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Cognitive profiles of blind children: A survey of intra-child differences

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Abstract

"Since 1900, when the first public school class was organized in Chicago, special classes for blind children have been established in most larger and intermediate-sized communities as well. At the onset, all of the instruction for the blind was conducted in special classes. Gradually, however, blind children in these classes were reassigned for part of the day to regular classes." Today, this trend has turned into a movement to fully integrate blind children into the regular classroom. Within regular classrooms, teachers recognize the existence of individual differences; therefore, instructional methods and assignments are tailored to meet the divergent needs in the classroom such that each child might benefit from the instruction.

COGNITIVE PROFILES OF BLIND CHILDREN: A SURVEY OF INTRA-CHILD DIFFERENCES

A Research Paper

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Linda L. Royster

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Date Approved

Dedication:

Heritage by Countee Cullen

What is Africa to me:
Copper sun or scarlet sea,
Jungle star or Jungle track,
Strong bronzed men, or regal black
Women from whose loins I sprang
When the birds of Eden sang?
One three centuries removed
From the scenes his fathers loved,
Spicy grove, cinnamon tree,
What is Africa to me?

To My Mothers

Rubertha Huggins
Rubertha White
Annie M. Royster

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Chapter 1

THE PROBLEM

INTRODUCTION

"Since 1900, when the first public school class was organized in Chicago, special classes for blind children have been established in most larger and intermediate-sized communities as well. At the onset, all of the instruction for the blind was conducted in special classes. Gradually, however, blind children in these classes were reassigned for part of the day to regular classes."[1] Today, this trend has turned into a movement to fully integrate blind children into the regular classroom.

Within regular classrooms, teachers recognize the existence of individual differences; therefore, instructional methods and assignments are tailored to meet the divergent needs in the classroom such that each child might benefit from the instruction. The concept of intra-child differences is used to organize an instructional program for the particular child in comformity with his abilities and

[1] Samuel A. Kirk, Educating Exceptional Children (Boston: Houghton Mifflin, 1972), p. 326.

disabilities, without regard to how he compares to other children.[2]

Since the time that Scholl described the value of the Wechsler Intelligence Scale for Children (WISC) in assessment of blind children, it has been widely used to gain an index of intra-child profiles.[3] To date, most work published about the blind child's performance on the WISC has dealt with the reliability and validity of the IQ scores derived from its use or inter-child comparisons of the blind child with the sighted. "But IQ in and of itself, is literally of no help to the elementary teacher in deciding what kind of educational experiences to provide for her children."[4] Though inter-child differences tell us how we expect the blind child to perform generally in comparison with his sighted peer, they are not particularly relevant when determining his educational needs and what cognitive strengths he possesses that may be used to foster achievements.

With this in mind, this experiment undertakes a scatter analysis of the WISC Subtest Verbal Scaled Scores (SS) designed to assess the cognitive style of blind

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[2]Ibid., p. 8.

[3]Geraldine Scholl, "Intelligence Test for Visually Handicapped Children," Exceptional Child, 20:116-123, December, 1953.

[4]T. Ernest Newland, "Prediction and Evaluation of Academic Learning by Blind Children, II: Problems and Procedures in Evaluation," International Journal for the Education of the Blind, 14:42-51, December, 1964.

children, and thus to aid educators in planning curricula designed to facilitate their congitive growth.

Statement of the Problem

The study assessed intra-Verbal Scale subtest scatter of blind children diagnosed legally blind to determine significant differences in performance within age and ability groups.

The hypotheses of this inquiry were as follows:

1. For Ss in Age Group 8-10, intra-scale differences between WISC Verbal SS will be non-significant.

2. For Ss in Age Group 11-13, intra-scale differences between WISC Verbal SS will be non-significant.

3. For Ss in Age Group 14-16, intra-scale differences between WISC Verbal SS will be non-significant.

4. For Ss in IQ Group 89 and below, intra-scale differences between WISC Verbal SS will be non-significant.

5. For Ss in IQ Group 90-110, intra-scale differences between WISC Verbal SS will be non-significant.

6. For Ss in IQ Group 111 and above, intra-scale differences between WISC Verbal SS will be non-significant.

Definition of Terms

Blind Child: An educationally blind child who, due to the nature of his disability, whether congenitally blind, totally blind or partially sighted, has been diagnosed as "legally blind" and admitted to a residential school for the blind because of his special instructional needs.

Assumptions

At present, the Verbal Scale of the WISC has not been standardized on a blind population. Thus, there are no norms for blind children. Therefore, a primary assumption underlying this investigation is that the WISC yields a valid and consistent measure of intellectual functioning for the blind child.

It is further assumed that evaluation of each child's disability has been done with great care such that all children used in this study have been correctly diagnosed as legally blind.

Chapter 2

REVIEW OF RELATED LITERATURE

Historically, little work has been done in the assessment of intra-group performance of blind children in an attempt to determine areas of cognitive strength and weakness and, moreover, the effect of maturation on these areas. Indubitably, most research has been concerned with the comparison of blind and sighted children or the validity and reliability of different instruments for assessment of blind children's intelligence.

