profile analysis. Sattler (1982) indicated that research into correlates associated with the WISC-R subtests was still limited.

The results of intelligence tests have been used to categorize students; however, research studies such as that done by Schooler, Beebe and Koepke (1978) have failed to show that distinct patterns exist for different groups of children such as emotionally impaired, mentally retarded and learning disabled. Profile analysis should not be used for making diagnostic classification decisions (Sattler, 1982).

The scatter analytic techniques used in profile analysis present a problem when applied uniformly to all subtests and to any individual child (Sattler, 1982). The range of scaled scores on all subtests is not uniform within every age level of

the WISC-R. The same number of scaled-score points can not be obtained on all subtests by children scoring high and who are over ten years of age. Since scaled scores are used in subtest patterns and comparisons of subtest scores form the basis of profile analysis it could be misleading to carry out a profile analysis on older gifted children.

Care must be taken against overinterpretation and interpretation without verification. When significant fluctuations are present in a profile it does not necessarily mean there is pathology or abnormality present. The differences in ability may be a reflection of the child's "cognitive style" (Sattler, 1982). It was emphasized by Vance, Wallbrown and Blaha (1978) that the WISC-R profile never constitutes an adequate basis for generating a remedial strategy. Hypotheses developed from the WISC-R profile analysis should be verified from other sources before being accepted or reported. Therefore the WISC-R should not be the only assessment administered. It should help supply some information on what should be investigated next.

The scores in the WISC-R profile analysis cannot be mechanically calculated and interpreted. Individualizing the interpretation of the WISC-R profile requires effort, competency and flexibility (Kaufman 1979). It requires an examiner who has:

1. Training in psychological theory.

2. An awareness of the limitations of the WISC-R and of the profile analysis.

3. Knowledge of different techniques for interpreting the WISC-R.

4. Knowledge of when, why, and how test performance is affected by the

different abilities and influences.

5. An "understanding of the educational, psychological and clinical ramifications of these patterns" (Kaufman, 1979, p.173).

6. The ability to integrate the analysis of subtest fluctuations with behavioral observations, test responses, supplementary test scores, case history material and background factors such as interests, socio-cultural factors, physical disabilities and school achievement.

7. The ability to generate hypotheses concerning strengths, weaknesses and needs, and translate these into effective remedial strategies.

Despite the problems which exist, Sattler (1982) stated that "it is still useful to evaluate routinely the pattern of scores obtained from the examinee" (p. 194). They can aid the examiner in the search for clues about a child's abilities; and they provide a broader base for understanding the child's functioning and for making meaningful recommendations.

Limitations also exist in this author's WISC-R Test Analysis Worksheet and computer WISC-R Analysis Program. There are many different kinds of information which can be obtained from the child's performance on the WISC-R. The proposed analysis program does not contain them all. The following approaches are not included:

1. Intertest scatter: analysis of subtest scaled-score ranges and the number of subtests deviating from the mean score.

2. Analysis of the discrepancy between Digits Forward and Digits Backward, in the Digit Span subtest.

3. Comparison of sets of individual subtest scores: pair and multiple.

4. Performance G.

5. Factor Analysis: based on Lutey (1977).

6. Determination of relative strengths and weaknesses.

The computer analysis program is limited to performing only the calculations in the analysis of scores. It does not calculate the scaled scores or IQs and it does not give tentative hypotheses or prescriptions for the differences in abilities identified.

The data used in the computer program for the test analysis is limited. For example, the analysis of Verbal-Performance differences uses the averages of the age-level data rather than the figures for each age level. Data for only one level of confidence (.05) is used thereby limiting the flexibility of choice. The calculations for determining subtests with significant deviations from their mean do not use precise values. The ± 3 value which is used may actually be slightly low.

In order to use the Test Analysis Worksheet with or without the computer program, the examiner must be knowledgeable with Kaufman's (1979) procedures for profile analysis. The Test Analysis Worksheet does not provide guidelines explaining how to investigate the subtest fluctuations.

The Test Analysis Worksheet is a guideline for a systematic, analytic interpretation of the WISC-R. It indicates four general areas of analysis and some of the more important specific types of information which can be investigated. It also provides the opportunity to record information in a systematic manner, thereby aiding test interpretation and report-writing. The computer program in combination with the worksheet makes the individualized interpretation of the WISC-R less time consuming and intimidating; therefore, it is more likely profile

analysis will be done routinely by the examiner.

The analysis of subtest fluctuations is not supported by all clinicians and researchers (Kaufman, 1979). However, the administration of the WISC-R only for the purpose of obtaining global IQ scores and making normative comparisons has little meaning or value in the elementary school setting. Since there is an emphasis in education at the present time on the individualization of instruction, a thorough understanding of the child's cognitive functioning is required. This author's proposed WISC-R Test Analysis Worksheet and computer analysis program are tools to assist the examiner carry out an individualized interpretation of the WISC-R which will help provide this required understanding of the child.

