DOCUMENT RESUME

ED 046 999 TM 000 365

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TITLE Clinical-Diagnostic Use of the WPPSI in Predicting Learning Disabilities in Grade One.
INSTITUTION New York Univ., N.Y. Medical Center.
PUB DATE Nov 70
NOTE 26p.

EDRS PRICE EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS *Clinical Diagnosis, Cognitive Processes, Diagnostic Tests, English (Second Language), Expectation, *Grade 1, *Intelligence Tests, Intervention, Language Handicaps, *Learning Disabilities, Non English Speaking, Oral Expression, *Predictive Ability (Testing), Predictive Measurement, Reading Diagnosis, Reading Difficulty, Spanish Speaking, Underachievers, Writing
IDENTIFIERS *Wechsler Preschool Primary Scale of Intelligence, WPPSI

ABSTRACT

The WPPSI was used in a Manhattan, N.Y., public school because administrators, teachers, and parents had asked for help in understanding children who had difficulty in learning to read well, despite special efforts to help them. A preventive intervention program was begun based on a clinical study of every first grader. Forty children were predicted to make normal progress; 30, a "high risk" group, gave evidence on neurological and perceptual examinations that they might have learning problems; and 12 children were omitted. High risk cases were those with a discrepancy between expectancy and achievement. Comparisons were made of the total groups of high risk and normal progress children, of samples matched for IQ and sex, and of subgroups based upon diagnosis within the Intervention (high risk) group. Despite the small diagnostic subgroups, some tentative conclusions can be drawn: (1) the WPPSI produced rich clinical material best understood in conjunction with the diagnostic subgroups; (2) the quantitative and qualitative WPPSI material helps in the selection and diagnostic processes and in planning intervention; and (3) it is inadvisable to assume that learning disability is a homogeneous condition manifesting itself in a characteristic cognitive pattern in first grade. WPPSI profiles for some typical cases and for the diagnostic subgroups are included. (CK)

Clinical-Diagnostic Use of the WPPSI in Predicting Learning Disabilities in Grade One*

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Assessment of cognitive functioning is a basic aspect of the diagnosis of learning disability. This paper describes the use of the Wechsler Preschool and Primary Scale of Intelligence for this purpose with children whom it has been our privilege to study as an intact group of first graders during the past school year. These children attend a public school located on 33rd Street in Manhattan, almost in the shadow of New York University Medical Center where our Language Research Unit is housed. The project was initiated in response to a request by school administrators, teachers, and parents for help in understanding children who were not learning to read well, despite such efforts as an afterschool tutoring program, provision of textbooks emphasizing urban content, "linguistically-based" readers, and special groups for children for whom English was a second language. This was not an idle complaint. Survey of group test scores indicated that in 1968:

61% of the first graders had earned scores in the lowest two categories of the Metropolitan Readiness test

40% of the second graders scored below second grade on reading tests given near the end of second grade

58% of the sixth graders scored below grade on reading tests given near the end of sixth grade

We decided to offer a preventive program based upon clinical study of every first grader. This study would utilize methods developed over the past twenty years at our Language Research Unit, with an interdisciplinary approach to diagnosis forming the basis for treatment planning. The intervention aspect, and as much of the diagnostic work as possible,

would take place in the school, in special resource rooms which we equipped. We would encourage integration of school and clinical staffs through formal and informal contacts and sharing of information and treatment skills. Diagnosis would enable us to locate "high risk" children and to intervene appropriately. This might take the form of direct educational intervention in the resource room, indirect educational intervention through consultation with classroom teachers, attempts to modify the emotional climate in which the child lived through parent counseling and teacher consultation, and, in a few cases, psychotherapy for the child, a service provided at the Medical Center Mental Hygiene Clinic.

This paper will deal with findings on the WPPSI which was administered to all children as part of the diagnostic battery. Data for the entire sample will be reported, as well as contrasts between the children for whom we predicted normal progress and those who we felt were in need of intervention.