However, the work of Tillman is most closely related to this investigation and his findings suggest possible outcomes of this project. In his factor and item analysis of the WISC Verbal Scale, Tillman found that each subtest loads on a Factor 1 and 2 for blind children.[5]

Factor 1: Information: Consists generally of items the answer to which the average 10 year old could pick up in the course of maturation.

Arithmetic: Rote process of manipulating numbers.

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[5]M. H. Tillman, "The Performance of Blind and Sighted Children on the Wechsler Intelligence Scale for Children: Study 2," The International Journal for the Education of the Blind, 16:106-112, May, 1967.

Comprehension: Judgment which is based on broader social experience.

Similarities: Items which can be solved by conceptualization at the concrete or fundamental level.

Vocabulary: Word definition

Factor 2: Information: Information acquired in the classroom or enriched environment.

Comprehension: Common sense judgment.

Arithmetic: Numerical reasoning process.

Similarities: Abstraction.

Vocabulary: Command of words or word richness.

By introducing Factor 1 and 2, Tillman seems to be making between-subtest comparisons similar to those between-subtest comparisons reported by Jensen: "In factor analysis, a variety of tests of associative learning abilities and memory (digit span, serial and paired-associate learning, free recall of uncategorized lists, etc.) tend to cluster together: these tests represent in varying degrees what I call Level 1 abilities. On the other hand another class of tests, which are not highly correlated with Level 1 tests also cluster together: standard verbal and nonverbal IQ tests, tests involving abstract reasoning, symbol manipulation, free recall of conceptually categorized lists, etc."[6] Blind children seem to perform better in Level 1 tasks, as they obtain more and higher factor loadings on

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[6]Arthur R. Jensen, "Reducing the Heredity-Environment Uncertainty: A Reply," Harvard Educational Review, 39:449-483, Summer, 1969.

Tillman's Factor 1 on all subtests.[7] This appears to hold true for blind children's inter-subtest performance; they do better on Level 1 (Digit Span and Information) than Level II (Similarities and Comprehension) tasks.

The modification of the Psycholinguistic Model proposed by Kirk and Paraskevopoulos[8], Figure 1, can help us further understand the implications of these findings with regard to the cognitive style of blind children. According to this model, learning involves three forms of input (visual, auditory, tactual), integration of these signals, and verbal or motor expression. Feedback is seen as a central cognitive and affective component of the model, and the Memory Bank plays a direct role in interpretation and synthesis of incoming messages and determining how expressive behavior is to be formulated and executed.

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[7] Tillman, op. cit., "The Performance of Blind and Sighted Children on Wechsler Intelligence Scale for Children: Study 2," pp. 107-111.

[8] Samuel A. Kirk and John Paraskevopoulos, The development and psychometric characteristics of the revised Illinois Test of Psycholinguistic Abilities (Urbana, University of Illinois Press, 1969).

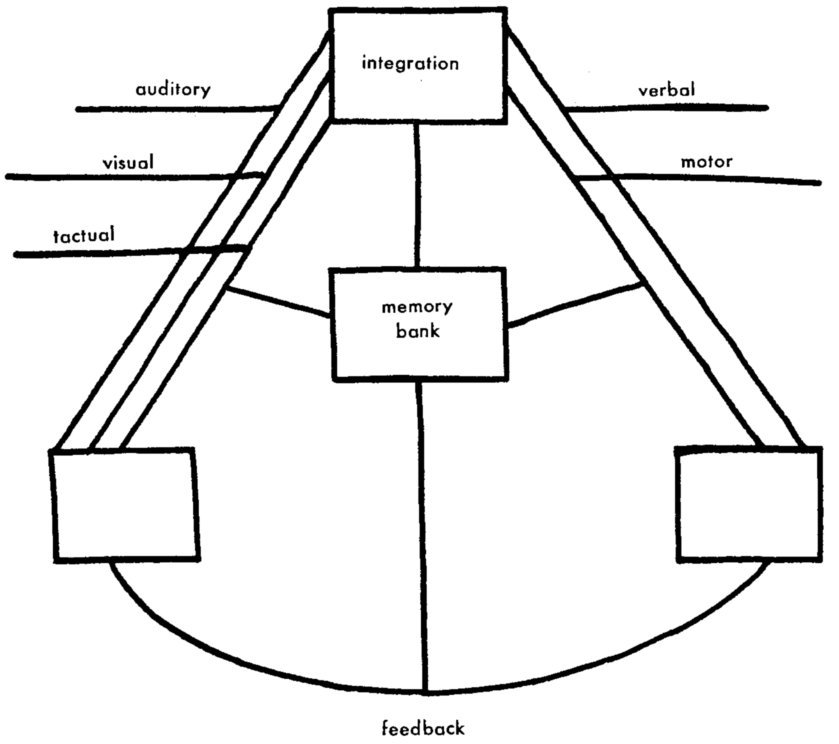

Fig. 1. Modified Psycholinguistic Cognitive-Affective Model.

