

# INTRATEST AND INTERTEST RELIABILITY AND STABILITY OF THE WISC, WISC-R, AND WAIS FULL SCALE IQS IN A MENTALLY RETARDED POPULATION<sup>1</sup>

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The reliability and stability of the Full Scale IQ scores of retarded adolescents and young adults on 3 Wechsler Scales were measured. For mean retest intervals ranging from about 1.75 to 3.5 years, intratest reliability and constancy were reasonably good, although a significant rise in mean IQ was found for the WISC-R retest. Intertest

reliability was also inadequate, but intertest constancy was not. The mean WISC-R IQ was significantly lower than the mean WISC IQ, and both were dramatically lower than the mean WAIS IQ. Comparisons are made with previous findings and implications of these results are discussed.

The periodic retesting of large numbers of individuals in residential facilities provides the opportunity for analysis of the stability and comparability of standardized intelligence tests for specified populations. The present study assesses the constancy and intertest correlations of the Full Scale IQ scores of retarded individuals who have been or who now are residents at the Johnstone Center, an open, relatively short-term residential facility housing primarily mildly and moderately retarded adolescents and young adults. This population provides a particularly severe test of the reliability of the IQ score, as most of the residents come from broken homes and are frequently under stress, particularly when they are tested shortly after admission.

## METHOD

The records of all students now or recently at Johnstone were searched. Each of the Wechsler Full Scale IQ scores of each student who was tested more than once, either on the same Wechsler Scale or on a different Wechsler Scale, was recorded. Because it is routine at Johnstone to retest students every 2 years, primarily on one of the Wechsler Scales, most scores were obtained from routine testing by the Johnstone Clinical Psychology Department, but a number of scores were also available from Wechsler Intelligence Scales given by qualified psychologists prior to the student entering Johnstone. The scores were from three Wechsler Scales: the Wechsler Intelligence Scale for Children (WISC), the Wechsler Intelligence Scale for Children-Revised (WISC-R), and the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1949, 1955, 1974). Full Scale IQ scores derived from limited numbers

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of subtests (prorated) were not included. Where Full Scale IQs were below scale, the lowest score possible for that Scale was used. However, because the lowest possible score is different on different Scales, these scores were not included in inter-Scale comparisons.

TABLE 1  
SUMMARY OF RESULTS

Tests	N	Mean age (yr.)	Mean interval	Mean IQ	Mean diff.	t	r
WISC to WISC	69	12.84 (1.28)	2.12	58.71 (8.74)	-0.83	1.06	.75*
		14.96 (.83)		57.88 (9.33)			
WISC-R to WISC-R	24	13.47 (1.28)	1.74	54.96 (11.50)	3.37	2.42**	.84*
		15.21 (1.37)		58.33 (12.28)			
WISC to WISC-R	33	12.92 (1.52)	2.30	61.42 (7.56)	-5.12	4.20*	.70*
		15.22 (1.16)		56.30 (9.65)			
WISC to WAIS	65	14.71 (1.21)	2.80	55.25 (8.72)	9.44	11.49*	.70*
		17.51 (1.11)		64.69 (8.03)			
WISC-R to WAIS	26	15.85 (.71)	1.77	51.50 (8.74)	14.31	13.73*	.80*
		17.62 (.85)		65.81 (7.41)			
WAIS to WAIS	42	17.46 (.75)	3.40	61.33 (6.69)	1.00	1.25	.75*
		20.86 (.64)		62.33 (7.65)			
WAIS to WAIS	23	21.08 (.60)	3.52	61.48 (8.56)	0.52	.60	.88*
		24.61 (.66)		62.00 (8.62)			

Note. Numbers in parentheses are standard deviations.

\* $p < .001$ .

\*\* $p < .05$ .

Scores were partitioned into sets. As defined here, a set consists of the Full Scale IQ scores from two tests given to a single individual, and can be composed either of a test and retest on the same Scale or a test on one Scale and a retest on a different Scale. A student could contribute to any number of sets. Of the 163 students for whom scores were obtained, 72 contributed to one set, 67 to two sets, 20 to three sets, and 4 to four sets. As Table 1 shows, these 282 sets of scores produced seven different combinations, four of which provided intratest data and three of which provided interestest data. Note that the WAIS/WAIS sets were divided into a younger and an older group to make the time intervals between test and retest as close as possible to the intervals of the other sets.

