Durham E-Theses

The effect of practice and coaching on the performance in intelligence tests of boys selected for courses leading to G.C.E and for boys who just fail to be selected

C. G. Lister

<u>The Effect of Practice and Coaching on the Performance</u>

<u>in Intelligence Tests of Boys Selected for Courses Leading to</u>

<u>G.C.E. and of Boys who Just Fail to be so Selected.</u>

By C.G.Lister.

(Abstract of thesis submitted for the degree of M.Ed in Durham University.)

The object of the inquiry was to investigate the effects of unassisted practice, and of practice accompanied by coaching, on the scores made in two intelligence tests by boys who were selected for grammar schools or for a selective modern school in which some children take G.C.E. courses. The two tests were those used in the allocation examination of the boys concerned, and the same tests were repeated as final tests at the end of the experiment. The use of two tests was intended to minimise the effects of individual inconsistency.

170 boys effectively took part in the experiment and they formed three groups of approximately equal numbers and ability. The first group had three practice tests at weekly intervals before the final tests; the second group, in addition to working the same tests, had one hour of standardised coaching on each of the three practice tests in turn; the third group did normal school work during the three weeks preceding the final tests.

The scores in the two final tests, compared with those in the same two tests in the allocation examination showed a total mean gain of 11½ pts. of I. Q. in the practice group, 17½ pts. in the coached group, and 5½ pts. in the control group. Analysis of

variance showed all these gains, and the differences between them, to be highly significant. Clearly therefore, the most effective way of raising the mean score of boys in intelligence tests is by a combination of practice and coaching. After the third test there was a falling off in mean score in the practice group whereas gains continued up to the last test in the coached group.

The results suggest that practice effect may be inhibited to some extent when practice is under actual selection examination conditions. There is some evidence that the effects of coaching may be relatively short-lived.

Individual response to practice and coaching varied considerably and was greater in the coached group. The maximum gains in both groups tended to occur at (initial) I.Q. 120 - 125. It appears that younger boys may benefit more than older ones in the same age-group.

In so far as allocation is based on I.Qs. it has been shown that a programme of practice and coaching before selection would, for these boys, have affected the allocation of about 15 per cent of the grammar school places.

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Thesis Submitted for the Degree of M.Ed.

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C.G.Lister.

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Acknowledgements.

I wish to express my thanks to the Education Committee
which gave permission for the experiment to be carried out, to
its Officers for their advice in organising the testing and coaching
and for providing most of the tests required, and to their staffs
for their administrative help and guidance.

My thanks are also due to the Institute of Education of
Durham University for a grant which covered the cost of all the
tests which had to be bought.

I am also very grateful to the staffs and boys of those
schools which took part in the experiment. The investigation
depended entirely on the full co-operation which they gave.

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I have not referred by name to the Local Education Auth-
ority in whose schools the experiment took place because the E
Education Committee reserves its right to control publication
of any data relating to the children for whom it is responsible.

Section I.

The Purpose of the Experiment.

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Investigation has repeatedly shown that children with previous experience of intelligence tests or test material have an advantage, in the performance of such tests, over other children. Thus, where intelligence tests are used in the selection of children for secondary schools at 11-plus, some children may be selected by virtue of their greater test experience and at the expense of others with less experience or none at all. It is said that despite attempts to minimise it coaching is widespread and cannot be stopped. For this reason it has been suggested that all children should be coached before the 11-plus examination. Other authorities prefer unassisted practice as a means of levelling out the test-experience of the children.

Estimates have been made of the relative advantages of varying kinds and degrees of test-experience. These estimates are average figures, and since intellectual development and the ability to benefit from experience varies with the individual such general tendencies cannot be expected to apply to each child. In some inquiries it has been possible to show that improvement in scores is greater with bright children than with duller ones, but there is by no means unanimity on this point.

Gains in test scores, in whatever way they are produced, are most likely to affect the educational future of those children

who are at, or near, the selection borderline. Before the
procedures which have been advocated to reduce the effects of
possible inequalities of test-experience are put into practice
their effects on these children should be more clearly demon-
strated.

This inquiry was designed to determine such effects.

Section II.

Introduction - Previous Inquiries.

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It has been known, for almost as long as group intelligence tests have been in general use, that previous experience of test material affects the scores of the individuals being tested.

Dunlap and Snyder (1920) gave four parallel forms of the Army Alpha composite test to 44 American college seniors at intervals of approximately three weeks. They found that the mean score for the group showed a gain at the second test and a further gain at the third test. There was a fall back of the mean score at the fourth test. They concluded:

> "Obviously, if tests susceptible to practice tests are used, the only system which will be at all fair involves the condition that all candidates shall have old forms of the test in advance, and shall have the opportunity to practice on them."