Applying this model, blind children obtain higher scores on tasks requiring use of short term memory (Digit Span) and recall of isolated bits of information (Information); they obtain consistently lower scores on tasks of judgment and abstract reasoning which require synthesis or analysis of information in the Memory Bank (Similarities and Comprehension). Looking at Tillman's findings in the framework of this model and in terms of educational objectives, there are several conclusions to be made about the blind child. "First, there appears to be a lack of integration among educational experiences with the result that each bit of knowledge is isolated and cast into a separate frame of reference. [Further research may reveal the tendency of blind children to fragment may be associated with anxiety as indicated in Rorschach research.[9]] Second, verbal abilities focus on the basic vocabulary without much elaboration. Third, the blind tend to approach abstract conceptualization problems from a concrete and functional level . . ."[10] and finally, by promoting greater social and environmental interaction, the reservoir of overlearned facts or "crystallized intelligence" can be brought cohesively together to enable them to better use their general ability, "fluid intelligence".[11]

In this study, we have also attempted to reconcile or discover if a true difference exists between the findings of Tillman, Gilbert and Rubin and those of Hopkins and McGurie. Tillman as well as Gilbert and Rubin have arranged the order of WISC Subtest appropriateness for blind children as Digit Span, Arithmetic, Information or Vocabulary,

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[9]Samuel J. Beck, Anne G. Beck, Eugene E. Levitt and Herman B. Molish, Rorschach's Test: I. Basic Processes (New York: Grune and Stratton, 1961), pp. 212-213 and 33-36.

[10]Tillman, op. cit., "The Performance of Blind and Sighted Children on the Wechsler Intelligence Scale for Children: Study 2," p. 112.

[11]Raymond B. Cattel, "Theory of Fluid and Crystallized Intelligence: A Critical Experiment," Journal of Educational Psychology, 54:1-22, January, 1966.

Similarities, and Comprehension.[12,13] However, Hopkins and McGurie have formulated a different order: Digit Span, Information, Similarities, Arithmetic, Vocabulary and Comprehension.[14] The difference in the two lists may be due to intelligence (mean IQ of Ss in Hopkins and McGurie's study is 110 as opposed to 78.5 in Gilbert's and Rubin's and 91.9 in Tillman's study), also age/maturation (mean age of Ss is 12.5 for Hopkins and McGurie, 10.0 for Tillman and ranged from 6 to 14 years for Gilbert and Rubin), or effects of blindness.

Tillman and Osborne have attacked this problem by holding age and intelligence constant, in order to lessen developmental irregularities between blind and sighted children and concluded that the effects of blindness largely explain any differences drawn between them.[15] Their primary conclusion asserts that the effect of group and age are not significant and that the differences

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[12] M. H. Tillman, "The Performance of Blind and Sighted Children on the Wechsler Intelligence Scale for Children: Study 1," The International Journal for the Education of the Blind, 16:65-73, March, 1967.

[13] Jeanne G. Gilbert and Edmund J. Rubin, "Evaluating the Intellect of Blind Children," The New Outlook for the Blind, 59:238-240, September, 1965.

[14] Kenneth D. Hopkins and Lenore McGurie, "Mental Measurement of the Blind: The Validity of the Wechsler Intelligence Scale for Children," The International Journal for the Education of the Blind, 15:65-73, March 1966.

[15] M. H. Tillman and Richard T. Osborne, "The Performance of Blind and Sighted Children on the Wechsler Intelligence Scale for Children: Interaction Effects," Education of the Visually Handicapped, 1:1-4, March, 1969.

between a blind child's and sighted child's performance on Similarities and Comprehension is due to experiential deficiencies. Both subtests confute the assumption of equal opportunity of learning and performance, which suggests some general sight bias of these subtests. This conclusion is consistent with those of Hepfinger and Gilbert and Rubin[16,17] and may be clarified by the use of the Psycholinguistic Model.

The absence of a visual input modality has substantially curtailed the blind child's interaction with the environment which, in addition, may be compounded by being over sheltered. This has led to what Wilkins, et al, call field-dependence or "inevitably greater reliance of the blind child on other people."[18] Not having the experiential background to draw upon, when called to cite appropriate behavior in the Comprehension subtest, the blind child has difficulty because he cannot meaningfully integrate the task or reflect on past performance. He lacks the advantage of deriving the requisite response as it seems "that visual deprivation may preclude social

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[16] Lucy M. Hepfinger, "Psychological Examination of Blind Children," New Outlook for the Blind, 56:309-315, November, 1962.

[17] Gilbert and Rubin, op. cit., p. 238.

[18] Herman A. Wilkins, Judith Birnbaum, Salvatore Lomonaco, Suzanne Lehr and Judith L. Herman, "Cognitive Pattering in Congenitally Totally Blind Children," Child Development, 39:767-786, September, 1968.

experiences which might be basic to understanding questions of this sort."[19]

Comprehension is basically a test of divergent thinking. Tisdall, et al., compared the performance of blind and sighted children (mean CA 11-8 years) on six tests of divergent thinking (Word Fluency, Product Improvement, Unusual Uses, Ideational Fluency, Consequences and Seeing Problems). He found that blind children did as well as sighted children on tests of divergent thinking.[20] Similarly, Tillman suggested, on review of his work and that of Gilbert and Hopkins, that blind children of greater ability may perform quite adequately on Similarities.[21] This suggests that blind and sighted children will perform on approximately the same level when the instrument is not sight biased or when some factor is common to them. However, if we are exclusively interested in the cognitive behavior of blind children we must focus on a comparative analysis of their performance across different age and ability groups to determine if past characterizations are truly indicative of their cognitive style.