Bibliography

Banas, N. & Wills, I.H. (1978). *WISC-R prescription how to work creatively with individual learning styles.* Novato, California: Academic Therapy Publications.

Beery, K.E. & Buktenica, N.A. (1967). *Developmental Test of Visual Motor Integration.* Chicago: Follett Educational Corporation.

Bush, W.J. & Waugh, K.W. (1982). *Diagnosing learning problems* (3rd Ed.). Columbus: Charles E. Merrill Publishing Co.

Butler, K.G., & Wallach, G.P. (1980). Topics in language disorders. *Language Disorders and Learning Disabilities, 1,* 5.

Cohen, J. (1959). The factorial structure of the WISC at ages 7-6, 10-6, and 13-6. *Journal of Consulting Psychology, 23,* 285-299.

Colarusso, R.P. & Hammill, D.D. (1972). *Motor-Free Visual Perception Test.* Novato, Ca: Academic Therapy Publications.

Connolly, A.J., Natchman, W., & Pritchett, E.M. (1971). *KeyMath Diagnostic Arithmetic Test.* Circle Pines, Minn: American Guidance Service.

Dash, O.N., Dennis, S.S., Mueller, H.H., Mancini, G.J., Snart, F.D. & Short, R.H. (1983). WISC-R subtest variability in a clinic-referred sample of Canadian children. *Canadian Journal of Behavioral Science, 15* (3), 211-227.

Davis, F.B. (1959). Interpretation of differences among averages and individual test scores. *Journal of Educational Psychology, 50,* 162-170.

Department of Educational Psychology. (1975). *Internship Programme.* Memorial University of Newfoundland.

Dunn, L.M., & Dunn, L.M. (1981). *Peabody Picture Vocabulary Test-Revised.* Circle Pines, Minn: American Guidance Service.

Dunn, L.M. & Markwardt, F.C., Jr. (1970). *Peabody Individual Achievement Test.* Circle Pines, Minn: American Guidance Service.

Durrell, D.D. & Catterson, J.H. (1980). *Durrell Analysis of Reading Difficulty* (3rd. Ed.). New York: The Psychological Corporation.

Foster, R. Giddan, J.J. & Stark, J. (1973). *Assessment of Children's Language Comprehension* (rev. ed.). Palo Alto Ca: Consulting Psychologists Press Inc.

Gardner, R.A. (1979). *The Objective Diagnosis of Minimal Brain Dysfunction.* Cresskill, New Jersey: Creative Therapeutics.

Hammill, D.D. & Larsen, S.C. (1983). *Test of Written Language.* Austin, Tx: PRO-ED.

Hammill, D.D. & Newcomer, P.L. (1982). *Test of Language Development* Austin, Tx: PRO-ED.

Harwell, J.M. (1982). *How to Diagnose and Correct Learning Difficulties in the Classroom.* West Nyack, New York: Parker Publishing Co. Inc.

Jastak, J.F., & Jastak, S. (1978). *The Wide Range of Achievement Test* (rev. ed.). Wilmington, Del: Jastak Associates.

Kaufman, A.S. (1975). Factor analysis of the WISC-R at eleven age levels between 6-1/2 and 16-1/2 years. *Journal of Consulting and Clinical Psychology, 43,* 135-147.

Kaufman, A.S. (1979). *Intelligent testing with the WISC-R.* New York: Wiley Interscience.

Kaufman, A.S. (1980). Issues in psychological assessment: Interpreting the WISC-R intelligently. *Advances in Clinical Child Psychology, 3,* 177-214.

Kaufman, A.S. (1981). The WISC-R and learning disabilities assessment: State of the art. *Journal of Learning Disabilities, 14,* 520-525.

Kaufman, A.S., & Kaufman, N.L. (1977). *Clinical evaluation of young children with the McCarthy scales.* New York: Grune & Stratton.

Klas. L.D. (1984). A comparison of sub-test scoring patterns for males & females in various IQ groups on the WISC-R: A Newfoundland study. *The Newfoundland Psychologist, 6,* 14-23.

Levine, M.D., Oberlaid, F. & Meltzer, L. (1981). Developmental output failure: A study of low productivity in school-aged children. *Pediatrics, 67*(1), 18-25.

Lewis, R.B. (1983, November). Learning disabilities and reading: Instructional recommendations from current research. *Exceptional Children, 50,* 230-283.

Lezak, M.D. (1976). *Neuropsychological Assessment.* New York: Oxford University Press.

Lutey, C. (1977). *Individual intelligence testing: A manual and sourcebook* (2nd Ed.). Greeley, Colorado: Carol L. Lutey Publishing.

Mayron, L.W. (1979, January). Allergy, learning and behavior problems. *Journal of Learning Disabilities, 12,* 41-50.

McCarthy, D.A. (1972). *McCarthy Scales of Children's Abilities.* New York: Psychological Corporation.