Thorndyke (1922) reported the records of 39 11-year old children who took fifteen forms of the same test, one on each successive school day. From these records he showed that both for 'gifted' and 'ordinary' children the gain due to practice fell off rapidly from about the fourth trial but did not entirely vanish even in the last test.

Since the early twenties the effect of test-experience on scores has been the subject of several investigations and Vernon (1952) was able to survey over forty relevant researches. In these articles Vernon was concerned with the criticism that intelligence

tests in the 11-plus examination were susceptible to coaching and practice. Of the material which he reviewed he wrote:

"These unanimously show, (a) that the effects of practice on similar test material (where children are not told the right answers and simply learn from their own experience) are fairly small; (b) that the effects of systematic coaching are much more serious; (c) that, therefore, it is illegitimate to make any comparisons between the scores or I.Qs. of groups of children who have had different amounts of previous experience."

Among the conclusions which, he writes, 'are well substantiated by several experiments', the following were noted:

Practice.

1. The practice effect due to a single test is 4 or 5 I.Q. points, but may be only 3 points for children who are already familiar with tests.

2. Further practice produces further diminishing increases giving a maximum gain of about 10 I.Q. points after four or five tests.

3. Brighter children benefit more than duller children, with the maximum gains occurring near the selection borderline.

4. Different tests differ in their susceptibility to practice effects.

Coaching.

1. The gain due to coaching averages about 14 I.Q. points, but for bright 'unsophisticated' pupils it may reach 18 points, and for dull or more experienced children it may be as low as 9 points.

2. The total amount of coaching makes very little difference.

3. Teachers vary very little in their ability as coaches.

Watts, Pidgeon, and Yates (1952) criticised Vernon's conclusions in these words:

"Some forty researches have recently been reviewed by Professor Vernon. In these inquiries many different kinds of tests were used, the samples varied considerably in age, educational background and range of ability, and the experimental design of many of the earlier researches had defects that seriously limited the value of their findings. They may be said to have provided strongly suggestive

evidence of the effects of practice on test scores, but failed satisfactorily to demonstrate an additional distinguishable effect ascribable to systematic coaching."

Yates (1953) was

"concerned with the practical issue of what is likely to happen when 11-year old children in the maintained schools of England and Wales are coached or practised in preparation for the kind of tests which are nowadays employed by most education authorities."

He therefore discounts

"the results of experiments in which a handful of American undergraduates are coached in the Army Alpha test, for example, or in which an investigator tries to find out how large a gain can be brought about in the performance of a home-made test by coaching some specially selected group."

In view of these criticisms of Vernon's conclusions and of the material from which they were derived, a search was made of the literature published (see footnote) before Vernon's review, in so far as it is concerned with 11-year old children being tested in Moray House Intelligence Tests or similar tests.

Rodger (1936) obtained a mean gain of 8 pts. of I.Q. when 76 children aged 11-12 years took six Moray House tests at fortnightly intervals. Most of this gain was achieved by the third test. He found the average individual range over the six tests was 10 pts. with a maximum of 24 pts., and he found a slight tendency for brighter children to benefit more than the duller ones.

McRae (1942) used seven different tests (of three different kinds), at weekly intervals with children aged 10-12 years. The

Footnote: Vernon (1954, p. 270) had access to unpublished works and confidential reports.

group (about 25 children) which had practice in all seven tests showed a mean gain of 6 pts. when the initial test was repeated. McRae emphasised the inconsistency of individuals from one test to another but he found no difference between bright and dull pupils. From a second experiment with 48 children aged 9-12 years he concluded that the average gain was 2 pts. of I.Q. for each practice test. He found no difference between coaching and practice. He suggested that the first 'and probably the second' test of a series acts as a 'shockabsorber'.

McIntosh (1944) set the same test weekly for six weeks to 74 children aged 11-12 years. At the end the average gain was $10\frac{1}{2}$ pts of I.Q., $9\frac{1}{2}$ of which had been gained on the third retest. Initial levels of ability had no effect on gains. The average individual range over the six tests was about 12 pts., with a maximum of about 24 pts.

Peel (1951) examined the results from 7101 children aged 10-11 years and found an average gain of just over 3 pts. of I.Q. when one Moray House Intelligence Test followed another after an interval of about one month.

These rather sparse pre-1952 results from 11-year old children give lower gains than Vernon suggested for the effect of practice. The average gain from one practice test is evidently a good deal less than 5 pts., and, though repeated practice in the same test produced total average gains of about 10 pts., the mean total gain is only about 6 pts. when practice is in parallel versions. The differences between these figures and Vernon's may be due, as he suggests, to differing amounts of test-experience

previous to the experimental period. He quotes, in support of this explanation, the Scottish Research Council's finding of a rise of about 4 pts. of I.Q., between 1932 and 1947, in areas where group tests were familiar material, whereas the rise in places where they were little used was insignificant. (Vernon 1954 p. 60).