Description of the Entire Sample

The children enrolled in the first grade during the 1969-70 school year numbered eighty-six. They were a relatively stable population with eight children moving out of the district and two children entering during the school year. There were eighty-two for whom data were available on all diagnostic measures, 40 boys and 42 girls. Their ages ranged from five years, eight months to seven years, eight months, with fifty percent of the children between 6 1/2 and 7 years.

Ethnic background included 79% white, 12% black, 9% oriental.

In comparison with the U.S. Census distribution, our group is higher at each end of the socio-economic scale, with 21% of our population in Group I (Professional and Technical) and 51% in Groups VI,VII, and VIII (Service and Farm Workers, Laborers) as contrasted with just under 12% and 20% respectively in the U.S. Census distribution. Children in our Intervention group were drawn from every socio-economic level.

They were a cosmopolitan group. English was found to be the major language spoken in 46, or slightly more than half of the households. Spanish was a major language in 28%. Chinese was spoken in six, German in two, Swahili three, and in one household each the major language was Nepalese, Estonian, Maltese, and Armenian. One third of the children with English as a major language at home and one half of those with Spanish as a major language at home became members of the Intervention group.

High risk children were defined as those with a discrepancy between expectancy and achievement in the use, comprehension, and oral and written expression of ideas. In educational terms they have difficulty in learning one or more aspects of the language arts; listening, speaking, reading, writing, spelling, despite intact senses, adequate educational opportunity, normal motivation, and adequate intelligence as judged from the WPPSI. In 1960 (Silver and Hagin, 1960) we described a syndrome based upon neurological and perceptual study of children with school learning problems. The major elements of this syndrome were:

1. on neurological examination, lack of organization corresponding to cerebral dominance for language as seen in

defects in right-left discrimination and orientation, discrepancy between preferred hand and elevated arm on the extension test, postural responses less mature and less well organized than might be expected from the child's age, body image problems as seen in tonus and postural deviations and in indications of finger agnosia

2. on perceptual study, visual-motor problems with difficulties in spatial orientation and in separation of figure from background, auditory problems in discrimination and in grasping the temporal relationship of sounds

Nine out of ten children with school learning problems seen at our Unit demonstrate some, but not necessarily all, of the elements of this syndrome. It was these children with whom we chose to intervene educationally.

Variations in rate of achievement were observable even in the early months of first grade as seen in the results for the Wide Range Achievement Test. There was one precocious reader, a number of children with no reading skills, and a large number able to identify letters and a few simple words. Even though some children were able to identify some letters and words, they were brought into the Intervention group because of neurological and perceptual deviations which might predispose them to learning difficulties when they encountered formal instruction.

Intellectual functioning as measured by the WPPSI revealed a range for the full scale IQs of the complete sample from 58 to 130, a mean of 97 with a standard deviation of 15.91. Performance

IQs yielded a mean of 99.16 with a standard deviation of 15.47., conforming closely to the standardization sample. Verbal IQ scores were more widely dispersed and with a lower mean, 96.65 and a standard deviation of 17.06.

Omitted from consideration in this paper were a total of twelve children from the complete sample. Of these, were eight children whose pattern of subtest scores was found to be incomplete or atypical because of their recent immigration to the United States. There were, in addition one child with severe mental retardation, and three children with severe emotional disturbance (a school phobia and two childhood schizophrenias). These subjects were eliminated because, in the case of the bi-lingual children, all eleven subtests scores were not available, and in the case of the others because it was felt that serious degree of disturbance might obscure findings in the analysis of group data.

With these omissions, our study identified forty children for whom we predicted normal progress and thirty children who gave evidence on neurological and perceptual examinations that they might experience learning problems in grade one. While the identification of a "high risk" group comprising more than one-third of the sample may seem to overestimate the incidence of the problem, it does not appear to be excessive when one considers the group test scores which have been reported in other samples of the population from the same school.

Three kinds of analysis of the WPPSI scores will be described in this paper :

1) comparisons of the total groups of "high risk" and normal progress

children

2) comparisons of a sample matched for IQ and sex

3) comparisons of subgroups based upon diagnosis within the Intervention group.

Total Group Findings

The mean IQ values for the Normal Progress and the Intervention Groups are presented in Table I.

Insert Table I about here.