McDermott, P.A. (1981). Sources of error in the psychoeducational diagnosis of children. *Journal of School Psychology, 19* (1), 31-45.

Newcomer, P.L. & Hammill, D.D. (1982). *Test of Language Development Primary.* Austin, Tx: PRO-ED.

Nunnally, J.C. (1978). *Psychometric Theory.* New York: McGraw-Hill.

Patterson, K.E. (1981). Neuropsychological approaches to the study of reading. *British Journal of Psychology, 72,* 151-174.

Raven, J.D. (1965). *The Coloured Progressive Matrices Test.* London: H.K. Lewis & Co. Ltd.

Reynell, J.K. (1977). *Reynell Developmental Language Scales* (rev. ed.). Windsor, England: NFER Publishing Co.

Sattler, J.M. (1974). *Assessment of children's intelligence* (rev. ed.). Philadelphia, PA: W.B. Saunders Co.

Sattler, J.M. (1982). *Assessment of children's intelligence and special abilities* (2nd Ed.) Boston: Allyn & Bacon Inc.

Schooler, D.L., Boebe, M.C. & Koepke, T. (1978). Factor analysis of WISC-R scores for children identified as learning disabled, educable mentally impaired and emotionally impaired. *Psychology in the Schools, 15,* 478-485.

Senf, G.M. & Torgeson, J.K. (1983). *Annual Review of Learning Disabilities, 1*

Slosson, R.L. (1963). *Slosson Oral Reading Test.* New York: Slosson Educational Publications.

Small, L. (1982). *The minimal brain dysfunctions.* New York: The Free Press.

Snart, H., Dennis, S., & Brailsford, A. (1983). Concerns regarding the Wide Range Achievement Test. *Canadian Psychology, 24,* 99-103.

Vance, H., Wallbrown, F., & Blaha, J. (1978). Determining WISC-R profiles for reading disabled children. *Journal of Learning Disabilities, 11,* 657-661.

Walker, N.W. & Myrick, C.C. (1985). Ethical considerations in the use of

computers in psychological testing and assessment. *Journal of School Psychology, 23,* 52-57.

Wallbrown, F.H., Vance, H.B. & Blaha, J. (1979). Developing remedial hypotheses from ability (WISC-R) profiles. *Journal of Learning Disabilities, 12* (8), 59-63.

Walsh, J., Marx, R.W. & Sudmant, W. (1983). WISC-R factor score profiles and academic achievement: A test of Kaufman's profile analysis procedures. *Canadian Journal of Behavioral Science, 15* (3), 203-210.

Wechsler, D. (1974). *Manual for the Wechsler Intelligence Scale for Children-Revised.* New York: Psychological Corporation.

Wechsler, D. (1974). *Wechsler Intelligence Scale for Children-Revised.* New York: Psychological Corporation.

Wechsler, D. (1955). *Wechsler Adult Intelligence Scale.* New York: Psychological Corporation.

Wepman, J.M. & Morency, A. (1975). *Auditory Sequential Memory Test & Auditory Memory Span Test.* Palm Springs, Ca: Language Research Associates.

Woodcock, R.W. (1973). *Woodcock Reading Mastery Tests.* Circle Pines, Minn: American Guidance Service.

Appendix A

WISC-R Test Analysis Worksheet

WISC-R TEST ANALYSIS WORKSHEET

NAME _____ SCHOOL _____

TEST DATE _____ GRADE _____

BIRTHDATE _____ TEACHER _____

AGE _____

1. Verbal Scale IQ _____ ±6

   Performance Scale IQ _____ ±8

   Full Scale IQ _____ ±5 Percentile Rank _____

   Classification _____

2. Verbal-Performance Discrepancy _____

   (a) probability of occurrence: Level of Significance _____

   (b) analysis of significance level at .05 confidence _____

   (c) frequency of occurrence: % of pop. obtaining this discrepancy is between _____ & _____

3. Profile of Scaled Scores and Analysis of Deviation of Subtest Scores from Mean Scores.

VERBAL	SCALED SCORE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	SIG.
INFORMATION: General Knowledge/Long Term Memory From Experience & School																				
SIMILARITIES: Relationship & Abstract Thinking/Association of Abstract Ideas																				
ARITHMETIC: Numerical Reasoning/ Computation/Concentration/Sequencing/Memory																				
VOCABULARY: Word Knowledge/ Verbal Fluency/Expressive Vocabulary																				
COMPREHENSION: Practical Knowledge/ Social Judgment/Reasoning/Logical Solutions																				
DIGIT SPAN: Attention/Concentration/ Rote and Immediate Memory/Sequencing																				
PERFORMANCE																				
PICTURE COMPLETION: Alertness to Details/Visual Attention and Memory																				
PICTURE ARRANGEMENT: Interpretation of Social Situation/Sequencing/Visual Alertness																				
BLOCK DESIGN: Reproduce Design from Pattern/Visual Perception/Analysis/Synthesis																				
OBJECT ASSEMBLY: Reproduce Familiar Forms from Memory/Visual Retention																				
CODING: Attention to Task/Speed & Accuracy of Learning Meaningless Symbols/Memory																				
MAZES: Planning & Following Visual Pattern																				