Before 1952 there was little published research on coaching 11-year old children in group intelligence tests. Johri (1939) produced appreciable gains after coaching and practice but because of the design of his experiments, which consisted of intensive practice and coaching and testing in particular types of test items, his results are not comparable with the sort of coaching which would be undertaken in schools.

In an experiment carried out by Watts in 1950 (Watts et al, 1952 p. 35), 35 children, in their first term at a secondary modern school, took a different Moray House Test each week for ten weeks and, in addition, had a coaching lesson from their own teachers between each pair of tests. This coached group showed a mean gain of 8.2 pts. of I.Q. at the end of the experiment as against a mean gain of 3.2 pts. produced by the 35 children of a control group who did normal school work between the first and last tests.

Thus there appears to be no evidence available from experiments with 11-year old children to support Vernon's claims. The published reports, both for coaching and practice, lead rather to the more conservative conclusions of Watts and his co-workers given on page 7.

Since 1952 further reports of inquiries have been published, and the remainder of this section will be devoted to a survey of these recent investigations.

Peel (1952) reported a total mean gain of about 4½ pts. of I.Q. when 1239 children aged 10 or 11 took three Moray House Intelligence Tests at monthly intervals. Nearly 4 pts. of this gain were achieved between the first two testings. He showed here, as he had done in his previous article (Peel 1951), that practice effect increases with initial level of intelligence with a maximum gain of about 9 pts. of I.Q. at about I.Q. 125, above which figure there is a falling off of gains. Later he reported, for 705 children, a practice effect of 6 pts. of I.Q. over an interval of two months between two parallel tests, and a gain of 3½ pts. when 1063 children were retested after an interval of six months. He concluded from these results that the effects of practice 'do not wear off rapidly, if indeed at all.' (Peel 1953).

Watts, Pidgeon, and Yates (1952) in their pilot study with 182 first-year secondary modern school children compared the effect of different amounts of coaching. N.F.E.R. Verbal Test 1 was used as the initial and final test. Coaching was carried out by Watts and Yates in 30-minute periods of which the children had six per week. There were three coaching groups with three, six, and nine hours of coaching lessons respectively. There were three corresponding control groups. The mean gain for all coaching groups was about 8½ pts of I.Q. whilst that for the control groups was just over 6 pts. They found that three hours of coaching produced much the same gains as nine hours but that six hours resulted in lower

gains than either of the other groups. The gains increased with initial ability of the individual but, it is pointed out, this effect and indeed the total gain was limited because the group was from secondary modern schools.

In the main experiment which followed, the same workers used 1214 primary school children about six months after they had worked the second of the two Moray House Tests which formed part of their selection examination. There were four experimental, and four control groups, each of about 150 children. Three of the experimental groups had, respectively, three, six and nine hours of coaching; the fourth group worked six Moray House Intelligence Tests between the initial and final tests which were common to all groups. The method of coaching was left to the teachers and the practice group was not informed of results.

As far as coaching was concerned the results broadly confirmed those of the pilot experiment. The coached groups showed gains of 5 to 6 pts. of I.Q. as against the control groups' $2\frac{1}{2}$ to 3 pts. The greatest gains were produced by three hours coaching, followed closely by nine hours, with six hours having considerably less effect. The gains increased with initial ability to a maximum at about I.Q. 120. The practice group showed a gain of about 6 pts. compared with $2\frac{1}{2}$ pts. for its control group. Nearly half of the total gain was achieved between the first and second tests. Analysis of the results showed the net gains due to practice to be significantly greater than the comparable figure for coaching. The effects of practice were distributed evenly among all levels of ability and were greater than the effects of coaching at all levels below I.Q. 125. It was found that boys responded better to coaching and

girls to practice and that there was considerable individual
variation. From a consideration of rank correlation between
matched groups they conclude that there are 'variations in
teachers' capacities to secure improved responses from their
pupils'.

Hammond (1953) reported the effects of giving practice tests
one week before each of the two selection tests taken by the 1600
11-year old children in Brighton in 1952/53. Each of the two
practice tests was marked by the teachers and then used as the
basis of coaching lessons in the week preceding the selection test.
From the first (practice) test to the last (selection) test the
mean gain was about 8 pts. of I.Q. The gains between the first
pair of tests were found only below the 75th percentile (about
I.Q. 110) whereas the gain between the second pair of tests
averaged about 5 pts. of I.Q. all through the range. She found
that there was great individual variation in scores from test to
test.

James (1953) found that the introduction of official
practice and coaching in Wiltshire was followed by an average
rise in I.Q. of about 4.3 pts. for boys and 5.5. pts. for girls.
The gains were fairly uniformly distributed throughout the scale.
The coaching and practice was from a booklet prepared by James which
offerred

>"all candidates three lessons and a practice test,
>and this limited amount of coaching was authorised in all
>primary schools.....during the month or so before the examin-
>ation."