Although the mean IQs for both groups fall approximately within the average range, the Intervention Group means were significantly lower on all three IQ measures. Verbal-performance differentials were slight and not statistically significant. While slight differentials in verbal-performance scores should not be over-emphasized, it is possible to judge variations on the basis of statistical strength through confidence levels supplied in the test manual (Wechsler (1967)) in a paper by Milliren and Newland (1969). This shows that a difference of thirteen points between WPPSI Verbal and Performance IQs at the six year level can be regarded as significant at the 5% level of confidence. By this standard, fourteen members of each group in our study showed significant deviations, seven each in the direction of a higher verbal IQ and seven in the direction of a higher performance IQ in each group. Thus there is no evidence that either group characteristically dealt with verbal or performance tasks more effectively.

Since there were significant differences in IQ levels of the

Normal Progress and the Intervention groups, one might expect to see these trends reflected in the mean subtest scores as well. Table 2 presents these data. Only the means for the Vocabulary subtest did not result in significant differences.

Insert Table II about here.

Differences between the means of the two groups can probably be accounted for by the overall differences in IQs. However, an unexpected finding is the lack of difference in the means for the Vocabulary subtest, particularly in view of results reported in studies utilizing the WISC in which a number of investigators (Graham, 1952; Hèrst 1960; McLeod, 1965; Belmont and Birch, 1966; Lyle & Goyen, 1969) found that low scores on Vocabulary, among various other combinations of subtests differentiated retarded from adequately achieving readers.

Subtest patterning was explored by two other statistics, as well. The first method was to determine the degree of relationships of the ranked mean subtest scores for the two groups. A rank-order coefficient of correlation (rho= .64) indicated some similarity in the rank of subtests in the two groups, although there were differences in most absolute levels of scores. The second method employed the coefficient of variation. Since the WPPSI was constructed so that the mean for each subtest was 10 with a standard deviation of 3 scaled score points, the theoretical coefficient of variation is 30%. It is possible to compare this with the coefficients of variation for the subtest scores for each group, as seen in Table 3.

Insert Table III about here

Coefficients of variation for the Intervention group in every case exceed those for the Normal Progress group, especially with such subtests as Comprehension, Sentences, Mazes, and Block Design. Variation as a characteristic of the Intervention Group is also demonstrated when absolute deviations from the mean of each child's scaled scores are charted, as in Table 4. These graphs show the percents of each group whose scores on individual subtests deviated significantly from the mean of their scaled scores, significant deviation having been defined as three or more scaled score points, on the basis of confidence levels supplied by the Test Manual (Wechsler, 1967) and by Milliren and Newland (1969).

Our data on the Normal Progress and Intervention Groups as a whole permit some tentative conclusions:

1) Means for the Normal Progress group exceed those of the Intervention Group on all IQ measures and subtest scores

2) no consistent pattern of verbal versus performance functioning is found; when only statistically significant differences are considered, the groups appear to be evenly divided as far as verbal and performance superiority is concerned

3) the Intervention group appears to be more variable as judged from the coefficient of variation and from percents of subjects who deviated three scaled score points from the mean of their scaled scores

4) no consistent subtest pattern was found to characterize the intervention group; indeed a rho coefficient of correlation of .64 suggests some degree of similarity of rank in the means of the subtests for the two groups.

Matched Groups

One must, however, consider whether these findings result from differences in levels of functioning. Therefore, a sub-sample of 17 pairs of subjects was drawn from the Intervention and Normal Progress Groups with each pair matched on the basis of full scale IQ and sex. The mean IQ values for the matched groups are presented in Table 5.

Insert Table 5 about here.

As with the total groups, no consistent verbal-performance differential was seen when mean differences were considered. Furthermore, when deviations of 13 or more IQ points were tabulated, four subjects of the Normal Progress and six of the Intervention Group were found to deviate significantly, one half each in the direction of superior verbal scores and one half in the direction of superior performance scores.

With the matched groups there was a different picture with subtest scores than that seen when the total group was considered. These data are presented in Table 6. The t-test (which took into account the correlation between the scores) confirmed the difference favoring the Intervention Group on the Vocabulary subtest, while a difference favoring the Normal Progress group was seen on the

etic subtest.

