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CHANGES IN IQ OF INSTITUTIONALIZED DELINQUENT BOYS

by

Robert Allen Roe

A Thesis Submitted to the Faculty of the Graduate School  
of Loyola University in Partial Fulfillment of  
the Requirements for the Degree of  
Master of Arts

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## LIFE

Robert Allan Roe was born in Seattle, Washington, May 11, 1930.

He was graduated from Roosevelt High School, Seattle Washington, June, 1948, and from Seattle University, June, 1952, with the degree of Bachelor of Social Science.

He began his graduate studies at Loyola University in September, 1952. During the period from November, 1954, to October, 1956, he served in the United States Army. Since February, 1957, he has been employed by the Illinois State Training School for Boys--first, as a student psychologist, and later, as a staff psychologist.

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## CHAPTER I

### INTRODUCTION

The purpose of this thesis is to determine if juvenile delinquents committed to an institution and participating in the academic educational program, show a change in IQ between the time they enter the institution and four to six months later. It has been the observation of psychologists, in evaluating delinquent boys for the Illinois Youth Commission, that IQ scores frequently indicate intellectual functioning below the potential intellectual level of these juveniles. In a limited number of cases, mainly with boys originally scoring in the mentally defective range, increases in test performance have been achieved upon retesting after periods of varying duration at the training school. It seems desirable to determine whether or not this observation can be shown to be significant under controlled conditions, with a sample representative, in terms of intellectual ability, of juvenile delinquents as a group. This investigation has been designed as a pilot study and employs a sample limited in size, but sufficient to suggest a meaningful answer to the question of whether or not IQ increases.

This knowledge seems important for two reasons, both having to do with the broader issue of rehabilitation of delinquents by placing them in training schools. First, increase in the level of intellectual functioning, if present, would seem to be an important effect of the rehabilitation process, or in combination with changes in many other factors, a practical definition of

rehabilitation. The second reason for the importance of knowledge about IQ change is that it would provide valid grounds for a program of extensive research into the relationship between the IQ change and participation in the training school program. If such a relationship could be demonstrated, it might lead to modifications of such programs that would increase their effectiveness. In fact if the rehabilitation process comes to be better understood, methods which do not have the inherent disadvantages of training schools (stigma, repression, and increased sophistication in delinquency) may replace this type of institution in the handling of a majority of these children.

Delinquents as a group fall below the general population in intellectual ability (2, 11, 16, 17). The word delinquents, here, should be understood to mean adjudicated delinquents, as it is likely that the more intelligent boys who commit delinquent acts are frequently not represented by the research data because they are more successful in avoiding apprehension. Another factor to be considered in evaluating IQ data on delinquents is the influence of school achievement upon test intelligence. The school attendance of these boys is frequently irregular, and their educational achievements are inferior to non-delinquents of comparable intellectual level (6, 11, 16). It is our concern, both in terms of the welfare of the individual—his opportunity for maximum development of his potential, and in terms of our welfare as a growing society, that rehabilitation be as complete as possible. Less than full participation by all is much too costly.

Research in the areas of intellectual ability, and various other abilities, is vital to our survival and continued advancement in a fast moving and competitive technical age. This is emphatically pointed out by Wolfle (27)

and Stalnaker (18) in their recent publications regarding discovery and maximum utilization of talent. Stalnaker describes the efforts of the National Merit Scholarship Corporation to discover students of superior intelligence and especially those of high academic achievement, and to encourage them to make full use of their talents by providing them with college scholarships, as well as by promoting a general respect for intellectual achievements. Wolfe's plea is for maximum use of individual potential by placing emphasis on the development of the diverse talents and interests of different individuals. He would like to see the use of teaching methods that allow the student to learn in whatever way he learns best. Thus he opposes the effort to develop, to an equal degree of proficiency, by rigid methods, all of the abilities which each individual possesses in varying degrees, in favor of developing the talent in which each excels.

The necessity for utilization of talent as it is possessed by those boys is urgent also. Only rarely are they superior in the degree referred to above. Their need is mainly for achievement on the high school level.

The hypothesis formulated for purposes of this investigation is as follows:

Delinquent boys will show an increase in IQ upon retesting after an exposure to the academic educational program of a correctional institution for at least four months.