In an investigation in Manchester in 1951, Wiseman and Wrigley (1953) used a published book of intelligence tests for coaching purposes. From 548 children of average age 9 years 9 months they formed three approximately equal groups - a practice group, a coaching group, and a control group. All were given an initial and a (different) final Moray House Intelligence Test. In the interval between these two tests the practice group worked six different Moray House Intelligence Tests at irregular but not less than weekly intervals; and the coaching group had one hour of coaching from the selected booklet on each occasion when the practice group worked a test. The mean gains were: practice group, 11 pts. of I.Q.; coaching group, $6\frac{1}{2}$ pts.; control group $4\frac{1}{2}$ pts. After the fourth and fifth tests the mean gains for the practice group were $8\frac{1}{2}$ and $9\frac{1}{2}$ pts. Gains due to practice increased with initial ability but the reverse was true for coaching gains - at I.Q. 115, 'a fairly typical pass mark', the net gain from practice was 12 pts. and from coaching $1\frac{1}{2}$ pts. of I.Q. A positive correlation between teaching efficiency (as rated by an observer) and coaching gains was obtained. Large variations of individual scores were noted in all three groups.

Experiments with coaching and practice in Southampton were reported by Dempster (1954). After classification procedure was complete in 1951, three groups were formed from the 11-plus age-group, each containing 112 girls and 116 boys. The practice group worked a new Moray House Test each week for eight weeks; the coaching group followed the same programme but had in addition, after the second test, one period of coaching each week. At the end of the period all three groups repeated the initial test.

The results showed coaching gains of 8.9 pts. for boys, and 9.8 pts. for girls; practice gains were 4.5 pts. (boys), and 5.5 pts. (girls); the gains made by the control group were 1.7 pts. (boys), and 2.4 pts. (girls). In the coaching group the mean gain increased up to the sixth test (i.e. after four hours of coaching) to 9.5 pts. (boys) and 9.0 pts. (girls). In the practice group the greatest gains were recorded at the fourth test; they were 5.6 pts. (boys) and 6.4 pts. (girls).

Dempster was able to show that coaching and practice on similar tests produced greater effects than coaching on different tests by getting the children in the above experiment to repeat, after the end of it, other verbal and non-verbal tests which had been part of the original classification examinations.

As a result of the 1951 experiment it was decided to introduce coaching into the Southampton classification procedure for 1952. Unassisted practice was ruled out because when combined with coaching it appeared to produce much larger gains. The practice and coaching was to be upon tests similar to those used for classification.

Accordingly in 1952 every child in the 11-plus age-group, a total of over a thousand children, worked a Moray House Intelligence Test which was marked and used in the schools as the basis for one period of coaching weekly for four weeks., At the end of this period a second test was set. The method of coaching was left to the teachers. The gains obtained were 4.3 pts. (boys) and 5.8 pts. (girls).

In 1953 the 1952 programme was changed to include another practice test in the middle of the four coaching periods and the total gains in that year were 7.7 pts. (boys) and 8.7 pts. (girls). Because these gains approached those obtained in the 1951 experiment it was decided to use a similar programme in 1954.

The Southampton results for 1954 and 1955, as given by Dempster in a personal communication to the present writer, were as follows. In 1954 the total gains were 8.2 pts. (boys) and 8.7 pts. (girls), and 7.3 and 7.8 pts. respectively of these gains were achieved between the first two tests and after only two periods of coaching. Consequently it was considered that such a limited programme might produce similar gains again, and in 1955 the children were set two Moray House Tests with two periods of coaching intervening. The resultant gains were 5 pts. of I.Q. for boys and 4 pts. for girls.

Donaldson, in her paper read to the Scottish Branch of the British Psychological Society in January 1954, gave an account of an experiment in which she set five Moray House Intelligence Tests to 101 boys of average age 10½ years. The boys were divided into two groups, one with a mean I.Q. of 123, and the other with mean I.Q. 108. Each of these two groups was further divided into two approximately equal groups, one of which, in each case, in addition to working the tests, had four hours coaching. She rotated the initial and final tests to eliminate differences due to standardisation. For the two groups of high initial I.Q. the mean gains from first to last test were 12.7 pts. from coaching plus practice, and 6.7 pts. from practice alone. For the two other groups the gains were 10.8 pts. for coaching plus practice and 7.5 pts.

for practice alone. There were large variations in individual scores, the variability being greater in the coached groups.

The results of these recent researches may be summarised as follows:

<u>Practice.</u>   1. Gains from a single practice are reported by Peel as 3.16; 3.5; 3.85; and 6.2 pts. on different occasions. Wiseman and Wrigley's Manchester control group gained $4\frac{1}{2}$ pts.; Dempster's 1951 Southampton control group gained about 2 pts.; Watts and his co-workers found gains of $2\frac{1}{2}$ to 3 pts. in their control groups. Dempster's and Watts' groups were composed of children with some previous experience of tests; the Manchester children were a good deal younger and less 'sophisticated'.