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[19] Gilbert and Rubin, op. cit., p. 240.

[20] William J. Tisdal, A. Edward Blackhurst, and Claude H. Marks, "Divergent Thinking in Blind Children," Journal of Educational Psychology, 62:468-473, December, 1971.

[21] Tillman, op. cit., "The Performance of Blind and Sighted Children on the Wechsler Intelligence Scale for Children: Study 1," p. 73.

Chapter 3

METHOD

SUBJECTS

Annually, students from the Iowa Braille and Sight Saving School for the Blind are administered the Verbal Scale of the WISC in the Educational Clinic at the University of Northern Iowa. The WISC profiles of these children (N = 65, mean CA = 12.1) have been accumulating since 1971, and provide the raw data for the present study. Table 1 gives an overview of these Ss' performance relative to those of Ss in previous studies. Mean SS and inter-scale t-test used to formulate this table are given in Appendix A.

LIMITATION OF THE STUDY

The primary limitation of this study lies in the use of the Verbal Scale of the WISC as the sole evaluation instrument on which to base our conclusions. This makes it impossible to obtain an indication of a subject's tactile perceptual and organizational abilities as measured by the Performance Scale of the WISC, information that is also extremely important in educational planning for blind

Table 1

Summary of WISC Studies with Blind Ss*

Present Study	Hopkins and McGuire	Tillman	Gilbert and Rubin
N = 65	N = 30	N = 110	N = 30
Age = 12.84	Age = 12.5	Age = 10	
IQ = 96.0	IQ = 110	IQ = 91.9	IQ = 78.5
Sim	Info and Sim	Arith	Arith and Info
Info and Arith	Arith	Voc and Info	Voc
Comp	Voc	Sim	Sim
Voc	Comp	Comp	Comp

*Digit Span, omitted from this table for comparative purposes, ranked highest.

children.[22] Thus, to secure a more global estimate of the blind child's potential for achievement or intellectual ability, along with the WISC Verbal Scale, we would have to employ a tactile performance test like the Raven's Progressive Matrices adapted for the blind by Robert P. Anderson, the Performance Subtest of the Haptic Intelligence Scale for Blind Adults by Harriet C. and Phillip C. Shurrager, or the Blind Learning Aptitude Test by T. Ernest Newland.[23]

This design does not yield a random distribution of sociological factors because all subjects have been past or present students of the Iowa Braille and Sight Saving School for the Blind in Vinton, Iowa. The students are predominantly Caucasian and from rural areas.

DESCRIPTION OF THE INSTRUMENT

The WISC was published by David Wechsler in 1949, as a downward extention of the Wechsler-Bellevue Intelligence Scale. The WISC has two scales, the Verbal and the Performance Scale. The Verbal Scale, which was used in the present study, is comprised of six subtests (Information,

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[22] Carl J. Davis, "The Assessment of Intelligence of Visually Handicapped Children," International Journal for the Education of the Blind, 12:48-51, December, 1962.

[23] William L. Dauterman, Bernice Shapiro and Richard M. Suinn, "Performance Test of Intelligence for the Blind Reviewed," International Journal for the Education of the Blind, 17:8-16, October, 1967.

Comprehension, Arithmetic, Similarities, Vocabulary and Digit Span). The major weakness of the WISC, when used with blind children, is that it gives only a Verbal IQ. Moreover, it does not have norms based on a blind population.

When comparing the Verbal WISC with the Hayes-Binet (H-B), an instrument especially developed for evaluation of blind children, Gilbert and Rubin stated that the IQ Scores yielded by the two instruments are not significantly different.[24] They also indicated that the WISC is preferable to the H-B because it is shorter, easier to use, and less tiring to the child. For Gilbert and Rubin's small sample (N = 20) the WISC was calculated to have a test-retest correlation of .91, the interval between testing was from 2 years 4 months to 3 years 9 months and a correlation of .90 with the H-B.

In another study, which compared scores on the WISC and the H-B, subjects who had been administered the H-B were given the WISC.[25] The WISC correlated .79 with the first administration of the H-B and .86 with the second, while the H-B correlated only .70 with its first administration. An earlier study by the same authors held the correlation between these instruments to be .86.[26]

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[24]Gilbert and Rubin, op. cit., p. 239.

[25]Kenneth D. Hopkins and Lenore McGuire, "IQ Consistency and the Blind Child," International Journal for the Education of the Blind, 16:113-114, May, 1967.

[26]Hopkins and McGurie, op. cit., p. 67.

The results of these studies suggest the WISC yields a consistent and reliable measure of the blind child's ability.