Verbal Mean _____ Performance Mean _____ Full Scale Mean _____

4. Analysis of Subtest Patterns

(a) Analysis of Factor Scores

(i) Factors Mean
VC _____
PO _____
FD _____

(ii) Significant discrepancies (differences of 3 or more)_____

(b) Analysis of Behavioral-Background Influences

			Verbal Subtests				Performance Subtests					
Influence	I	S	A	V	C	DS	PC	PA	BD	OA	Cd	M
1 Freedom from Distractibility			A			DS					Cd	
2 Attention span			A			DS						
3 Concentration			A				PC					
4 Freedom from uncertainty							PC			OA		M
5 Fluency -Responsiveness				(V)	C	DS					Cd	
6 Anxiety			A			DS					Cd	
7 Working under time pressure			A				PC	PA	BD	OA	Cd	M
8 Cultural opportunities	I			V	C			PA				
9 Richness of early environ.	I			V								
10 Interests -Extent of outside reading	I	S		V								
11 School learning	I		A	V								

(c) Analysis of Cognitive Abilities

	Verbal Subtests						Performance Subtests					
Ability	**I**	**S**	**A**	**V**	**C**	**DS**	**PC**	**PA**	**BD**	**OA**	**Cd**	**M**
A Verbal												
1 Comprehension	I	S		V	C							
2 Concept formation -Abstract thinking		S		V								
3 Much expression -Conceptualization		S		V	C							
4 Little expression	I		A			DS						
B Visual (Motor)												
5 Perceptual org.							PC	PA	BD	OA		M
6 Spatial							PC		BD	OA		(M)
7 Organization (no essential motor)							PC	PA				
8 V-M coordination									BD	OA	Cd	M
9 Pencil skill											Cd	M
10 Abstract stimuli -Model reproduct.									BD		Cd	
11 Meaningful stimuli							PC	PA		OA		
12 Synthesis								PA	BD	OA		
C Memory												
13 Auditory	I		A			DS						
14 Visual							PC				Cd	
15 Long term -Acquired knowl.	I		A	V								
16 Short term						DS					Cd	
17 Recall	I			V		DS						
18 Fund of Info.	I			V								

Ability	Verbal Subtests						Performance Subtests					
	I	S	A	V	C	DS	PC	PA	BD	OA	Cd	M
D Auditory												
19 Brief stimuli		S		V		DS						
20 Long stimuli	I		A		C							
E Cognitive Style												
21 Right brain -Holistic							PC			OA		
22 Left brain -Abstract thinking		S		V								
23 Simultaneous							PC		BD	OA		
24 Successive								PA			Cd	M
25 Integrated funct.								PA	BD		Cd	M
26 Convergent prod.								PA			Cd	
27 Sequencing			A			DS		(PA)			Cd	
28 Field indep./dep.							PC		BD	OA		
F Thinking												
29 Cognition		S	A	V			PC		BD	OA		M
30 Reasoning		S	A		C			PA				M
31 Learning ability				V							Cd	
32 Mental alertness			A			DS						
33 Evaluation					C		PC	PA	BD	OA	Cd	
34 Common sense -Social judgment					C			PA				
35 Dist. essential from nonessential		S					PC	PA				
36 Planning ability								PA				M
37 Numerical facility			A			DS					Cd	

Appendix B

WISC-R Analysis Program
for the Texas Instrument TI 99-4A Computer.