### RESULTS AND DISCUSSION

Table 1 gives the major results, which are shown graphically in Figure 1. Note that the average test-retest interval for the first five sets is 2.27 years  $\pm$  0.53, but for the last two sets it is about 3.5 years. Results of each set will now be described and compared with a sampling of related studies. I have tried to include most of the relevant studies in which retarded or borderline populations were used. The literature on the Wechsler Scales with nonretarded populations, on the other hand, is exhaustingly voluminous (e.g., Buros, 1978, pp. 330-355), and only a few of these studies are referred to here.

#### WISC/WISC

Over an average of about 2 years, the average WISC IQ of this population of retarded young adolescents was quite stable. Of the 69 pairs of scores, 59% deviated by 5 IQ points or less, 28% by 6 to 10 IQ points, and the remaining changed

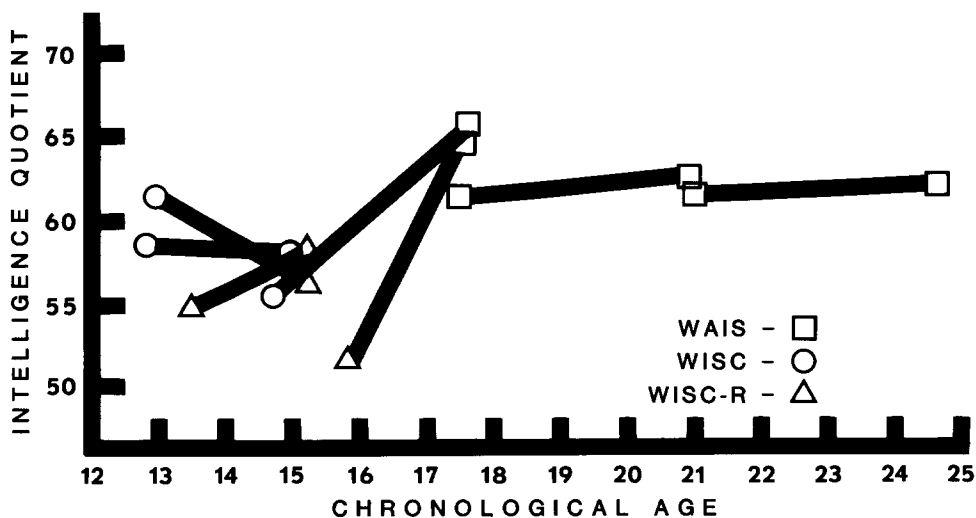


Figure 1. Mean Full Scale IQs of retarded individuals retested on the same or on a different Wechsler Intelligence Scale.

11 to 15 IQ points—results quite comparable to those reported by Whatley and Plant (1957; see also Klonoff, 1972). The changes were split evenly between increases and decreases in IQ except for those that changed 6 to 10 IQ points, where about twice as many decreased as increased. The retest correlation was .75.

The present results are in the same range as those generally found for retarded and borderline groups over relatively long retest intervals. At intervals of 6 months to 6 years, WISC/WISC Full Scale IQ correlations ranging from .68 to .95 have been reported (Friedman, 1970; Rosen, Stallings, Floor, & Nowakiwska, 1968; Throne, Schulman, & Kasper, 1962; Walker & Gross, 1970; Wesner, 1973), and changes in the mean IQ have been small and not statistically significant (see also Goodman, 1976; Whatley & Plant, 1957), with two exceptions—one in which a significant increase of 4.6 points in mean IQ occurred over a 1-year period and increased an additional 1.6 points a year later (Reger, 1962), and the other in which 183 children showed a significant mean increase of 2.8 points after almost 3 years (Thomas, 1980).

The .75 correlation found here is also of the same order of magnitude as that reported in most studies of nonretarded children, where WISC/WISC correlations ranged from the .70s to the .80s for retest intervals of 3 months to 4 years (Conklin & Dockrell, 1967; Gehman & Matyas, 1956; Klonoff, 1972; Quereshi, 1968a; Tigay & Kempler, 1971). With a retest interval of 3 to 5 weeks, correlations as high as .94 and .98 have been reported (Irwin, 1966). However, for some groups of nonretarded children significant increases in mean IQs of about 4.5 to 8.5 points have been found (Holloway, 1954, combined controls groups only; Levinson, 1961; Quereshi, 1968a; Tigay & Kempler, 1971) for retest intervals ranging from 2 months to 3 years.