Insert Table 6 about here

On the basis of data considered so far, the Intervention Group does not emerge in any clearly defined fashion. These children tend to function lower than their normally achieving classmates, they are somewhat more variable in their functioning if we consider the group as a whole, and they may have broader vocabularies and possibly less skill in dealing with numbers. Beyond this, it would be difficult to isolate special cognitive characteristics which could help us understand and make appropriate educational provisions for them. The picture becomes clearer, however, when the findings on the WPPSI are related to the three diagnostic subgroups which we find comprise the Intervention Group.

Diagnostic Groups

The first diagnostic sub-group, children with specific language disability, numbered eleven children. It was described at the outset in terms of deviations on neurological and perceptual examinations. These children demonstrate problems in developing body image concepts and in establishing clear cut cerebral dominance for language. They have difficulty in the orientation of figures in space and sounds in time. Richard is typical of this group (see Table 7). He was found to be neurologically intact in terms of the classical neurological examination. There were, however, evidences of gross errors in right-left orientation, mild difficulties in praxis, abnormal elevation on the extension test. Perceptual examination showed that visual-motor skills were

good, but that he had difficulties in auditory discrimination and sequencing. He earned a full scale IQ of 98 on the WPPSI, but there was a discrepancy of 23 points between his verbal IQ of 87 and his performance IQ of 110. The profile of WPPSI subtest score deviations charted against his mean scale score of 9.5 shows the difficulty he had in dealing with complex auditory stimuli. His handling of the Information and Vocabulary subtests shows that there was no paucity of verbal content, although ideas were sometimes awkwardly expressed. His good potential for learning is seen in the effortful and productive approach to the performance scale. Educational intervention during the school year emphasized the auditory modality. Progress was rapid both at home and at school; his mother has recently called to our attention the increase in his ability to comprehend and to express himself verbally.

The second sub-group, whom we call organics demonstrated many of the behaviors of the specific language disabilities, but had in addition evidences of abnormality in one or more areas of the classical neurological examination, in muscle tone and synergy, in cranial nerves, in deep, superficial, and pathological reflexes. As we review findings for this group, there are evidence of hyperkinesis in some, while others may be hypokinetic. Sometimes there are choreoform movements of the outstretched arms, poor fine motor coordination, and apraxia, cranial nerve abnormalities as seen in mild facial paresis, eccentric pupils, sustained nystagmus on lateral or upward gaze, increased muscle tone with myoclonic-like

twitching palpable on neurological examination. There may also be deep reflex inequality, or sensory defects (such as extinction on the face-hand test), or autonomic lability. Rarely do these findings point to focal brain damage and rarely can specific etiological factors be found in the history. These children, do however, present special educational problems because of their poor impulse control, their difficulties in sustaining attention, their difficulties in motor coordination, and their predisposition to anxiety. In this sample they numbered twelve.

Karl is an example of the organic sub-group. He cannot be regarded as typical, because there is no typical organic. On neurological examination he was found to have poor fine and gross motor coordination and severe praxic difficulties. Right-left discrimination was confused. Palpation of muscles revealed myoclonic-like twitching which kept him in constant, restless motion. On the extension test there was no conflict, but there was convergence of the outstretched arms and bursts of tremors more on the left side than on the right. Karl was not only hyperactive physically, but conceptually as well. It was difficult to follow his thought processes because he had a tendency to be incoherent and circumstantial. He earned a full scale IQ of 110 on the WPPSI, with a verbal IQ of 106 and a performance IQ of 112. His profile of deviations from his mean scaled score of 11.2 shows the variability of his functioning. (see Table 8 . His motor problems were apparent in his difficulty in grasping the pegs in the Animal House subtest and in his 4-finger, non-oppositional grip on the pencil for the

Geometric Designs. He did better with structured tasks than with those for which he had to provide his own structure. When he became familiar with task requirements and limits, he could work effortfully; a second trial frequently elicited improvement in response. Educational intervention for him emphasized visual-motor and organizational skills. Progress has not been rapid, but what Karl learns he retains. Now that he finds life more predictable, he is also less anxious about new experiences.