WISC-R Analysis Program

for the Texas Instrument TI 99-4A Computer

```
100 VST=0
110 CALL CLEAR
120 DIM SS(12)
130 DIM SIGT(12)
140 DIM TEST$(12)
150 TEST$(1)="I"
160 TEST$(2)="S"
170 TEST$(3)="A"
180 TEST$(4)="V"
190 TEST$(5)="C"
200 TEST$(6)="DS
210 PRINT "   WISC-R ANALYSIS PROGRAM ":::::::::::
220 TEST$(7)="PC"
230 TEST$(8)="PA"
240 TEST$(9)="BD"
250 TEST$(10)="OA"
260 TEST$(11)="Cd"
270 TEST$(12)="M"
280 INPUT "1 NAME  :":NAME$
290 PRINT "":::
300 PRINT "  IQ"
```

```
310 INPUT "   V:":VIQ
320 INPUT "   P:":PIQ
330 INPUT "   FS:":FSIQ
340 PRINT "":
350 PRINT "  SCALED SCORES"
360 PRINT "   verbal "
370 INPUT "   I:":SS(1)
380 INPUT "   S:":SS(2)
390 INPUT "   A:":SS(3)
400 INPUT "   V:":SS(4)
410 INPUT "   C:":SS(5)
420 INPUT "   DS:":SS(6)
430 PRINT "   performance"
440 INPUT "   PC:":SS(7)
450 INPUT "   PA:":SS(8)
460 INPUT "   BD:":SS(9)
470 INPUT "   OA:":SS(10)
480 INPUT "   Cd:":SS(11)
490 INPUT "   M:":SS(12)
500 PRINT "":
510 VPD=ABS(VIQ-PIQ)
520 PRINT "2 V-P DISCREP. =  ";VPD
530 IF VPS> 4.06 THEN 560
540 A$="> .50"
```

```
550 GOTO 780
560 IF VPD> 6.77 THEN 590
570 A$=".50"
580 GOTO 780
590 IF VPD> 7.54 THEN 620
600 A$=".25"
610 GOTO 780
620 IF VPS> 9.72 THEN 650
630 A$=".20"
640 GOTO 780
650 IF VPD> 11.54 THEN 680
660 A$=".10"
670 GOTO 780
680 IF VPD> 13.72 THEN 710
690 A$=".05"
700 GOTO 780
710 IF VPD> 15.19 THEN 740
720 A$=".02"
730 GOTO 780
740 IF VPD> 19.43 THEN 770
750 A$=".01"
760 GOTO 780
770 A$=".001"
780 PRINT " (a) prob. of occur. is ";A$
```

```
790 IF VPD> 11.54 THEN 820
800 PRINT " (b) discrepancy is not sig."
810 GOTO 830
820 PRINT " (b) discrepancy is sig."
830 IF VPD> 8.41 THEN 860
840 A$="50&100 %"
850 GOTO 1080
860 IF VPD> 14.01 THEN 890
870 A$="25&50 %
880 GOTO 1080
890 IF VPD> 15.60 THEN 920
900 A$="20&25 %"
910 GOTO 1080
920 IF VPD> 20.11 THEN 950
930 A$="10&20 %"
940 GOTO 1080
950 IF VPD> 23.88 THEN 980
960 A$="5&10 %"
970 GOTO 1080
980 IF VPD> 28.39 THEN 1010
990 A$="2&5 %"
1000 GOTO 1080
1010 IF VPD> 31.44 THEN 1040
1020 A$="1&2 %"
```

```
1030 GOTO 1080
1040 IF VPD> 40.21 THEN 1070
1050 A$=".1&1 %"
1060 GOTO 1080
1070 A$="0&.1 %"
1080 PRINT " (c) freq. of occur. is        between ";A$
1090 PRINT "":
1100 CALL KEY(0,K,S)
1110 IF S=0 THEN 1100
1120 C=0
1130 FOR A=1 TO 6
1140 IF SS(A)=0 THEN 1170
1150 VST=VST+SS(A)
1160 C=C+1
1170 NEXT A
1180 VST=VST/C
1190 PRINT "3 (a) SCALE MEANS"
1200 PRINT "      V: ";VST
1210 C=0
1220 FOR A=7 TO 12
1230 IF SS(A)=0 THEN 1260
1240 PST=PST+SS(A)
1250 C=C+1
1260 NEXT A
```

```
1270 PST=PST/C
1280 PRINT "      P: ";PST
1290 C=0
1300 FOR A=1 TO 12
1310 IF SS(A)=0 THEN 1340
1320 FSST=FSST+SS(A)
1330 C=C+1
1340 NEXT A
1350 FSST=FSST/C
1360 PRINT "     FS:";FSST
1370 X=VST
1380 GOSUB 1630
1390 RVST=X
1400 FOR A=1 TO 6
1410 IF SS(A)-3>=RVST THEN 1450
1420 IF SS(A)+3<=RVST THEN 1470
1430 NEXT A
1440 GOTO 1490
1450 SIGT(A)=1
1460 GOTO 1430
1470 SIGT(A)=2
1480 GOTO 1430
1490 X=PST
1500 GOSUB 1630
```

```
1510 RPST=X
1520 FOR A=6 TO 12
1530 IF SS(A)-3>+RPST THEN 1570
1540 IF SS(A)+3<=RPST THEN 1590
1550 NEXT A
1560 GOTO 1610
1570 SIGT(A)=1
1580 GOTO 1550
1590 SIGT(A)=2
1600 GOTO 1550
1610 REM
1620 GOTO 1720
1630 REM ROUND OFF
1640 Y=INT(X)
1650 Z=X-Y
1660 Z=X*10
1670 IF Z>=5 THEN 1690
1680 GOTO 1700
1690 Y=Y+1
1700 X=Y
1710 RETURN
1720 PRINT "";
1730 PRINT "  (b) SIG. SUBTESTS :"
1740 PRINT "(    strong:"
```

```
1750 FOR A=1 TO 12
1760 IF SIGT(A)<>1 THEN 1780
1770 PRINT TAB(9);TEST$(A)
1780 NEXT A