TECHNIQUE OF MEASUREMENT

The subject's WISC protocols were divided into three groups according to chronological age: 8-0 to 10-11, 11-0 to 13-11, 14-0 to 16-11, as well as three ability group levels: IQ 89 and below, 90 to 110, and 111 and above. F-ratios were then employed to detect the presence of significant differences between individual pairs of subtests and subsequently lay the basis for acceptance or rejection of the null hypotheses. As the F-ratio does not denote which or how many pairs of subtests differ significantly, Duncan's New Multiple Range Test was used. This technique identifies the source of any variance by requiring a greater difference between means occupying extreme positions in the analysis of variance array than those in proximal positions. The difference is called the shortest significant range, or SSR. Finally, for the total group of 65 subjects, the mean CA, IQ and Scaled Scores on each subtest was calculated and numbers of Standard Error Units were secured to determine possible significant difference.[27]

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[27] R. J. Senter, Analysis of Data (Glenview: Scott, Foresman, 1969), pp. 281-291.

Chapter 4

ANALYSIS OF THE DATA

RESULTS

Intra-Age Differences

The results of the intra-age group comparisons are summarized in Tables 2, 3, and 4 respectively. It is noted in Table 2 that Comprehension scores of Ss in Age Group 8-10 were significantly lower than attainments in all other subtest except Vocabulary. Tables 3 and 4 show no significant intra-age differences within the Age Groups 11-13 and 14-16. Consequently, Hypothesis 1 was rejected while Hypotheses 2 and 3 were accepted.

Inter-age and inter-ability group, as well as total group, differences were assessed; they are presented in Appendixes B and C.

Intra-IQ Group Differences

On Table 5 it is observed that for IQ Group 1 (IQ 89 and below) there are no significant within-group differences, although Ss in this group secured their highest scores in the Digit Span subtest. Table 6 reveals

Table 2

Analysis of Variance of Verbal WISC Subtests, Mean Scale Score Differences for Ss Ages 8-10[a,b]

	Voc	Info	Arith	DS	Sim
Comp 7.85	1.78	2.71 *	3.85 **	4.42 **	4.64 **
Voc 9.64		.92	2.07	2.64	2.85
Info 10.57			1.14	1.71	1.92
Arith 11.71				.57	.78
DS 12.28					.21
Sim 12.50					

Source	x	df	SD	F	p
Among	223.67	5	44.73	3.95	< .01
Within	1153.57	102	11.30		
Total	1177.24	107			

[a]N = 14

$\bar{X}$ IQ = 105.07

$\bar{X}$ Age = 9.36

[b]On this and similar tables, ANOVA employed the Duncan's New Multi-Range Test.

*p = .05

**p = .01

Table 3

Analysis of Variance of Verbal WISC Subtests, Mean Scale Score Differences for Ss Ages 11-13[a]

	Comp	Arith	Info	DS	Sim
Voc 7.91	.66	.75	1.00	1.87	2.00
Comp 8.58		.83	.33	1.20	1.25
Arith 8.66			.25	1.12	1.25
Info 8.91				.87	1.00
DS 9.79					.12
Sim 9.91					

Source	x	df	SD	F	p
Among	70.20	5	14.04	.60	NS
Within	2366.62	102	23.20		
Total	2436.82				

[a]N = 24

$\overline{X}$ IQ = 93.75

$\overline{X}$ Age = 11.99

Table 4

Analysis of Variance of Verbal WISC Subtests, Mean Scale Score Differences for Ss Ages 14-16[a]

	Voc	Info	Sim	Comp	DS
Arith 8.18	.18	.37	.66	.88	2.40
Voc 8.37		.18	.48	.70	2.22
Info 8.55			.29	.22	1.74
Sim 8.85				.33	1.85
Comp 9.07					1.51
DS 10.59					

Source	x	df	SD	F	p
Among	102.25	5	20.51	1.25	NS
Within	2629.81	102	25.78		
Total	2731.06	107			

[a]N = 27

$\bar{X}$ IQ = 93.33

$\bar{X}$ Age = 15.41

Table 5

Analysis of Variance of Verbal WISC Subtests, Mean Scale Score Differences for Ss In IQ Group 1 (IQ 89 and Below)[a]

	Info	Sim	Voc	Comp	DS
Arith 4.91	.39	.52	.52	.82	2.82
Info 5.30		.13	.13	.43	2.43
Sim 5.43				.30	2.30
Voc 5.43				.30	2.30
Comp 5.73					2.00
DS 7.73					

Source	x	df	SD	F	p
Among	116.24	5	23.24	2.34	NS
Within	1010.86	102	9.91		
Total	1127.10	107			

[a]N = 23

$\bar{X}$ IQ = 73.43

$\bar{X}$ Age = 13.93

Table 6

Analysis of Variance of Verbal WISC Subtests, Mean Scale Score Differences for Ss In IQ Group 2 (IQ 90-110)

	Arith	Voc	Info	Sim	DS
Comp 8.83	.04	.08	.75	1.87 *	2.33 *
Arith 8.87		.04	.70	1.83 *	2.29 *
Voc 8.91			.66	1.79	2.25 *
Info 9.58				1.12	1.58
Sim 10.70					.45
DS 11.16					

Source	x	df	SD	F	p
Among	125.38	5	25.07	2.79	< .01
Within	912.91	102	8.96		
Total	1039.29	107			

[a]N = 24

$\overline{X}$ IQ = 98.08

$\overline{X}$ Age = 12.32

*p = .05

Table 7

Analysis of Variance of Verbal WISC Subtests, Mean Scale Score Differences for Ss In IQ Group 3 (IQ 111 and Above)[a]