2. The maximum gain was 11 pts. of I.Q., obtained by the Manchester group after seven practice tests, and most of this gain was achieved on the fourth test. Dempster found that maximum gains were achieved after four tests and these were 5.6 pts (boys) and 6.4. pts (girls). Again the different experience of the two groups must be taken into account.

3. Peel shewed that practice effect does increase with initial ability up to about I.Q. 120. Wiseman and Wrigley confirmed this, their greatest gain being 12.5 pts. at about that I.Q. The National Foundation workers found a similar but less well marked effect in their 'London' experiment.

4. The 1951 Southampton experiment confirmed that the

most effective practice is that which is given in parallel versions.

Coaching. 1. Apart from Donaldson's two high-ability groups,

which had gains of 12.7 and 10.8 pts., the greatest gains

obtained after coaching were those of about $9\frac{1}{2}$ pts.

reported by Dempster from the 1951 experiment, and Hammond's

8 pts. in Brighton. Both of these gains resulted from a

combination of coaching with timed practice - in Southampton

eight tests were worked as practice, in Brighton only three.

2. The gains produced by coaching after a single practice

(or initial) test were much less. Wiseman and Wrigley's

coaching group gained 6.3 pts.; Dempster obtained over 7 pts.

in 1954, and about 5 pts. in 1952 and 1955; Watts' 'London'

experiment produced 5 to 6 pts. rise; and James reported a

gain of about 5 pts.

3. Watts et al found that coaching benefitted the more-

able to a greater extent than the less-able children up to

about I.Q. 125. Donaldson's figures support this. James and

Hammond found fairly even distribution of gains. Wiseman

and Wrigley found that when coaching was from a published

booklet gains decreased with initial ability and at I.Q.

120 the gain was zero.

4. The National Foundation workers found the most

effective amount to be three hours. Dempster's figures

for 1951 showed maximum gains after four hours of coaching

(and five practice tests).

5. Watts, and Wiseman and Wrigley, are agreed that teachers

vary in their abilities as coaches.

6. Dempster's results in 1951 showed that coaching is most effective when it is based on tests similar to the final test.

It will be seen from the above summary that, for groups of normal ability, the highest claims for unassisted practice exceed those for any sort of coaching. At the same time it has been shown that comparisons of the gains obtained by different workers are difficult because of the differing age and experience of the children tested, because of the lack of control groups in some cases, and the different meanings attached to the word 'coaching'.

On the whole we may say that, as far as practice is concerned, Vernon's conclusions have been confirmed by subsequent research. The gains seem to be lower today than they were just a few years ago, and Vernon's explanation of these lower gains as being due to greater test-sophistication is supported by Dempster's figures for the mean I.Qs. of the whole 11-plus age-groups in recent years:

Southampton 11-plus		1952	1953	1954	1955
Initial Test (Mean I.Q.)	Boys	101.5	102.2	103.5	104
	Girls	103.8	104.5	104.6	106

Today the effect of a single practice test seems to average 3 or 4 pts. of I.Q. and this gain appears to be about doubled by further practice which reaches an effective maximum at about the fourth testing.

Vernon's conclusions as to the effects to be expected from coaching (with practice), however, seem to require more drastic

revision as follows:

(a) His claim for average gains seems to be about 6 pts.
too high. Recently reported gains are of the order of 8 or 9 pts.
for coaching combined with practice. The gains produced by coaching
alone without any timed practice are very little greater than
those which would be produced in any case by the initial test
practice effect.

(b) It has been established that 3 or 4 hours is the most
effective coaching time. Navathe's gain of 11 pts. after only
one hour's coaching (Vernon 1953) has not been equalled.

(c) It has also been established that teachers vary in their
ability to coach their pupils and Yates (1953) provides evidence
that they improve in this task with practice! The relatively high
gains in 1953 and 1954 in Southampton from a relatively limited
programme may be due to this effect.

In his most recent paper Vernon (1954 b) has revised his
earlier opinions but he still seems somewhat reluctant to abandon
the higher figures. He wrote:

> "In most areas, nowadays, we can expect rises averaging
> 8-9 units from 'apt' practice and coaching......this
> implies that some 17 percent of children will show gains
> of 14 units and over."

"A few hours only produce the maximum achievable effect."

He 'does not deny' that teachers may differ in ability as
coaches and he aggrees that small-scale experiments yield larger
rises than wider investigations in which many teachers undertake
coaching.

Taken as a whole the evidence suggests that, at the present time,

1. the mean score of an 11-plus age-group will be increased by 3 or 4 pts. of I.Q. as the result of a single practice test;

2. this gain may be increased

    (a) to about 5 pts. by about three hours' coaching without further practice,

or (b) to about 6 or 7 pts. by two or three additional practice tests,

or (c) to about 9 pts. by additional practice together with coaching.