## CHAPTER II

### REVIEW OF RELATED LITERATURE

Previous investigation of the specific topic here under study appears to be limited to one published article. Gersten (5), in studying the effectiveness of group psychotherapy at the New York Training School for Boys, divided forty-four boys into matched groups. The experimental group was exposed to the full institutional program and, in addition, to activity-interview group therapy for a period of twenty weeks. The control group had no psychotherapy, but otherwise was exposed to the full institutional program for the same period. Chronological ages ranged from 13-7 to 16-6--mean 15-5; Wechsler-Bellevue IQ's, from 71 to 105--mean 85.6. The effects of group therapy upon intellectual adjustment was one of the areas of evaluation. Retesting, accomplished with an alternate form of the Wechsler-Bellevue, showed an increase of 2.80 IQ points for the experimental (therapy) group, significant at the five per cent level of confidence, but no change for the control group. Significant improvement in school achievement, as measured by the Stanford Achievement test was also demonstrated for the experimental group.

The control group of Gersten's excellent study appears to have been tested under conditions roughly comparable to those of this investigation, that is, exposure to a routine training school program for about six months. The test used in the present study, however, was the Wechsler Intelligence Scale for Children. Relative to intellectual achievement Gersten says (p. 54)

"One of the chief factors in the maladjustment of the boys is their exposure to constant frustration and failure in intellectual achievement and in the school area. If this condition can be improved, it should make for a better total adjustment."

A study by Holloway (12) using 107 subjects, mean age 5 yr., 6 mo., seeking to measure the effectiveness of an experimental program in comparison with the standard kindergarden training reveals IQ gains as measured by both the WISC (8.40) and the SRA Primary Mental Abilities test (9.47) which were significant at the five per cent level of confidence. These gains applied to both groups. The experimental group gained significantly more as compared to the control group as measured by the PMA but not as measured by the WISC; which fact the author attributed to the similarity between the exercises of the training program and the PMA test items. He concludes that IQ's do change significantly and, from further evaluation of his data, that perhaps the relationship between IQ gains and IQ standing is zero or negative.

To measure the stability of the WISC and the Binet, Form L (1937 revision) over a long period of time, Gehmann and Matyas (4) compared the performances of sixty boys and girls who took both tests in the fifth grade and again, four years later in the ninth grade (same subjects). They found that none of the IQ differences were significant at the five per cent level of confidence. Apparently we may conclude that practice effect is not significant after such a period of time.

Whitley and Plant (25) retested, with the WISC, children whose IQ's were ninety or below on the initial test in order to determine the stability of the WISC for children of this intellectual level. The seventy children

ranged in IQ from 46 to 90. They were retested after a minimum of twelve months--median, seventeen months. No statistics are presented as to the significance of the results; however, the authors conclude that "there were no apparent meaningful differences in mean IQ scores or median IQ scores for either the Full Scale, Verbal Scale, or Performance Scale," and accept the test as stable relative to other individual intelligence tests with like groups. The absence of adequate statistical data, is a serious limitation of this study.

Littell (15, p. 146), in his recent review of literature on the WISC comments, relative to the Holloway study as follows: "The problem suggested by this study of the practice effects on repeated administrations of the WISC given over relatively short periods of time has not, to the writer's knowledge, been subjected to further direct investigation."

This area of practice effects relative to the WISC is largely undefined. Many studies have been conducted on the subject using other intelligence tests. There seems to be undeniable evidence that practice effects exist, but the extent of their magnitude and the length of time that they are significant seem unclear. Kagan, et al., (13) report that the use of the Binet, administered repeatedly to the average-to-superior children in the Fels Research longitudinal study, results in increasing IQ scores. They find that this practice effect is most pronounced in certain children who appear to learn the tasks in the test. These children have been found to differ on several personality variables from those children who show markedly limited learning on these tasks.

Derner (3) found significant differences in Full Scale IQ on

re-administration of the Wechsler-Bellevue I, after periods of one week, four weeks, and six months. Hamister (10) also found significant change with the same test on Full Scale weighted score upon re-administration using psychiatric patients.