### *WISC-R/WISC-R*

After an average interval of almost 2 years there is a significant average increase of somewhat more than 3 IQ points in the WISC-R retest, and a substantial correlation of .84. Compared with initial testing, 54% of the 24 students deviated by 5 IQ points or less, 25% by 6 points, 4% (one student) by 9 points, 8% 11 to 15 points (both up), and 8% by 16 points (one up and one down). Most of the changes (75%) were increases.

Solly (in press) reported that the mean Full Scale WISC-R of 55 mentally retarded children and adolescents, drawn from public school special classes, did not change reliably over a period of approximately 3 years, while the mean IQ of 52 learning-disabled students declined a reliable 2.31 points. Over a 2-year period, Vance, Blix, Ellis, and Debell (1981), having excluded children who were severely emotionally or sensorially disturbed, found a retest correlation of .88 and no change in mean IQ (76) in a group of 30 retarded and 45 learning-disabled children (mean age 10.2 years at initial testing). The mean IQ of Covin's (1977a) sample of 30 learning-disabled children, who were of low-average intelligence, did not change reliably after a 1-day retest interval. The retest correlation was .85.

Wechsler (1974) retested 303 children on the WISC-R after a 1-month interval and reported a significant average gain of 7 points, with three different age groups

producing correlations ranging from .92 to .95. Tuma and Appelbaum's (1980) 45 unselected public school children produced a significant increase of 4.73 IQ points after an interval of about 6 months, and a test-retest correlation of .95.

The modest rise of 3 IQ points in the present sample is not out of line with the limited evidence on WISC-R stability over an appreciable time. The high correlations reported in all the studies indicate that the relative positions of the children compared with one another remained fairly constant.

### WAIS/WAIS

The mean WAIS IQs changed by only about 1 IQ point. For the younger group, 67% of the IQs deviated by no more than 5 IQ points, 31% by 6 to 10 points, and one student's score decreased by 14 points. Sixty-two percent of this sample increased their IQ scores. In the older group 74% deviated by no more than 5 IQ points and the remaining 26% deviated by 6 to 10 points, with the increase/decrease ratio approximately equal. Test-retest correlations increased from .75 in the younger group to .88 in the older; the combined correlation was .81.

Rosen et al. (1968) reported that 141 institutionalized retarded young adults, after a mean retest interval of about 2.5 years, showed no significant change in WAIS IQ, and a test-retest correlation of .88. Goodman (1976) assessed the performance of institutionalized retarded populations drawn from four different age levels and retested at intervals of 3.6 to 5.6 years. No significant change in IQ for any of the groups was found. (The correlation was not reported.) Dinning, Andert, and Hustak (1977) retested 24 institutionalized retarded adults after a mean interval of 2.67 years and found no reliable change in average IQ, and a .90 test-retest correlation. Ninety-three percent of their sample changed no more than  $\pm 8$  IQ points.

WAIS stability studies with other than atypical or elderly groups are rare. Matarazzo, Wiens, Matarazzo, and Manaugh (1973) tested 29 police applicants and retested them 14 to 22 weeks later. Mean IQs rose significantly from 118.1 to 123.6 and the retest correlation was .91. As part of a larger longitudinal study, Kangas and Bradway (1971) retested a group of 48 adults whose mean age averaged 29.7 years at initial testing and 41.6 years at retest. Their mean IQ rose a reliable 8.5 points, with a test-retest correlation of .73.

No change in mean WAIS IQ over retest intervals ranging from 2 to 6 years is the norm for groups of institutionalized retarded samples, but apparently the mean WAIS IQ of samples of average and above-average adults does increase upon retest, at least for some groups at some retest intervals, though relative performance remains quite stable (cf. Matarazzo, 1972).