	Comp	Info	DS	Arith	Sim
Voc 11.77	.27	1.61	2.00	3.05	3.22 *
Comp 12.05		1.33	1.72	2.77	2.94
Info 13.38			.28	1.44	1.61
DS 13.77				1.05	1.22
Arith 14.83					.16
Sim 15.00					

Source	x	df	SD	F	p
Among	131.57	5	26.31	3.43	< .05
Within	781.94	102	7.66		
Total	923.51	107			

[a]N = 18

$\bar{X}$ IQ = 122.11

$\bar{X}$ Age = 12.16

*p = .05

that scores on Digit Span are significantly higher than Comprehension, Arithmetic and Vocabulary; and Similarities significantly higher than Comprehension and Arithmetic, for IQ Group 2 (IQ 90 to 110). It is noted on Table 7 that for IQ Group 3 (IQ 111 and above) there is only one significant difference between Ss: Similarities is significantly higher than Vocabulary. Thus Hypothesis 4 was accepted and Hypotheses 5 and 6 were rejected.

Chapter 5

DISCUSSION AND CONCLUSIONS

The purpose of the present investigation was to examine the intra-child differences, as reflected in intra-group patterns of performance on the WISC Verbal Scale of blind children and to note if there are significant effects related to chronological age and/or intelligence. Results indicate that both these factors result in selected significant differences within groups.

Consistent with other studies, the present investigation revealed that Age Group 8-10 Comprehension SS is significantly lower than any other Verbal WISC Subtest SS. Comprehension ranks next to last for Age Group 11-13. However, this trend is reversed for the Age Group 14-16; in this group, Comprehension SS is the second highest. The improvement in performance on Comprehension relative to other subtests across age groups implies that maturation may contribute significantly to better performance on this subtest. In examining this effect Glasser and Zimmerman state, "young children must be independent and oriented towards problem-solving to attempt an answer to items covering situations they have never heard of. Even very bright children are not exposed to many of the Comprehension items. On the other hand, older children may do well simply because they have learned to reel off rules of behavior without necessarily understanding them" or formally over-learned "right" answers which are increasingly available to them.[28]

Consistent with other research, the current experiment also reveals relatively lower performance on Vocabulary. Vocabulary ranks lowest for Age Group 11-13 and next to lowest for Age Groups 8-10 and 14-16. The blind child's manifest difficulty with tasks like Vocabulary has been attributed to causes such as their rote memory approach to word definition, word unreality and the tendency for tasks like this to rely heavily on experiences the blind child has not had the opportunity to acquire.[29,30,31] Summarizing his findings on the effects of age, intelligence and experience on verbalism in blind children, Harley concludes that as age and intelligence are predetermined and experience can be controlled, verbal skills may be improved by education that provides a rich and stimulating

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[28]Alan J. Glasser and Irla L. Zimmerman, Clinical Interpretations of the Wechsler Intelligence Scale for Children (New York: Grune and Stratton, 1967), p. 53.

[29]Carson Y. Nolan, "On the Unreality of Words to the Blind," New Outlook for the Blind, 54:100-102.

[30]Thomas D. Cutsforth, "The Unreality of Words to the Blind," Teacher's Forum, 4:86-89, May, 1932.

[31]Gilbert and Rubin, op. cit., p. 238.

environment and encourages use of the child's remaining senses. "A sound basis in concrete and practical experience is indicated as desirable for clarifying and strengthening basic concepts before moving into abstractness. This program of concreteness would need to be broader in earlier years of development than in later years. Certain results would occur as this base is broadened: (a) the fundamental concepts of each child would become more rich, varied and inclusive; (b) the capacity for meaningful abstract thinking could be increased."[32]

In the home, the yound blind child will benefit from an environment which is open to investigation, in which he is taught to use olfactory, auditory and tactile sense clues for meaningful interaction with the environment and development of relevant expressive language, rather than conceptually meaningless visually oriented verbalisms.

At school, teachers of blind children should encourage mobility in the school and classroom as well as to foster development of concepts which will aid mobility, meaningful interaction with the total environment and further encourage expressive language. The classroom teacher may utilize small group activities to achieve these goals, as well as promote social awareness and interaction. Activities for young children may center around identification of body

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[32]Randall K. Harley, Jr., "Verbalisms Among Blind Children: An Investigation and Analysis," American Foundation for the Blind, Research Series No. 10 (New York: AFB Publications, 1963), pp. 52-53.

parts and how the parts relate to each other.[33,34] For older children emphasis may be placed on the child's spatial environment and understanding positional terminology,[35,36,37] or traditional games.[38] Outside the classroom non-visual cues such as the characteristic odor of a bakery may be pointed out to serve to locate it and inform the blind of its purpose; the heat of the sun can indicate if it is a clear day or help distinguish east from west; echoes and sounds may tell the size of a room or what type of surface one is walking on.[39] Later, these cues may be reinforced in classroom simulations.

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[33] Robert J. Mills, "Orientation and Mobility for Teachers," Education of the Visually Handicapped, 2:80-82, May, 1970.

[34] Lawrence B. Hapeman, "Developmental Concepts of Blind Children Between the Ages of Three and Six as They Relate to Orientation and Mobility," International Journal for the Education of the Blind, 17:41-48, December, 1967.