Steissel (19) using normal female subjects, mean age 19 yr., 11 mo., mean IQ 116.8, re-administered the W-B I, to one group of seventeen after a mean interval of 13.94 days, and to a matched group after 77.35 days. Increases significant at the five per cent level of confidence were demonstrated on the three IQ scores and on several subtest scores for both groups. In comparing the increases between the matched subjects of the two groups (20), he found no significant differences except on the Arithmetic subtest (greater increase for 77 day group) and concluded: "The findings, in general corroborate those of previous studies in indicating that the significant gains in retest scores are maintained up to approximately three months, but may dissipate thereafter." His data are based on a rather small sample.

Investigations of the intellectual level of adjudicated delinquents seem to agree that mean IQ is lower than that of the general population. Mean IQ scores of most studies fall in the interval ranging from the low 80's to the low 90's. Illinois Youth Commission (2) figures place the median IQ in the 90 to 99 interval, with IQ's being relatively normally distributed with regard to this median.

Richardson and Surko (16) studying the relationship between IQ and status in reading and arithmetic of delinquent children--boys and girls--at the New Jersey Diagnostic Center, Menlo Park, N.J., report that the mean WISC Full Scale IQ for their group of 105 children was 88.4. Verbal IQ was 87.0;

Performance IQ, 92.4. All of these scores are significantly different from the standardization population. Fifty-two per cent of their group scored below an IQ of 90. Three subtests, Object Assembly, Picture Arrangement, and Picture Completion, did not differ significantly from the norm. Four subtests, Vocabulary, Information, Arithmetic, and Coding were significantly lower than the three above. They conclude:

Our results are better summarized in the statement that the average child referred to the New Jersey Diagnostic Center is somewhat below the norm in general intelligence, but close to average in tests that do not require the use of symbols.

The most outstanding feature in our results, however, is the tendency for our group to be lowest in the abilities that are developed in school (p. 258).

.....

the lowest scores are in tests which are most dependent on school learning or which require concentration and persistency of effort in a task involving symbols (p. 260).

Shney (17) averaging results reported by others on the IQ's of delinquents finds a mean score of 75.24 for Negroes, and 81.3 for whites. Healy and Bronner (11) also report below-average IQ's for their group.

Wechsler's (23) report that delinquents achieve higher Performance IQ than Verbal IQ is confirmed in a number of studies (6, 26).

Personality variables related to gains and losses in IQ by Kagan (13) by means of Thematic Apperception Test analysis are:

1. need for achievement
2. competitive strivings
3. curiosity about nature
4. passivity.

The relationship of anxiety as measured by the Children's Manifest Anxiety Scale and functioning on the performance scales of the WISC was studied by Hafner and others (9). Forty-two children, ages 10-12 years were their subjects. Significant correlations on Block Design and Coding subtests suggest a negative relationship between manifest anxiety and WISC functioning. In another study, Trent (21) found no significant relationship between anxiety and intelligence among institutionalized delinquent boys.

Socio-economic status was found to have a significant effect on the three IQ scores of the WISC in a study of two matched groups of sixty 11-year-old boys. Laird (14) found IQ's to be higher among the higher socio-economic group.

The influence of personality and cultural factors upon test intelligence, as demonstrated by Shney's (17) comparison of the difference between IQ's of Negro and white subjects, Kagan's (13) TAT study, Hafner's (9) investigation on anxiety, and Laird's (14) study of socio-economic status, suggests that modifications of such factors--which are attempted in the rehabilitation process--may produce changes in IQ.

Regarding the WISC itself, Littell (15) has formulated some criticisms based on his review of research with the test. These include the absence of Negroes in the standardization group, the subjectivity of scoring with regard to certain verbal items, the fact that IQ's cannot be determined at very low levels, and on the basic consideration that the test does not have an adequate rationale. In support of the test he reports that Verbal and Performance Scales are roughly supported on factor analytic studies, but that they are not factorially pure. Areas needing investigation are: 1) effects of repeated administration, 2) differences in techniques of administration between

examiners, and 3) effect of the relationship between examiner and child.