1790 PRINT"     weak:"
1800 FOR A=1 TO 12
1810 IF SIGT(A)<>2 THEN 1830
1820 PRINT TAB(9);TEST$(A)
1830 NEXT A
1840 PRINT "":
1850 CALL KEY(0,K,S)
1860 IF S=0 THEN 1850
1870 C=0
1880 IF SS(1)=0 THEN 1910
1890 VC=VC+SS(1)
1900 C=C+1
1910 IF SS(2)=0 THEN 1940
1920 VC=VC+SS(2)
1930 C=C+1
1940 IF SS(4)=0 THEN 1970
1950 VC=VC+SS(4)
1960 C=C+1
1970 IF SS(5)=0 THEN 2000
1980 VC=VC+SS(5)
```

```
1990 C=C+1
2000 MVC=VC/C
2010 C=0
2020 FOR A=7 TO 10
2030 IF SS(A)=0 THEN 2060
2040 C=C+1
2050 PO=PO+SS(A)
2060 NEXT A
2070 IF SS(12)=0 THEN 2100
2080 PO=PO+SS(12)
2090 C=C+1
2100 MPO=PO/C
2110 C=0
2120 IF SS(3)=0 THEN 2150
2130 FD=FD+SS(3)
2140 C=C+1
2150 IF SS(6)=0 THEN 2180
2160 FD=FD+SS(6)
2170 C=C+1
2180 IF SS(11)=0 THEN 2210
2190 FD=FD+SS(11)
2200 C=C+1
2210 MFD=FD/C
2220 PRINT "4 (a) FACTORS"
```

```
2230 PRINT "      means: VC";MVC
2240 PRINT "             PO";MPO
2250 DIF1=ABS(MVC-MPO)
2260 PRINT "             FD";MFD
2270 DIF2=ABS(MPO-MFD)
2280 PRINT "     sig.dif.:"
2290 DIF3=ABS(MVC-MFD)
2300 IF DIF1>=3 THEN 2320
2310 GOTO 2330
2320 PRINT TAB(14);"VC & PO"
2330 IF DIF2>=3 THEN 2350
2340 GOTO 2360
2350 PRINT TAB(14);"PO & FD"
2360 IF DIF3>=3 THEN 2380
2370 GOTO 2390
2380 PRINT TAB(14);"VC & FD"
2390 REM
2400 DATA 3,6,11,-1,3,6,-1,3,7,-1,7,10,12,-1
2410 DATA 5,6,11,-1,3,6,11,-1,3,7,8,9,10,11,12,-1
2420 DATA 1,4,5,8,-1,1,4,-1,1,2,4,-1,1,3,4,-1,0,0,0
2430 DIM SC(38)
2440 PRINT "";
2450 PRINT "  (b) INFLUENCES"
2460 PRINT "      sig. weak:"
```

```
2470 TA=1
2480 CH=0
2490 SI=0
2500 READ X
2510 IF X<>-1 THEN 2580
2520 IF CH<>1 THEN 2560
2530 IF SI<>0 THEN 2560
2540 SC(TA)=1
2550 PRINT TAB(7);TA
2560 TA=TA+1
2570 GOTO 2480
2580 CO=VST
2590 IF X<7 THEN 2610
2600 CO=PST
2610 IF CO-SS(X)<3 THEN 2630
2620 CH=1
2630 IF CO-SS(X)>=1 THEN 2650
2640 SI=1
2650 IF TA<12 THEN 2500
2660 RESTORE 2400
2670 PRINT "     sig. strong:"
2680 TA=1
2690 CH=0
2700 SI=0
```

```
2710 READ X
2720 IF X<>-1 THEN 2790
2730 IF CH<>1 THEN 2770
2740 IF SI<>0 THEN 2770
2750 SC(TA)=1
2760 PRINT TAB(7);TA
2770 TA=TA+1
2780 GOTO 2690
2790 CO=VST
2800 IF X<7 THEN 2820
2810 CO=PST
2820 IF SS(X)-CO<3 THEN 2840
2830 CH=1
2840 IF SS(X)-C>=1 THEN 2860
2850 SI=1
2860 IF TA<12 THEN 2710
2870 PRINT "";
2880 DATA 1,2,4,5,-1,2,4,-1,2,4,5,-1,1,3,6,-1
2890 DATA 7,8,9,10,12,-1,7,9,10,-1,7,8,-1,9,10,11,12,-1
2900 DATA 11,12,-1,9,11,-1,7,8,10,-1,8,9,10,-1,1,3,6,-1
2910 DATA 7,11,-1,1,3,4,-1,6,11,-1,1,4,6,-1,1,4,-1
2920 DATA 2,4,6,-1,1,3,5,-1,7,10,-1,2,4,-1,7,9,10,-1
2930 DATA 8,11,12,-1,8,9,11,12,-1,8,11,-1,3,6,11,-1,7,9,10,-1
2940 DATA 2,3,4,7,9,10,12,-1,2,3,5,8,12,-1,4,11,-1,3,6,-1
```

```
2950 DATA 5,7,8,9,10,11,-1,5,8,-1,2,7,8,-1,8,12,-1,3,6,1,1,-1,0,0,0
2960 PRINT "  (c) ABILITIES"
2970 PRINT "      sig. weak:"
2980 TA=1
2990 CH=0
3000 SI=0
3010 READ X
3020 IF X<>-1 THEN 3090
3030 IF CH<>1 THEN 3070
3040 IF SI<>0 THEN 3070
3050 SC(TA)=1
3060 PRINT TAB(7);TA
3070 TA=TA+1
3080 GOTO 2990
3090 CO=VST
3100 IF X<7 THEN 3120
3110 CO=PST
3120 IF CO-SS(X)<3 THEN 3140
3130 CH=1
3140 IF CO-SS(X)>=1 THEN 3160
3150 SI=1
3160 IF TA<38 THEN 3010
3170 PRINT "      sig. strong :"
3180 RESTORE 2880
```

```
3190 TA=1
3200 CH=0
3210 SI=0
3220 READ X
3230 IF X<>-1 THEN 3300
3240 IF CH<>1 THEN 3280
3250 IF SI<>0 THEN 3280
3260 SC(TA)=1
3270 PRINT TAB(7);TA
3280 TA=TA+1
3290 GOTO 3200
3300 CO=VST
3310 IF X<7 THEN 3330
3320 CO=PST
3330 IF SS(X)-CO<3 THEN 3350
3340 CH=1
3350 IF SS(X)-CO>=1 THEN 3370
3360 SI=1
3370 IF TA<38 THEN 3220
```