3. there are great individual variations in response to both coaching and practice.

There is conflicting evidence on the relation between initial ability and 'improvability', and on the relative response of boys and girls to coaching and practice.

On the question of official coaching Vernon (1954 b) believes that "familiarisation is positively desirable in that it reduces children's fears" and that, in consequence, reliability and validity are improved. (Dempster, in his 1951 experiment, found that validity was improved after coaching and practice). To correct those injustices likely to occur because of individual variation and differences in previous test-experience Vernon (1954 a) suggests a programme of two practice tests and three hours' coaching.

In Southampton intelligence tests are no longer used as part of the classification procedure but Dempster (1956) writes:

"I think if we had gone on with the tests in 1956,
we should have put back the three tests with two coaching
periods in between."

The National Foundation workers believe that official practice
by itself would be enough to offset the effects of unofficial
coaching and they regard official coaching as unnecessary and
undesirable. Wiseman (1954) is of the same opinion and suggests
three practice tests, with children marking their own work, as
the best way to swamp the effects of unofficial coaching.

Section III.

Design of the Experiment.

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Except for Donaldson's inquiry all the published works on the effects of test-experience on 11-year old children have been on complete age-groups or on more or less representative samples therefrom. The purpose of this inquiry was to determine the relative effects of unassisted practice and practice accompanied by coaching on the children most likely to be affected by a planned programme of test-experience as a preliminary to selection for secondaty schools, that is to say those children near or above the selection borderline.

A local education authority, whose preselection procedure was under revision, was interested in this project and, through its officers, gave the fullest co-operation.

The first part of this authority's allocation examination for 1954-55 consisted of Moray House Tests in English, Arithmetic, and 'Intelligence' (MHT 52), and these were taken in early December 1954 by about 3000 children who comprised the 11-plus age-group. The second part of the examination was taken in early March by those children in the top third of the order of merit drawn up from the results of the December tests. This second part included another Moray House Intelligence Test (MHT 51). The standardised scores from the two intelligence tests together made up one third of the total allocation score for each child.

Because of the difference reported by some workers in the
responses of boys and girls to coaching and practice it was decided
to confine the experiment to boys. There were, in 1955, under the
authority concerned, about 150 grammar school places for boys
and about 80 places in a selective secondary modern school which
has courses leading to the General Certificate of Education. There
were 1426 boys in the 11-plus age-group in 1955. In the allocation
of boys to secondary schools there were, therefore, two borderline
groups; one at about the 10% level and the other at about the 15%
level.

It was planned to include in the investigation all the boys
who were included in or placed above the lower borderline group.
From these were to be formed two experimental groups, one to be
given unassisted practice in tests similar to those used in selection,
and the other coaching, in addition to a similar amount of practice.
The adoption of Wiseman's suggestion of letting the children in the
practice group mark their own work was considered, but rejected as
it was felt that it would be likely to lead to discussion in the
classroom which might develop into something very like coaching.

It was decided to treat the two intelligence tests used in
the allocation examinations as the initial tests for the experiment
and, to avoid error due to differing standardisation of tests, to
set the same two tests as final tests at the end of the experiment.
This made the use of a control group an essential addition to the
two proposed experimental groups. The use of two tests as initial
and final criteria was intended to minimise the effect of the
wide variation in individual scores between tests which has so

frequently been recorded.

The possibilty of getting all the boys concerned together in one place for testing and coaching under standard conditions was considered but, in the face of administrative and legal difficulties, was rejected. The education authority/agreed that testing and coaching should take place in the schools to which the boys belonged.

It was decided that the use of 'matched' groups was precluded by the disorganisation it would cause in the schools, since many of those schools concerned would, if this method were adopted, have boys in each of the three groups. It was therefore decided to form three groups by schools in such a way as to give, as nearly as possible, an equal number of boys with the same average I.Q. and range of I.Qs. in each group. This was done except that those schools were omitted which had (literally) only one or two boys above the lower borderline limit. These schools were omitted because it was intended to use a standardised method of coaching in the schools and this would have been inapplicable to these very small numbers.

The three groups, as originally planned, each contained boys from six different schools. The first group had 73 boys of mean I.Q. 119.1; the second had 74 boys of mean I.Q. 116.2; and the third contained 76 boys of mean I.Q. 119.4. Tests showed that the three groups could be treated as random samples.

Before the first part of the authority's allocation examination all the children had worked three short practice tests each of twenty minutes' duration. It was thought that, after this practice, together with that afforded by the two selection tests,

a programme of three practice tests plus, in the coaching group, three periods of coaching would show effectively any further attainable gains.

The procedure which was followed by the groups was as follows:

Group 1. (Practice Group). Three different Moray House Tests were worked at weekly intervals. The tests were collected and marked. No results were made known to the schools concerned.