### WISC/WISC-R

Our sample showed a reliable drop of 5.12 IQ points when going from the WISC to the WISC-R after a 2.3-year interval, and their test-retest correlation was .70. Seventy-three percent of the 33 students showed a decrease in IQ.

Four studies comparing the WISC and WISC-R of retarded and borderline samples have used a counterbalanced design, and in all of them the retarded had

WISC IQs that ranged from about 5 to 10 IQ points higher than WISC-R IQs over retest intervals ranging from 3 to 39 days (Catron & Catron, 1977; Hamm, Wheeler, McCallum, Herrin, Hunter, & Catoe, 1976; Rowe, 1977; Solly, 1977; Knight, Note 1), although in Rowe's study one group of 10 students with borderline intelligence scored lower on the WISC than on the WISC-R when the latter was given second. WISC/WISC-R correlations ranged from .87 to .89. (Solly, 1977, did not report correlations, but based on the data he kindly supplied to me, his sample of 12 retarded children had a correlation of .87. No reliable correlation was found for his sample of 12 gifted children.) In a number of other studies the WISC was always given first and retest intervals ranged from 1.5 to 3.6 years. In four of these (Girona, 1977; Covin, 1977b; McGonagle, 1977; Thomas, 1980) no significant differences in mean IQ were found (calculated by me for the Thomas study), although the Girona and the McGonagle studies included only 20 and 13 students, respectively. In two other studies with substantial samples (Covin, 1976; Reschly & Davis, 1977) the WISC was reliably higher by about 3 to 4 points for mean retest intervals of 1.4 to 2 years. Of the above six studies only Girona reported a correlation (.54) of less than .87 (neither McGonagle nor Thomas reported correlations).

Of four studies of WISC/WISC-R comparisons in which a counterbalanced design was used with groups of normal children, two (Schwartz, 1976; Tuma, Appelbaum, & Bee, 1978) reported the WISC to be reliably higher by 7.49 and 4.05 IQ points over average intervals of about 2 months and 20 days, respectively. In the two other studies (Appelbaum & Tuma, 1977; Stokes, Brent, Huddleston, Rozier, & Marrers, 1978) the statistical analyses are unclear or nonexistent, but the small differences in favor of the WISC do not appear to be statistically significant if measured by nondirectional *t* tests. Order effects and interactions with intelligence level have occasionally been reported. There are numerous WISC/WISC-R comparisons using minority as well as atypical groups (usually children referred for evaluation). Reviews of some of these can be found in Munford and Munoz (1980) and Swerdlik (1977, 1978). Although the WISC IQ is frequently higher than the WISC-R, this is by no means a universal finding. However, correlations are almost always high.

Perhaps the most informative study of WISC/WISC-R comparisons did not involve a repeated-measures design. Doppelt and Kaufman (1977) took their data from 2,200 children, aged 6.5 to 15.5 years, in the WISC standardization sample, and 2,000 from the same age range in the WISC-R standardization sample, and compared them on those items that were the same in both tests (19 Information items, 8 Arithmetic, 21 Vocabulary, 2 Object Assembly, 8 Mazes, and the entire Coding subtest). Multiple-regression equations were developed from the WISC sample to predict WISC IQs from the common items, and these equations were used to estimate the IQs of the WISC-R standardization sample for 10 different age levels. The WISC gave consistently higher Full Scale IQs, more so in the 6.5- to 10.5-year-old age range than in the 11.5- to 15.5-year-old age range. The largest difference (8 points) was in the retarded sample at the younger age range. For the retarded sample in the older age range, the difference in favor of the WISC was 3 IQ points. Comparable numbers for children of average intelligence were 6 and 3

points for the younger and older groups, respectively, while for above-average and superior children differences were even smaller. However, Larrabee and Holroyd (1976) reported that a superior group of fifth graders had a WISC IQ that was 9.4 points higher than the WISC-R after a 10-week interval in a partially counterbalanced design, although most of the difference was accounted for by a much higher WISC score when it followed the WISC-R.

In any case, the present finding that WISC IQs of a retarded group were on the average about 5 points higher than WISC-R IQs is not unusual and can apparently be attributed to the fact that the standardization sample for the WISC-R was somewhat brighter than that for the WISC.