The third diagnostic subgroup we call children with developmental immaturity. With them there is no clinical or historical evidence of structural defect of the central nervous system, but there is slowness in reaching developmental landmarks in all parameters. The uniformly low curve of maturation is apparent in their physical appearance. They were found to be small in size and to appear younger than their stated ages. In gross and fine motor development, in aspects of language, and in social awareness they seem to be younger than their chronological ages. There are no evidence of dysplastic characteristics or gross asymmetries in their development. Their head circumferences tend to be low, but still within the normal range. The only significant finding which appears frequently in their histories is a low birth weight. Seven children in the Intervention Group demonstrated developmental immaturity.

Rosemary can be regarded as representative of this group. On examination she was found to be neurologically intact. Praxis

was described as excellent, although she seemed slow in understanding directions. Her head circumference was 19 3/4 inches, when a range from 20.5 to 21.7 is considered normative at her age. Extension test was abnormal, and there were some errors in right-left orientation. Her generally slow pattern of development is seen in the Verbal IQ of 80, the Performance IQ of 82, and the Full Scale IQ of 79 she earned on the WPPSI. The profile of deviations of subtest scores from the mean of her scaled scores (7.0) is flat with the only significant variation occurring with the Animal House subtest. Intervention with Rosemary was directed toward general enrichment, with particular emphasis upon language stimulation. Although not rapid, her response has been consistent and encouraging.(Table 9)

Table 10 shows the mean IQ values for the Diagnostic subgroups within the Intervention Group:

Insert Table 10 about here

Even with the limited size of the subgroups it is possible to see group characteristics emerging, both in level of intellectual functioning and dispersion of scores. The group identities became even more apparent when significant deviations of subtests from the mean of each child's scaled scores is considered as in Table 11. The flat picture of the Developmental Immaturity Group contrasts with the relatively homogeneous pattern of the Specific Language Disability Group and with the highly variable picture of the Organics. Rho coefficients of correlation bear out the impression that there is little relation-

ship in the ranks of average subtest scores for the groups. (Specific Language Disability group ~~in~~ with the Organic group =.21; Specific Language Disability group ~~in~~ with the Developmental Immaturity group = .03; Organic group ~~in~~ with the Developmental Immaturity group = .34.)

When one examines each sample for significant (13 point) verbal-performance differentials we find that four of the eleven SLDs earned significantly high performance IQs, and three of the seven developmental immaturities earned significantly high verbal IQs, but with characteristic variability, three of the twelve organics earned high verbal and three earned high performance IQs.

Conclusions

The small size of the diagnostic subgroups requires that one must be cautious in generalizing from these data about young children with learning disabilities. We shall, of course attempt to replicate present findings next year as we study the 1970-71 first grade and as we follow the 1969-70 group into second grade. We can, however, permit ourselves some tentative conclusions:

1) the WPPSI produced rich clinical material which was best understood when it was related to diagnostic subgroups, but even with some subgroups patterns of functioning were highly idiosyncratic

2) the qualitative and quantitative material elicited by the WPPSI was useful not only for its contribution to the selection and diagnostic processes, but more importantly in planning appropriate strategies of intervention

3) it appears inadvisable to assume that learning disability is a homogeneous condition, manifesting itself in any characteristic cognitive pattern in first grade.

The results for the WPPSI in this study differ to a considerable extent from findings of a number of studies utilizing the WISC to study patterns of intellectual functioning in older children with learning disabilities, (findings, incidentally, which are by no mean unanimous) but difference may be accounted for by the nature of our sample, the age of our subjects, and the test material itself. Ours was an intact sample, consisting of every child who could produce responses to all subtests of the WPSSI. Therefore, although not the ideal sample, it was less subject to inherent psychological, economic, and interpersonal biases which operate in studies of subjects referred for clinical services. Second, for most children in our sample, this was the beginning of their exposure to academic work. Thus they had not yet experienced the effects of school failure. The positive abilities our sample demonstrated (as in the Vocabulary subtest, for example) raise questions whether some test patterns seen with older children on the WISC might not represent the results of school failure, rather than basic cognitive patterns underlying learning disability. Finally, our study adds weight to the warning offered in the original WISC manual by the test author (Wechsler, 1949) in which the clinical examiner is "cautioned to avoid assuming that similar materials have the same meaningfulness at all ages or that similar

tests tap identical abilities at all ages." Our study emphasizes the responsibility of the school psychologist to elicit all the quantitative and qualitative data available in order to understand how a child approaches cognitive tasks and to formulate the information so that the school can teach him effectively.