Appendix C

Tables C-1 - C-9

Table C-1

Confidence Intervals for WISC-R Scales:

Average of 11 Age Groups

Scale	Confidence Level	
	85%	90%
Verbal Scale IQ	+-5	+-6
Performance Scale IQ	+-7	+-8
Full Scale IQ	+-5	+-5

Note. From *Assessment of Children's Intelligence and Special Abilities* (2nd Ed.) (p. 566) by J.M. Sattler, 1982, Boston: Allyn & Bacon Inc.

Table C-2

Probability of Obtaining Designated Differences between Individual WISC-R Verbal and Performance IQs

Probability of Obtaining Given or Greater Discrepancy by Chance	Verbal-Performance Difference
.50	4.06
.25	6.77
.20	7.54
.10	9.72
.05	11.54
.02	13.72
.01	15.19
.001	19.43

Note. From *Assessment of Children's Intelligence and Special Abilities* (2nd Ed.) (p. 572) by J.M. Sattler, 1982, Boston: Allyn & Bacon Inc.

Table C-3

Percentage of Population Obtaining Discrepancies Between WISC-R Verbal and Performance IQs

% in Population Obtaining Given or Greater Discrepancy	Verbal-Performance Difference
50	8.41
25	14.01
20	15.60
10	20.11
5	23.88
2	28.39
1	31.44
.1	40.21

Note. From *Assessment of Children's Intelligence and Special Abilities* (2nd Ed.) (p.572) by J.M. Sattler, 1982, Boston: Allyn & Bacon Inc.

Table C-4

Differences Required for .05 Significance Level when each WISC-R Subtest Scaled Score is Compared to the Relevant Verbal or Performance Mean Scaled Score

	Verbal Scale		Performance Scale	
Subtest	5 Subtests	6 Subtests	5 Subtests	6 Subtests
Information	2.81	2.94	----	----
Similarities	3.07	3.22	----	----
Arithmetic	3.14	3.30	----	----
Vocabulary	2.74	2.86	----	----
Comprehension	3.15	3.32	----	----
Digit Span	----	3.42	----	----
Picture Completion	----	----	3.38	3.55
Picture Arrangement	----	----	3.59	3.78
Block Design	----	----	2.92	3.03
Object Assembly	----	----	3.82	4.06
Coding	----	----	3.70	3.89
Mazes	----	----	----	4.03

Note. From *Assessment of Children's Intelligence and Special Abilities* (2nd Ed.) (p.568) by J.M. Sattler, 1982, Boston: Allyn & Bacon Inc.

Table C-5

The Amount of Specificity for WISC-R Subtests

Ample	Adequate	Inadequate
Information	Vocabulary	Similarities-
Similarities-	Comprehension	ages 9 1/2 - 16 1/2
ages 6 1/2 - 8 1/2	Picture Completion-	Object Assembly
Arithmetic	ages 9 1/2 - 16 1/2	
Digit Span		
Picture Completion-		
ages 6 1/2 - 8 1/2		
Picture Arrangement		
Block Design		
Coding		
Mazes		

Note. From *Intelligent Testing with the WISC-R* (p. 114) by A.S. Kaufman, 1979, New York: John Wiley & Sons.