### WISC/WAIS

For the present sample the mean Full Scale WAIS IQ was 9.44 IQ points higher than the WISC IQ that had been obtained, on the average, 2.80 years previously, a difference that represents 63% of the 15 points set as the standard deviation in the Wechsler Scales. Ninety-two per cent of the 65 students had an increase in IQ. The correlation of .70 indicates that the increase is approximately proportional for a large percentage of this sample.

Numerous investigators have made WISC/WAIS comparisons of both institutionalized and noninstitutionalized populations of retarded and borderline intelligence. Test-retest intervals have ranged from 1.6 to 5.5 years. In five studies the WAIS was higher by 10 IQ points, with correlations of .70, .94, .78, .84, and .90 (Fisher, 1962a; Walker & Gross, 1970; Walker & Walker, 1972; Webb, 1963; Wesner, 1973, respectively). In another study, the WAIS was about 6 points higher, but the correlation was unreported (Lowe, Roberts, & Whidden, 1974). In the only study with low-IQ individuals in which a counterbalanced design was used, the WAIS was higher by 5.5 points, and the correlation was .89 (Fagan, 1972).

Results with nonretarded groups are quite different. Four studies used a counterbalanced design and, necessarily, high school students. In two studies in which a counterbalanced design was used, it was the WISC that gave the higher IQ by 3 to 4 points, which was reliable in one study (Quereshi, 1968b) where the intertest interval was 100 days (and in which order effects were found), but not in the other, where the interval was 17 to 22 days (Quereshi & Miller, 1970). (The former study used 14- and 15-year-olds, although the WAIS was standardized only down to 16 years, while the latter study used 17-year-olds, although the WISC was standardized only up through 15 years.) On the other hand, when both tests were administered on the same day in a counterbalanced design, it was the WAIS that was a reliable 6.28 IQ points higher (Simpson, 1970). Testing a range of students in an all-male high school, and using a mean retest interval of 2 weeks, Hannon and Kicklighter (1970) found that the WAIS was significantly higher by 7 points in students with less than 80 IQs, but the WISC was significantly higher by 2 and 7 points in the average and above-average students, respectively.

In two studies where tests were not counterbalanced, the WAIS of high school students was significantly higher by 3 points in one (Green, 1965), and higher, but not significantly so, in the other (Ross & Morledge, 1967).

Correlations, given in only four of the above studies, ranged from .80 to .96.

In sum, consistently higher scores on the WAIS were found only in low-IQ populations, and the present results are in line with that finding. Apparently the standardization sample of the WISC was somewhat brighter than the WAIS sample in the lower IQ range.

### WISC-R/WAIS

The most dramatic finding in the present study was that the mean WAIS IQ was 14.31 points higher than the mean WISC-R IQ when the WAIS was given an average of about 2 years after the WISC-R. This difference is almost a full standard deviation. All 26 students had higher WAIS IQs. These results are quite compatible with findings, in counterbalanced designs, that the mean WAIS Full Scale IQs (75 to 77) of 16-year-old public school special education students were 12 to 13 points higher than their mean WISC-R Full Scale IQs (Craft & Kronenberger, 1979; Nagle & Lazarus, 1979). The mean retest interval in those studies was 37 days and 10 days, respectively, and the latter study reported a .81 correlation. Taken together, these three studies provide powerful evidence that the two Scales are simply not comparable for retarded and borderline individuals.

In his manual for the WISC-R, Wechsler (1974) described a study comparing performance on the WAIS and WISC-R in a counterbalanced design over a 1- to 3-week interval with a sample of 40 16-year-olds. The correlation was .95, but the mean WAIS IQ was 6 points higher than the WISC-R, a discrepancy that he suggested might be due to the fact that 16-year-olds in 1974 performed better on the WAIS than did their counterparts 20 years ago, when the WAIS was standardized. However, it seems more likely that, again, a difference in the standardization samples accounts for the lower WISC-R scores, and that sampling differences were greatest at the lower intellectual levels. The fact that with retarded samples the WAIS also produces higher IQs than the Stanford-Binet (Fisher, 1962a, 1962b) suggests that the WAIS overestimates IQ in this intelligence range.