Table 1

Mean WPPSI IQs for Normal Progress (N=40) and Intervention (N=30) Groups

IQ	Intervention Group	Normal Progress Group	t	p
Full Scale	89.7 ± 14.5	106.0 ± 11.7	6.13	<.01
Verbal Scale	91.6 ± 14.9	104.8 ± 14.5	3.71	<.01
Performance Scale	90.9 ± 15.1	106.7 ± 10.1	4.96	<.01
M_{v-p} diff	.7	-1.9		
t	.31	.89		
p	N.S.	N.S.		

Table 2

Mean WPPSI Subtest Scores for Normal Progress and Intervention Groups

Subtest	Intervention Group	Normal Progress Group	t	p
Information	7.9 ± 2.6	10.7 ± 3.1	4.14	<.01
Vocabulary	9.9 ± 3.3	11.4 ± 3.8	1.72	N.S.
Arithmetic	8.6 ± 2.8	10.6 ± 2.8	4.16	<.01
Similarities	7.8 ± 2.4	10.1 ± 2.4	3.92	<.01
Comprehension	8.9 ± 3.6	11.1 ± 3.0	2.69	<.01
Sentences	7.6 ± 3.0	10.1 ± 3.0	3.42	<.01
Animal House	8.7 ± 2.6	10.6 ± 2.1	3.19	<.01
Picture Completion	9.3 ± 2.5	11.6 ± 2.9	4.53	<.01
Mazes	8.4 ± 3.7	11.2 ± 2.7	3.42	<.01
Geometric Designs	9.2 ± 3.0	10.9 ± 2.3	2.59	<.05
Block Design	8.3 ± 2.9	10.8 ± 2.8	3.49	<.01

Table 3

Coefficients of Variation for Normal Progress and Intervention Groups

Subtests	Intervention Group	Normal Progress Group
Information	33%	28.4%
Vocabulary	33.6%	33.6%
Arithmetic	32%	26.1%
Similarities	30.1%	23.7%
Comprehension	40.4%	29.8%
Sentences	39.9%	29.3%
Animal House	29.4%	20.7%
Picture Completion	31.5%	25%
Mazes	43.9%	24.4%
Geometric Designs	33%	20.9%
Block Design	35.3%	25.6%