The value of the concept of general intelligence as proposed by Wechsler (23) and of his subtests has been challenged of late. The many studies that have been done using the technique of factor analysis, have made it clear that the sub-tests call for the use of many abilities and not always the same abilities at various ages, as Balinsky (1) showed many years ago in his excellent critical study. A fascinating three-dimensional model of intellectual abilities has been described by Guilford (8)--apparently a further development of his thinking as presented several years ago (7). The theory predicts 120 distinct abilities. Already known are 50 of these abilities. He suggests that through further research these factors may be found to cluster into meaningful groups. Tests designed to measure these varied abilities would result in several scores more meaningful perhaps than a general IQ.

## CHAPTER III

### METHOD

In order to investigate the possibility that changes in IQ occur during institutionalization, the following hypothesis was formulated:

Delinquent boys will show an increase in IQ upon retesting after an exposure to the academic educational program of a correctional institution for at least four months.

The subjects for this investigation had all been committed to the Illinois Youth Commission. After study and evaluation at the IYC Reception and Diagnostic Center at Joliet, Illinois, they had been transferred by the Commission to the Illinois State Training School for Boys, at St. Charles, Illinois. They are residents of Illinois, and are of various racial and religious backgrounds.

Selection of subjects was made during February, 1960, and was limited to those boys present who were thirteen, fourteen, or fifteen during that month. Boys participating in the academic educational program, to whom this study is limited, rarely exceed sixteen years of age for three reasons: first, mandatory school attendance is no longer required by Illinois state law after age sixteen; second, the boys typically are eager to be transferred from school to the vocational work program; and third, school facilities are limited, resulting in over-crowding, and policy has been to provide the available educational opportunities to those children required by law to be in school. Further reason to place this upper limit on age is that the norms of the



Wechsler Intelligence Scale for Children extend up to fifteen years, eleven months.

In order to insure sufficient exposure to the training school, considering operating policies relative to length of stay, as well as to control practice effect in re-administration of the WISC, the minimum period in the school before retesting was set at four months and the maximum at six months. The average period of confinement before parole at this institution is approximately six months. It is postulated that the effects of practice upon the retest scores will be negligible after an interval of four months.

Only boys who had not previously been confined at the training school were included. The subjects were selected from boys who had been tested originally at the IYC Diagnostic Center. The investigator thus had no control over which subtests were used. In order to insure a reasonably accurate measure of IQ only those boys who originally were given at least nine subtests were included in the sample. The subtests used originally were re-administered in each case.

From the group as specified above, were selected thirteen, fourteen, and fifteen-year-old boys who were admitted between August 1, 1959, and October 31, 1959, and fourteen and fifteen-year-old boys who were admitted between November 1, 1959, and November 31, 1959. Testing began at once and continued until the list of subjects was exhausted. This procedure resulted in forty-one subjects being retested by the investigator--three of whom were eliminated from the sample because of disqualifying circumstances. Many students were unavailable for retesting due to their being paroled or transferred to other institutions.

The test employed--the Wechsler Intelligence Scale for Children--was

especially designed for this age group, and has enjoyed general use and acceptance since its introduction in 1949. It provides an opportunity not only for study of a total estimate of intelligence--Full Scale IQ--but of two subgroups--Verbal IQ and Performance IQ. A further analysis of abilities is possible by study of the scaled (weighted) scores of the subtests (maximum 12) which are organized on the basis of the type of problem-solving task involved.

In order to evaluate the significance of the results, the differences between first test and retest mean scores for the Full Scale IQ, Verbal Scale IQ, and Performance Scale IQ, and for ten subtests, were subjected to t test in an attempt to determine whether or not the null hypothesis might be rejected in each case.

Since this study involves matched samples--same subjects in both groups--the high correlation between groups must be taken into account. The direct-difference method as described by Underwood (22, P. 167), which automatically takes into account the correlation that exists between the distributions, was used. The formula is:

$$\frac{t}{\sigma_{M_D}} = \frac{M_D}{\sigma_{M_D}} \quad (22, P. 170)$$

Where:

$M_D$  = algebraic mean of the difference between the two test performances

$\sigma_{M_D}$  = standard error of the mean difference

The  $\sigma_{M_D}$  is computed according to the formula:

$$\sigma_{M_D} = \frac{\sigma_D}{\sqrt{N-1}}$$

Where:

$N$  = number of pairs of scores

The  $\sigma_D$  is obtained as follows:

$$\sigma_D = \sqrt{\frac{\sum D^2}{N} - (M_D)^2}$$

Where:

$\sum D^2$  = sum of the squares of the differences between test scores for each S.