[35] Everett W. Hill, "The Formation of Concepts Involved in Body Position in Space," Education of the Visually Handicapped, 2:112-115, December, 1970.

[36] Everett W. Hill, "The Formation of Concepts Involved in Body Position in Space: Study II," Education of the Visually Handicapped, 3:21-25, March, 1971.

[37] Robert J. Mills, "Orientation and Mobility for Teachers," Education of the Visually Handicapped, 3:58-62, May, 1971.

[38] George L. Abel, "Resources for Teachers of Blind with Sighted Children," American Foundation for the Blind, Research Series No. 9 (New York: AFB Publications, 1957).

[39] Robert H. Whitslock, "IV Orientation and Mobility for Blind Children," New Outlook for the Blind, 54:90-94, January, 1960.

Several previously cited authors attest to the fact that blind and sighted children perform quite similarly in Arithmetic and consequently they rank Arithmetic high in terms of appropriateness for blind children. However, there are indications that the math achievement of blind children is approximately 16 to 27 percent below that of sighted children.[40,41] This retardation appears to relate primarily to specific numerical operations and is apparently not the result of deficiencies in reasoning.

Frustration manifest as computational errors by the blind child are likely to be (or seem to stem directly from) a direct result of early stress on mental arithmetic and its accompanying high level of abstraction which may complicate later learning.[42] Likewise, it may also account for the change in relative performance in Arithmetic across age groups and notably so in Age Group 14-16. In an experiment with students grade 7B through 9B, the approximate age grade placement of Age Group 14-16, Nolan and Morris found that significantly increased computational accuracy to the point

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[40] Carson Y. Nolan and Samuel C. Ashcroft, "The Stanford Achievement Arithmetic Computation Test: A Study of An Experimental Adaptation for Braille Administration," International Journal for the Education of the Blind, 8:89-92, May, 1959.

[41] Roy J. Brothers, "Arithmetic Computation by the Blind: A Look at Current Achievement," Education of the Visually Handicapped, 4:8-11, March, 1972.

[42] Carson Y. Nolan, "Research in Education of the Blind," Blindness Research: The Expanding Frontiers, ed. Maxwell H. Goldberg (University Park, Penn State University Press, 1969), pp. 240-249.

of producing non-significant difference between blind and sighted students.[43] Many computational aids are available to the blind child but there apparently is a need to introduce these instruments earlier, develop new materials which convey more abstract math concepts and processes and put presently available media to new and innovative uses.[44,45]

Surveying results secured with all three age groups it is noted that the Ss' Similarities scores are well within and above normal range, based on norms for sighted children. However, there is a general belief that abstract reasoning in blind children is retarded by lack of sight.[46] An additional disparity is seen in the fact that Similarities is ranked above Digit Span for Age Group 8-10 and 11-14 whereas, other researchers have considered Digit Span to be the most notable subtest strength of blind children.[47,48] It is possible that previous research has drawn from samples

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[43] Carson Y. Nolan and June E. Morris, "The Japanese Abacus as a Computational Aid for Blind Children," Exceptional Child, 31:15-17, September, 1964.

[44] Marian Lewis, "Teaching Arithmetic Computation Skills," Education of the Visually Handicapped, 2:66-72, May, 1970.

[45] Tuck Tinsley, III, "The Use of Origami in the Mathematics Education of Visually Impaired Students," Education of the Visually Handicapped, 4:8-11, March, 1972.

[46] Gilbert and Rubin, op. cit., p. 240.

[47] Tillman, op. cit., "The Performance of Blind and Sighted Children on the Wechsler Intelligence Scale for Children: Study 1," p. 72.

[48] Gilbert and Rubin, op. cit., p. 239.

which were on "a whole rather dull" whereas it would appear from this investigation and that of Hopkins and McGuire, as well as Rubin that blind children of average and above IQ perform quite adequately on Similarities.[49,50,51]

The configuration of SSs for IQ Group 1(IQ 89 and below) (Table 5) shows no significant variance, although this group consistently attains its highest score on Digit Span. Very often blind children falling in this group exhibit emotional problems which interfere with learning. Therefore it is important that they be in a non-threatening environment in which they are given predictable structure and allowed to experience success. The tasks they are required to do should be of a basic nature (such as grouping objects according to physical characteristics, shape or size, or expressive language activities, like rhyming word games, which emphasize auditory discrimination) and characteristically "associative".[52] However, their curriculum should involve a broad scope of activities

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[49]Loc. cit.

[50]Hopkins and McGuire, op. cit., "Mental Measurement of the Blind: The Validity of the Wechsler Intelligence Scale for Children," pp. 68-69.

[51]Edmund J. Rubin, "Abstract Functioning in the Blind," American Foundation for the Blind, Research Series No. 11 (New York: AFB Publications, 1964), pp. 37 and 38.