Table C-6

Differences Required for .05 Significance Level when each WISC-R Subtest Scaled Score is Compared to the Mean Scaled Score

Subtest	10 Subtests	11 Subtests	11 Subtests	12 Subtests
Information	3.25	3.29	3.30	3.34
Similarities	3.60	3.65	3.66	3.71
Arithmetic	3.69	3.75	3.76	3.81
Vocabulary	3.15	3.19	3.20	3.24
Comprehension	3.71	3.77	3.78	3.83
Digit Span	-----	3.89	-----	3.96
Picture Completion	3.86	3.92	3.93	3.98
Picture Arrangement	4.14	4.21	4.22	4.28
Block Design	3.20	3.24	3.25	3.29
Object Assembly	4.45	4.53	4.54	4.61
Coding	4.29	4.36	4.37	4.43
Mazes	-----	-----	4.54	4.61

Note. From *Assessment of Children's Intelligence and Special Abilities* (2nd Ed.), 1982, by J.M. Sattler, Boston: Allyn & Bacon Inc.

Table C-7

Major factors in the WISC-R

Verbal Comprehension	Perceptual Organization	Freedom from Distractibility
Information	Picture Completion	Arithmetic
Similarities	Picture Arrangement	Digit Span
Vocabulary	Block Design	Coding
Comprehension	Object Assembly	
	Mazes	

Note. From *Intelligent Testing with the WISC-R* (p. 22) by A.S. Kaufman, 1979, New York: John Wiley & Sons.

Table C-8

Behavioral-Background Influences which may affect Performance on two or more Subtests

	Verbal Subtests						Performance Subtests					
Influence	**I**	**S**	**A**	**V**	**C**	**DS**	**PC**	**PA**	**BD**	**OA**	**Cd**	**M**
1 Freedom from Distractibility			A			DS					Cd	
2 Attention span			A			DS						
3 Concentration			A				PC					
4 Freedom from uncertainty							PC			OA		M
5 Fluency -Responsiveness				(V)	C	DS					Cd	
6 Anxiety			A			DS					Cd	
7 Working under time pressure			A				PC	PA	BD	OA	Cd	M
8 Cultural opportunities	I			V	C			PA				
9 Richness of early environ.	I			V								
10 Interests -Extent of outside reading	I	S		V								
11 School learning	I		A	V								

Note Adapted from *Intelligent Testing with the WISC-R* (p. 177) by A.S. Kaufman, 1979, New York: John Wiley & Sons.

Table C-9

Cognitive Abilities which may affect

Performance on two or more subtests

	Verbal Subtests						Performance Subtests					
Ability	**I**	**S**	**A**	**V**	**C**	**DS**	**PC**	**PA**	**BD**	**OA**	**Cd**	**M**
A Verbal												
1 Comprehension	I	S		V	C							
2 Concept formation		S		V								
-Abstract thinking												
3 Much expression		S		V	C							
-Conceptualization												
4 Little expression	I		A			DS						
B Visual (Motor)												
5 Perceptual org.							PC	PA	BD	OA		M
6 Spatial							PC		BD	OA		(M)
7 Organization (no essential motor)							PC	PA				
8 V-M coordination									BD	OA	Cd	M
9 Pencil skill											Cd	M
10 Abstract stimuli									BD		Cd	
-Model reproduct.												
Meaningful stimuli							PC	PA		OA		
12 Synthesis								PA	BD	OA		

(table continues)

Ability	Verbal Subtests						Performance Subtests					
	I	S	A	V	C	DS	PC	PA	BD	OA	Cd	M
C Memory												
13 Auditory	I		A			DS						
14 Visual							PC				Cd	
15 Long term -Acquired knowl.	I		A	V								
16 Short term						DS					Cd	
17 Recall	I			V		DS						
18 Fund of Info.	I			V								
D Auditory												
19 Brief stimuli		S		V		DS						
20 Long stimuli	I		A		C							
E Cognitive Style												
21 Right brain -Holistic							PC			OA		
22 Left brain -Abstract thinking		S		V								
23 Simultaneous							PC		BD	OA		
24 Successive								PA			Cd	M
25 Integrated funct.								PA	BD		Cd	M
26 Convergent prod.								PA			Cd	
27 Sequencing			A			DS		(PA)			Cd	
28 Field indep./dep.							PC		BD	OA		

(table continues)

Ability	Verbal Subtests						Performance Subtests					
	I	S	A	V	C	DS	PC	PA	BD	OA	Cd	M
F Thinking												
Cognition		S	A	V			PC		BD	OA		M
30 Reasoning		S	A		C			PA				M
31 Learning ability				V							Cd	
32 Mental alertness			A			DS						
33 Evaluation					C		PC	PA	BD	OA	Cd	
34 Common sense					C			PA				
Social judgment					C			PA				
35 Dist. essential from nonessential		S					PC	PA				
36 Planning ability								PA				M
37 Numerical facility		A			DS					Cd		

Note Adapted from *Intelligent Testing with the WISC-R* (pp. 174 - 176) by A.S. Kaufman, 1979, New York: John Wiley & Sons.