The number of degrees of freedom is  $N-1$ . Differences were considered significant if the  $t$  value was great enough to allow rejection of the null hypothesis at the five per cent level of confidence.

## CHAPTER IV

### RESULTS AND DISCUSSION

It has been hypothesized that the subjects selected for this investigation would show an increase in IQ under the conditions specified. With respect to the Full Scale IQ, the mean difference between the first test and the retest, as indicated in Table I, was an increase of 2.37 IQ points. The obtained t value of 2.24 allows rejection of the null hypothesis at the 5% level of confidence.

The mean difference for the Verbal IQ was an increase of 0.82 IQ points with a t value of 0.66, which does not allow rejection of the null hypothesis. Thus, in terms of Verbal IQ, a change cannot be demonstrated.

For the Performance IQ the mean difference of 4.42 additional points and t value of 3.35 indicate a change significant at the 1% level of confidence.

Thus the hypothesis that IQ will increase is accepted as it applies to Full Scale IQ and Performance IQ, but is not accepted as it applies to Verbal IQ.

It is interesting to compare these results with those of Gersted (5) referred to above, whose control group appears to have been comparable to the subjects of the present study. Using alternate forms of the Wechsler-Bellevue, he found no change in the mean IQ of the control group, and an increase in the experimental group, who participated in group therapy, of 2.80 IQ points.

TABLE I

SIGNIFICANCE OF DIFFERENCE BETWEEN  
FIRST TEST AND RETEST IQ SCORES

Scale	N	Mean Difference	<u>t</u>	P
Verbal IQ	38	0.82	0.66	n.s.
Performance IQ	38	4.42	3.35	1%
Full Scale IQ	38	2.37	2.24	5%

TABLE II

SIGNIFICANCE OF DIFFERENCE BETWEEN FIRST  
TEST AND RETEST SCALED SCORES  
(SUBTESTS)

Scale	N	Mean Difference	<u>t</u>	P
Information	38	-0.03	-0.12	n.s.
Comprehension	38	-0.03	-0.08	n.s.
Arithmetic	38	0.55	1.53	n.s.
Similarities	38	-0.13	-0.38	n.s.
Digit Span	37	0.24	0.62	n.s.
Picture Completion	38	-0.63	-1.75	n.s.
Picture Arrangement	38	0.82	1.46	n.s.
Block Design	38	0.89	2.87	1%
Object Assembly	36	0.81	1.80	n.s.
Coding	38	1.13	3.32	1%

Table II indicates the mean differences, t values, and significance of the obtained scaled score values. Only in two subtests are significant changes found, both of which tests are classified as performance tests. On the Block Design test, a mean difference of 0.89 of an additional scaled score point was obtained. The t value of 2.87 indicates a change significant at the 1% level of confidence. The mean difference on the Coding test was an increase of 1.13 scaled score points. Change significant at the 1% level of confidence is indicated by the t value of 3.32.

The obtained differences in IQ on all three of the IQ scales were increases, although as described above only the changes in Performance IQ and Full Scale IQ can be considered significant. Six of the ten subtests showed increases--the two indicated above being significant. Three Verbal subtests--Information, Comprehension, and Similarities--and one Performance subtest--Picture Completion--showed decreases; however, none of these changes were demonstrated to be significant.

The mean scores for both the first test and the retest are indicated in Table III for the three IQ scales and the ten subtests. The Performance IQ is higher than the Verbal IQ--a rather consistent finding in research dealing with delinquents (6, 16, 23, 26).

The level of intelligence is approximately as reported by other investigators--mean IQ's generally falling between the low eighties and the low nineties (2, 11, 16, 17).