Group 2. (Coaching Group). This group worked the same practice tests at the same times as Group 1. The tests were collected and marked and then returned (together with an answer key) to the schools and were used as the basis of one hour's coaching which took place on the day before the next test. In order to minimise as far as possible any differences t there may be between teachers as coaches a standardised method of coaching was drawn up for each of the three tests (see Appendix I).

Group 3. (Control Group). This group followed normal timetable during the three weeks in which practice and coaching took place.

All three groups were retested in the two initial tests in the two weeks following the end of the practice period.

It was considered desirable to allow some weeks to elapse after the competitive allocation tests in March before the experimental period began. The timetable was therefore arranged as follows:

		Group 1	Group 2	Group 3
17 June,	MHT 48.	✓	✓	
23 June,	1 hour's coaching on MHT 48.		✓	
24 June,	MHT 49.	✓	✓	
30 June,	1 hour's coaching on MHT 49.		✓	
1 July,	MHT 50.	✓	✓	
7 July,	1 hour's coaching on MHT 50.		✓	
8 July,	MHT 52.	✓	✓	✓
15 July,	MHT 51.	✓	✓	✓

Teachers were asked to tell the boys that the object of the exercise was to find out just how well they could do in intelligence tests after some practice, and before the two final tests, to ask them to do their best in those tests. Teachers were also asked to report any signs of boredom in the boys.

Section IV.

Experimental Results.

o.

Note:

1. Full details of I.Qs. for all tests are given in Appendix II.

2. All scores are given as I.Qs. and all gains as points of I.Q.

3. In this and following sections the tests used may be referred
to by number as follows:

T1.	MHT 52.	7 Dec 1954.	} Initial Tests.
T2.	MHT 51.	8 Mar 1955.	}
T3.	MHT 48.	17 Jun 1955.	)
T4.	MHT 49.	24 Jun 1955.	} Practice Tests.
T5.	MHT 50.	1 Jul 1955.	)
T6.	MHT 52.	8 Jul 1955.	} Final Tests.
T7.	MHT 51.	15 Jul 1955.	}

4. In response to the inquiry made only one boy was reported as
being bored by the proceedings; he was in Group 1, Index No.
141.

Section IV.

Experimental Results.

(I) Composition of the Groups: Initial and Final Scores.

In each group the final number of boys whose results could be subjected to analysis was much smaller than had been planned. The numbers in the two experimental groups were reduced as a result of boys being absent from one or more of the tests or coaching periods; one school withdrew completely from the control group. The effective composition of the groups with the results of the two initial tests is given in Table I.

Table I.

Composition of Groups and Results of Initial Tests

	No.	Mean "Age".	T1		T2		Initial IQ Total	
			Mean IQ	SD	Mean IQ	SD	Mean	SD
Group 1 (Practice)	56	11.3	119.0	8.8	120.9	8.2	239.9	16.6
Group 2 (Coaching)	56	11.3	115.7	7.6	118.5	7.0	234.2	13.2
Group 3 (Control)	58	11.4	120.2	9.2	119.8	8.0	240.0	16.6

The differences between the means of the three definitive groups in the first test (T1) were greater than those of the original groups. Testing showed that the differences were now significant, so that the groups cannot be regarded as 'random'.

The scores obtained at the end of the experiment when all groups were retested are given in Table II.

Table II.

Results of Final Tests.

	T6		T7		Final IQ Total	
	Mean IQ	SD	Mean LQ	SD	Mean	SD
Group 1 (Practice)	125.3	6.5	126.1	7.7	251.4	13.1
Group 2 (Coaching)	125.7	6.7	126.0	6.0	251.7	10.8
Group 3 (Control)	122.9	7.8	122.5	9.3	245.4	16.4

Tests were made of the significance of the differences between the standard deviations of the groups in each of the initial and final tests and only in the last test (T7) was there a significant difference - that between Groups 2 and 3. With this exception we may say that there is homogeneity of variance between the groups. This homogeneity extends to the initial and final 'IQ Totals'.

(II) Increases in Mean Scores.

The gains achieved by each group are given in Table III.

Table III.

Mean Gains from Initial to Final Tests.

	MHT 52 (T6 - T1)	MHT 51 (T7 - T2)	Total Gains
Group 1 (Practice)	6.3	5.2	11.5
Group 2 (Coaching)	10.0	7.5	17.5
Group 3 (Control)	2.7	2.7	5.4

As a preliminary measure these gains were tested for significance using the 't-ratio'. The results of this testing are summarised in Table IV.

Table IV

't-ratios' for Differences between Initial and Final Mean Scores.