Wechsler recently published a revised and restandardized version of the WAIS (WAIS-R, Wechsler, 1981) that may not have the shortcomings of the original WAIS. The content has been updated and new norms were obtained. In the manual for the WAIS-R he describes a WAIS/WAIS-R comparison study, counterbalanced over a 3- to 6-week interval with a sample of 72 35- to 44-year-olds, in which the mean WAIS-R Full Scale IQ was 8 points lower than the WAIS.<sup>2</sup> He also reported that the Full Scale IQs of 80 16-year-olds on the WAIS-R and the WISC-R (counterbalanced) over a 1- to 6-week interval were not significantly different from each other. These findings suggest that at least for some populations the new WAIS-R will not overestimate IQ, as had the original WAIS. It is essential, however, that we track the progress of the new Scale to determine whether it decreases

<sup>2</sup>However, after this paper was in press I was able to compare the WAIS and WAIS-R scores of 31 Johnstone residents (18 men, 13 women, mean age at WAIS testing = 22.41 yr,  $SD = 3.75$ ). The average IQ remained the same: 58.48 ( $SD = 7.80$ ) on the WAIS, and 58.55 ( $SD = 5.13$ ) on the WAIS-R that was administered, on the average, 1.95 yr ( $SD = .30$ ) later. The correlation was .69 ( $p < .0001$ ). Apparently, for retarded individuals at this level the WAIS-R is no different than the WAIS, and it too can be expected to produce higher IQ scores than do the WISC and WISC-R.

or eliminates the large discrepancy found in the WAIS IQs of retarded and borderline populations when compared with the WISC or WISC-R. It should be noted that Wechsler reported that both the WAIS/WAIS-R and WISC-R/WAIS-R correlations were .88.

## DISCUSSION

Many workers are unaware of the large discrepancies that are likely to occur when going from Wechsler's Children Scales to the Wechsler Adult Intelligence Scale. At a time when there is heated debate concerning the immutability of intelligence, it is essential to control for IQ changes resulting from difference in standardization samples. Without this awareness an observer following a retarded individual from early to late adolescence might be unduly optimistic about the apparent intellectual improvement from initial testing on the WISC or WISC-R to retesting on the WAIS, and not recognize that a stable IQ should in this instance be cause for concern.

This problem does not appear in the Stanford-Binet Intelligence Scale, although Wechsler (1974), in commenting on the WISC-R/WAIS shift in IQ, noted a similar upward shift from ages 15 to 17 in the Stanford-Binet normative data (Terman & Merrill, 1973, p. 358). However, the Binet shift was not as large as Wechsler indicated, and had been smoothed for the tables of norms. In any case, the Binet IQs of retarded samples appear to be very stable (e.g., Earhart & Warren, 1964; Fisher, 1962a, 1962b; Holowinsky, 1962; Walker & Gross, 1970), and Fisher (1962b) has suggested that, compared with the Stanford-Binet, the rate of decline with age of a retarded sample is inadequately tested by the WAIS.

An alternative to the sampling explanation for the large increase in IQ is that students tested at 14.5 to 16 years are at an age when they can benefit from their institutional stay, and when retested some 2 years later they demonstrate a true increase in intelligence. This seems unlikely, for there appears to be no reason why a dramatic increase in capability should occur over only that particular age range and not over the other age ranges sampled.

Finally, a word should be said about dramatic changes in IQ scores occasionally found even when retarded individuals are retested on the same test, changes that are obscured in group data. For example, in the WISC-R/WISC-R sample, one student's IQ rose 16 points, another's fell 16 points. Needless to say, in a clinical setting there is no substitute for treating each person as an individual and not a statistic. But the frequency of dramatic changes should not be exaggerated any more than the presence of an occasional dramatic change should be denied. Consider that in the present study, (a) no effort was made to screen out individuals who were brain damaged and/or receiving therapeutic drugs, (b) the correlations were not corrected for attenuation, (c) the IQ range of the sample was rather restricted, (d) some students were emotionally disturbed and most came from broken or unstable family backgrounds, (e) many students were tested during a particularly stressful period of their lives, and (f) the retest intervals were about 2 years. High intra- and inter-Scale correlations under these circumstances suggest that these intelligence tests are remarkably reliable. Perhaps the new WAIS-R will make the inter-Scale IQs of the Children and Adult Scales as constant as they are reliable.

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