[52]Arthur R. Jensen, "How Much Can We Boost IQ and Scholastic Achievement," Harvard Educational Review, 39:111-117, Winter, 1969.

including: play therapy, sense training, music recreation and development of academic skills.[53]

Reviewing Table 6, it is noted that IQ Group 2 (IQ 90-110) attained scores in Similarities and Digit Span that are significantly higher than the scores they attained in Comprehension and Arithmetic. Replication and extended studies also reveal that students functioning at this level would benefit from creative and expressive activities which utilize auditory memory and abstract reasoning to develop math and social skills. Understanding of social situations may be promoted by involving the blind child in small group activities, simulations or dramatizations and encouragement of full participation in all aspects of school life.

Surveying Table 7, it is observed that IQ Group 3 (IQ 111 and above) obtains above average scores on all subtests; however, for these Ss Similarities is significantly higher than Vocabulary. Blind children at this ability level possess a good store of facts or symbols, which are necessary to acquire other symbols. Understanding new symbols and more abstract qualities of those symbols already known may be promoted in activities which encourage synthesis and analysis of known concepts or in directed learning situations involving specific concepts. For

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[53] Maurice I. Tretakoff and Malcolm H. Farrell, "Developing a Curriculum for the Blind Retarded," American Journal of Mental Deficiency, 62:610-615, January, 1958.

example, by working with learning materials which help him understand the concepts "longer than" or "bigger than" the student may derive the meaning of "length" and "bigness". He may then, through use of these symbols, acquire the concept of "magnitude" as it relates to "length" and "bigness".

<u>Summary</u>

This study was undertaken in an attempt to determine if significant intra-scale differences are depicted in the performance of blind children, of varying age and ability, on the Verbal WISC and the educational implications were discussed. The following conclusions were reached:

1. Children age 8-10 appear to obtain significantly lower scores on Comprehension than on Information, Arithmetic, Digit Span and Similarities.

2. Children age 11-13 appear to obtain consistently lower, but statistically non-significant, scores on Vocabulary.

3. Children age 14-16 appear to attain consistently lower, but statistically non-significant, scores on Arithmetic.

4. Children obtaining IQ scores of 89 and below appear to attain consistently higher, but statistically non-significant, scores on Digit Span.

5. Children obtaining IQ scores in the range of 90 to 110 appear to obtain scores on Digit Span that are

significantly higher than Comprehension, Arithmetic and Vocabulary; and Similarities scores that are significantly higher than Comprehension and Arithmetic.

6. Children obtaining IQ scores of 111 and above appear to attain Similarities scores that are significantly higher than their attained Vocabulary score.

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APPENDIX A

t Values, Comparing WISC Verbal Subtest Scaled Scores[a]

	Info 9.12	Comp 8.63	Arith 9.12	Sim 10.03	Voc 8.47	DS 10.67
Info		t=.723	t=.00	t=1.24	t=1.00	t=2.21 **
Comp			t=.642	t=1.90 *	t=.237	t=2.89 ***
Arith				t=1.12	t=.884	t=1.98 **
Sim					t=2.22 **	t=.858
Voc						t=3.29 ***

[a]N = 65

$\bar{X}$ Age = 12.84 years

$\bar{X}$ IQ = 96.01

*p = .05

**p = .02

*** p = .001

APPENDIX B

Comparison of Verbal WISC Scaled Scores and IQs[a]

Subtest Comparison	df	t	Level of Significance
I_{11-14}	49	.32	NS
I_{8-11}	39	1.67	NS
I_{8-14}	36	1.39	NS
C_{14-11}	49	.42	NS
C_{14-8}	39	1.06	NS
C_{11-8}	36	.55	NS
A_{11-14}	49	.36	NS
A_{8-14}	39	2.33	.05
A_{8-11}	36	2.04	.05
S_{11-14}	49	.87	NS
S_{8-14}	39	2.61	.01
S_{8-11}	36	1.98	.05
V_{14-11}	49	.50	NS
V_{8-14}	39	1.00	NS
V_{8-11}	36	1.28	NS
DS_{14-11}	49	.67	NS
DS_{8-14}	39	1.39	NS
DS_{8-11}	36	1.87	.05
IQ_{11-14}	49	.06	NS
IQ_{8-14}	39	1.77	NS
IQ_{8-11}	36	1.67	NS

[a] 14, 11 and 8 denote Age groups 14-16, 11-13, and 8-10 respectively

APPENDIX C

Comparison of Subjects Grouped by IQ:
Verbal WISC Scaled Scores[a]

Group Comparison	df	t	Level of Significance
$I_{111-100}$	40	6.05	.001
I_{111-89}	39	13.29	.001
I_{100-89}	45	6.57	.001
$C_{111-100}$	40	3.52	.001
C_{111-89}	39	6.52	.001
C_{100-89}	45	3.40	.001
$A_{111-100}$	40	6.50	.001
A_{111-89}	39	10.87	.001
A_{100-89}	45	5.26	.001
$S_{111-100}$	40	6.60	.001
S_{111-89}	39	13.36	.001
S_{100-89}	45	7.63	.001
$V_{111-100}$	40	3.46	.001
V_{111-89}	39	7.88	.001
V_{100-89}	45	5.65	.001
$DS_{111-100}$	40	2.56	.01
DS_{111-89}	39	5.32	.001
DS_{100-89}	45	3.45	.001

[a] 111, 100 and 89 denote IQ Groups 1, 2 and 3 respectively.