Table 4

Total Group

% of Deviations ± 3 Scaled Score Points from Each Subject's Mean Scaled Score

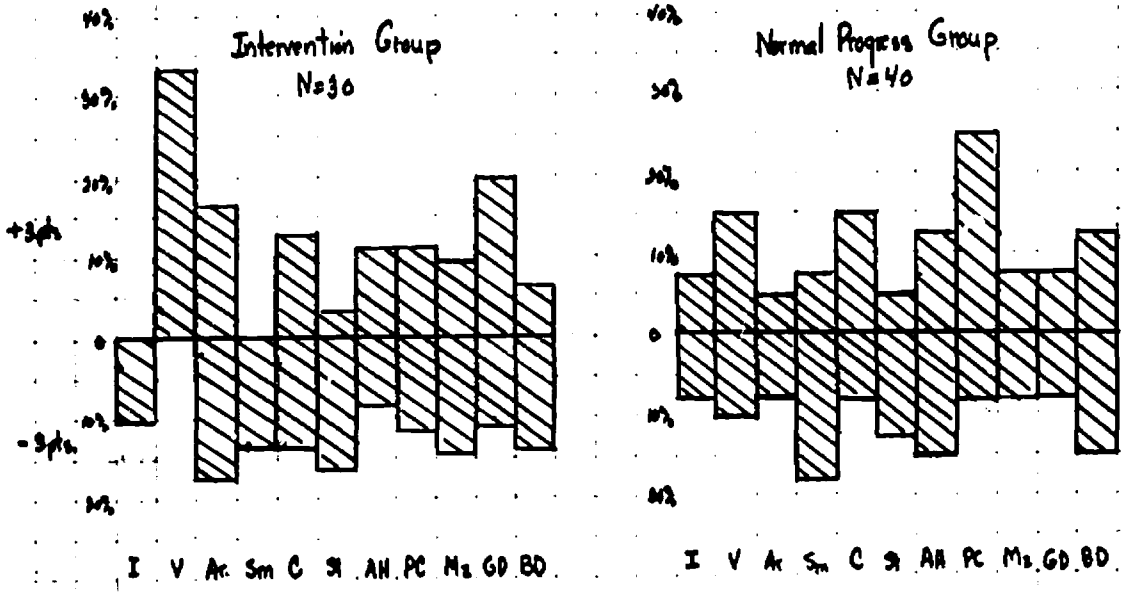


Table 5

Mean WPPSI IQs for Matched Groups (N=17 pairs)

IQ	Intervention Group	Normal Progress Group
Full Scale IQ	98.3±10.7	99.7±9.3
Verbal IQ	98.8±10.0	98.1±11.7
Performance IQ	98.4±13.8	101.5± 7.6
$M_{v-p\ diff}$	.5	-3.4
t	.14	1.32
p	NS	NS

Table 6

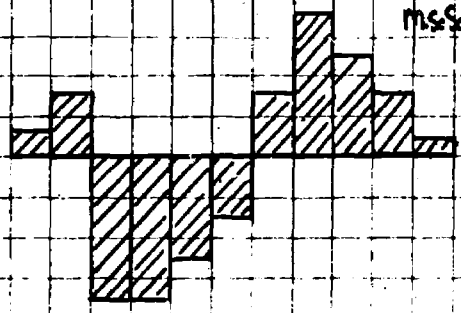
Mean WPPSI Subtest Scores for Matched Group (N=17 pairs)

Subtest	Intervention Group	Normal Progress Group	diff M_1-M_2	t	p
Information	9.1	9.2	-.1	.25	N.S.
Vocabulary	11.4	9.8	1.6	3.46	<.01
Arithmetic	9.29	10.47	-1.18	2.19	<.05
Similarities	9.12	9.18	-.06	.07	N.S.
Comprehension	10.24	9.82	.42	.39	N.S.
Sentences	9.06	9.35	-.29	.36	N.S.
Animal House	9.35	10.35	-1.00	1.66	N.S.
Picture Completion	9.71	10.82	-1.11	.94	N.S.
Mazes	10.00	9.82	.18	.29	N.S.
Geometric Designs	10.18	10.18	0	0	N.S.
Block Design	9.35	10.00	-.65	.82	N.S.

Table 7:

WPPSI Profile: Richard SLD

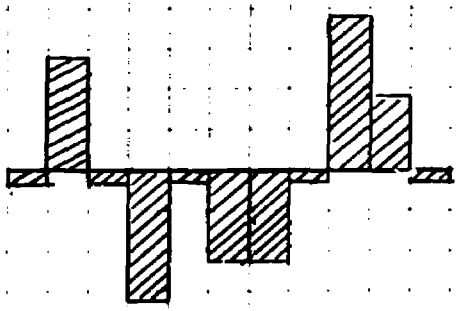
MS Score = 9.5



I V Ar Sm C St AH PC Mz GD BD

Table 8:

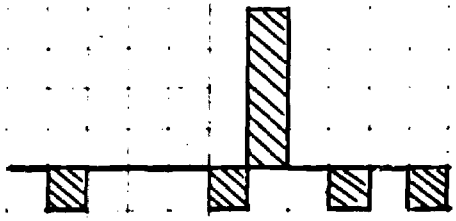
WPPSI Profile: Karl MS Score = 11.2.