For the subjects participating in this study the mean age at the time of retesting was fourteen years, nine months. The mean interval between the first test and the retest was six months, eight days. The mean period of exposure to

TABLE III  
MEAN SCORES ON FIRST TEST AND RETEST

Scale	First Test	Retest
Verbal IQ	83.08	83.89
Performance IQ	85.18	89.61
Full Scale IQ	82.74	85.11
Information	6.32	6.29
Comprehension	7.18	7.16
Arithmetic	7.00	7.55
Similarities	7.84	7.71
Digit Span	8.38	8.62
Picture Completion	9.63	9.00
Picture Arrangement	8.00	8.82
Block Design	6.87	7.76
Object Assembly	7.53	8.33
Coding	7.37	8.50

the training school was five months, twenty-two days.

In the light of Richardson's (16, P. 260) conclusion "that the delinquent is not so much deficient in intellectual ability as in the utilization of his ability in school tasks," and the fact that the subjects whose results are presented here participated in the academic program, it is surprising that none of the significant subtest changes were those that one might expect to be most closely related to school learning. The Information score cannot be considered to have changed. The Arithmetic increase of one-half scaled score point can be accepted only with a twenty per cent probability of error.

## CHAPTER V

### SUMMARY AND CONCLUSIONS

This thesis proposed to determine if IQ's of institutionalized juvenile delinquents change during the time at the training school. The hypothesis was as follows:

Delinquent boys will show an increase in IQ upon retesting after an exposure to the academic educational program of a correctional institution for at least four months.

To test the hypothesis, thirty-eight boys of the Illinois State Training School who had been tested prior to their institutionalization, were retested after a minimum of four months in the academic program. The subjects were limited to thirteen, fourteen, and fifteen year olds who were at the training school for their first time. The Wechsler Intelligence Scale for Children was used for measuring IQ's. Changes in IQ were defined as statistically significant (5% level of confidence) differences between mean IQ scores for the first test and the retest on the Full Scale, Verbal Scale, and Performance Scale of the WISC, as determined by t test. Mean differences between subtest scaled scores were evaluated by the same method.

The hypothesis was demonstrated with regard to the Full Scale IQ, which increased 2.37 IQ points, and may be considered significant at the five per cent level of confidence. The Performance IQ increased 4.42, significant at the one per cent level of confidence. The hypothesis cannot be accepted with regard to the Verbal IQ since the obtained increase did not approach sig-



nificance. Significant changes in subtest scores were limited to two of the ten subtests used. Both the Block Design and the Coding scores increased (0.89 and 1.13, respectively) and both were found significant at the one per cent level of confidence.

This investigation was designed as a pilot study to explore IQ change, during institutionalization, of delinquents. The results suggest that there is change in the direction of increase. It appears that certain of the subtests of the WISC are particularly sensitive to this change. The Block Design Scale and the Coding Scale showed increased scores which were statistically significant. The Arithmetic, Picture Arrangement, and Object Assembly Scales tended towards significance in the direction of increase, and Picture Completion in the direction of decrease.

The IQ change indicated here, although rather slight, would seem to have important implications relative to determining the changes that institutions effect in the juveniles committed to them for care, custody, and rehabilitation. If it can be demonstrated that these changes in test performance are in fact increases in the efficiency of intellectual functioning and not merely the result of a more cooperative attitude toward test taking, or of improved overall motivation to perform as expected, and further demonstrated that they are produced by participation in the training school program, this knowledge will be introduced in an area where the dearth of research has allowed much more speculation. Such knowledge should be of value in planning training school programs so as to maximize desired effects. Further research seems indicated by these results. Employing a larger sample would reduce the probability of error and might result in more definitive conclusions about the

roles of the subtests in measuring the change. A comparison of these results with like data on boys whose institutional time is spent in the vocational work program or in the forestry camps should demonstrate the relative effectiveness of these methods of attempting to rehabilitate delinquents insofar as IQ change is a criterion of rehabilitation.

Perhaps, in the future, research of the type discussed by Guilford (7, 8) will produce concepts of various specific kinds of intelligence which are more soundly based in theory and more clear in meaning than our present concept of "general intelligence." Tests based on such concepts would be expected to yield results more meaningful and specific than can be obtained with tests such as the Wechsler Intelligence Scale for Children.

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APPROVAL SHEET

The thesis submitted by Robert Allen Roe has been read and approved by three members of the Department of Psychology.

The thesis is therefore accepted in partial fulfillment of the requirements for the Degree of Master of Arts.

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Date

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