I V Ar Sm C St AH PC Mz GD BD

Table 9: WPPSI Profile: Rosemary D-I

MS Score = 7.0



I V Ar Sm C St AH PC Mz GD BD

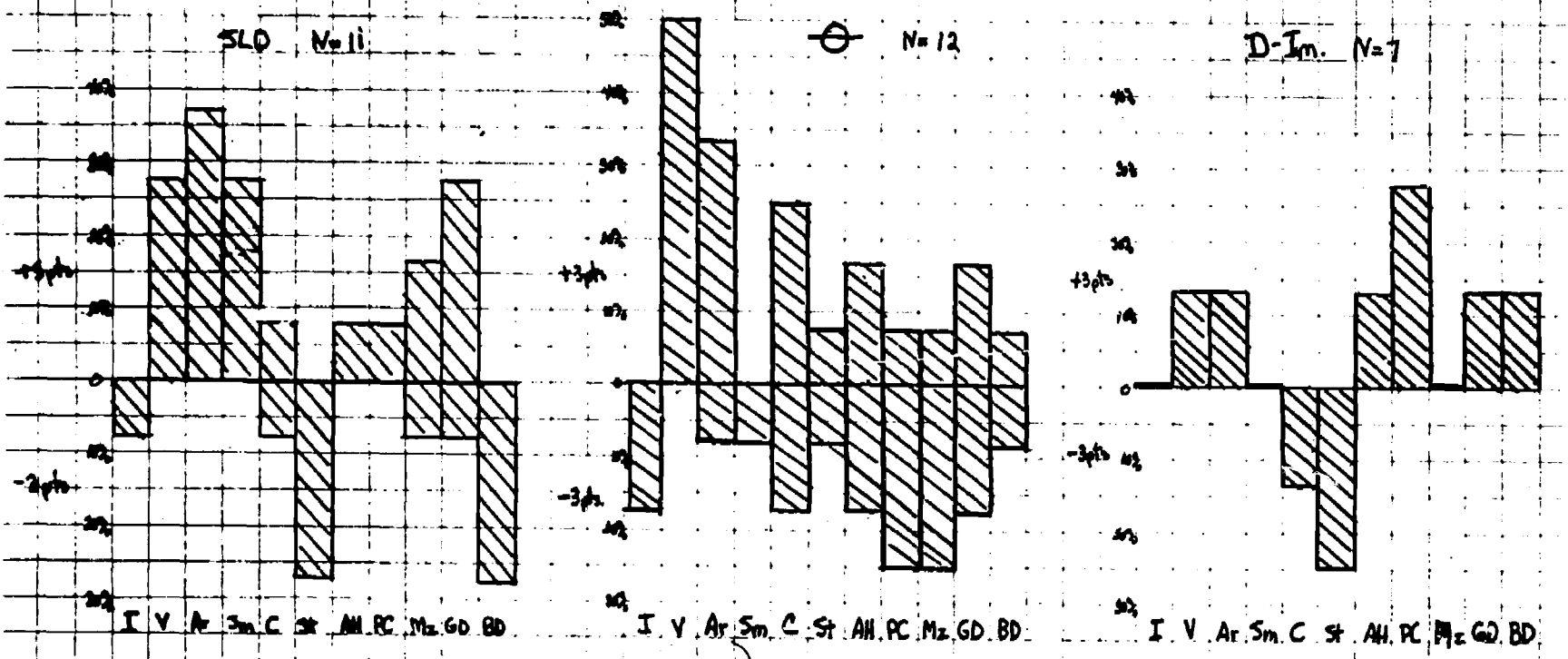
Table 10
Mean WPPSI IQs for Diagnostic Groups

IQ	SLD (N-11)		~~0~~ (N-12)		DI (N=7)	
Full Scale IQ	95.6	10.9	91.0	16.1	78.1	10.7
Verbal IQ	94.6	11.6	94.2	18.4	82.4	10.2
Performance IQ	98.9	13.0	90.8	14.1	78.6	12.5
$M_{v-p\ diff}$	-4.3		3.4		3.8	
t	1.09		1.32		.88	
p	N.S.		N.S.		N.S.	

Table 11:

Diagnostic Groups

% of Deviations ± 3 Scaled Score Points from Each Subject's Mean Scaled Score



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