Group	T6 - T1			T7 - T2			IQ Totals		
	1	2	3	1	2	3	1	2	3
M_1-M_2	6.3	10.0	2.7	5.2	7.5	2.7	11.5	17.5	5.4
$r_{T_1 T_2}$	.66	.57	.74	.63	.43	.79	.74	.69	.80
σ_D	.89	.78	.76	.92	.92	.77	1.49	1.30	1.34
t	7.1	12.8	3.6	5.7	8.1	3.5	7.7	13.5	4.0

Since the t-ratio for 60 degrees of freedom at P = .001
is.3.46, all the gains are highly significant.

This established, the next step was to assess the mean gains
of the different groups in relation to one another. From the gains
given in Table III 'net' gains attributable to practice alone, to
practice combined with coaching, and to coaching on top of practice
were derived and are given in the following table.

Table V

'Net' Gains Attributable to Practice and Coaching.

Factor	MHT 52	MHT 51	Total Scores
Practice alone	3.6	2.5	6.1
Practice plus Coaching	7.3	4.8	12.1
Coaching (on top of Practice)	3.7	2.3	6.0

To determine the significance of these 'net' gains, since
it has been shown that the groups cannot with confidence be treated
as random, it was first necessary to test for homogeneity of variance
of gains between the groups in each test and in the total scores.
It was found that the standard deviations of the gains made by the

groups were not significantly different in any of the three sets of scores. These SDs are shown in Table XXI on page 44.

Analysis of variance was then applied to the gains (differences of scores) in the three groups. This was done for the two individual tests and for the combined scores. The F-ratios obtained were all significant at the 0.1% level of confidence. The differences between the mean gains of each group (i.e. the net mean gains) were then tested for significance using 't'. The results are given in the next table.

Table VI

Significance of 'Net' Mean Gains - Analysis of Variance.

	MHT 52		MHT 51		Total Scores	
	Mean Gain	P =	Mean Gain	P =	Mean Gain	P =
Practice alone	3.6	.01	2.5	.05	6.1	.001
Practice plus Coaching	7.3	.001	4.8	.001	12.1	.001
Coaching (above Practice)	3.7	.01	2.3	>.05	6.0	.001

(The gain of 2.3 pts for Coaching in MHT 51 falls short by only
0.05 pts of the figure necessary for significance at P - .05)

Thus, apart from the gains from practice alone and coaching (above practice) in MHT 51, all the gains are highly significant. The two gains mentioned may be described as of moderate significance but it will be noted that they contribute to the very highly significant gains found when the total scores are compared.

(III) <u>The Effect of Practice on Mean Scores.</u>

(a) <u>Group 1 (Practice Group)</u>

The mean IQs for Group 1 in successive tests were as shown in Table VII.

Table VII.

Group 1; Mean Scores in All Tests.

	Initial Tests		Practice Tests			Final Tests	
	T1	T2	T3	T4	T5	T6	T7
Mean I.Q.	119.0	120.9	125.4	125.0	123.1	125.3	126.1
S.D.	8.8	8.2	7.3.	6.8	8.5	6.5	7.7

The correlation between each successive pair of tests was calculated and the significance of the differences between the means of successive tests was then determined by using 't'.

Table VIII

Group 1: Significance of Mean Differences between Successive Tests.

	T2-T1	T3-T2	T4-T3	T5-T4	T6-T5	T7-T6
D_M	1.9	4.5	-0.4	-1.9	2.2	0.8
r	.70	.67	.67	.77	.55	.52
P =	.05	.01	nil	.01	.05	nil

The net gain of 0.7 pts made between T3 and T7 is not significant.

(b) <u>Group 2 (Coaching Group)</u>

Coaching did not begin until after the third test in this group. Table IX shows the mean IQs obtained by this group in the first three tests and Table $\overline{x}$shows the significance of the gains achieved between tests.

Table IX.

Group 2: Mean Scores in the First Three Tests.

	T1	T2	T3
Mean I.Q.	115.7	118.5	123.6
S.D.	7.6	7.0	6.7

Table X

Group 2: Significance of the Mean Differences between Three Tests.

	T2-T1	T3-T2
D_M	2.8	5.1
r	.62	.57
P =	.01	.01

(c) Group 3 (Control Group)

The average IQs for this group in the initial and final tests, the correlation between successive tests, and the significance of the differences between the means, are given in the next two tables.

Table XI.

Group 3: Mean Scores in Initial and Final Tests.

	Initial Tests		Final Tests	
	T1	T2	T6	T7
Mean I.Q.	120.2	119.8	122.9	122.5
S.D.	9.2	8.0	7.8	9.3

Table XII.

Group 3: Significance of the Mean Differences between Successive Tests.

	T2-T1	T6-T2	T7-T6
D_M	-0.4	3.1	-0.4
r	.76	.63	.73
P=	nil	.01	nil

From the preceding tables it can be seen that the practice effect of the first test was small. It produced a mean gains of 1.9 and 2.8 pts. in the experimental groups, and a mean loss of 0.4 pts. in the Control Group. The practice effect of the second test was greater, resulting in gains of 4.5 and 5.1 pts. in Groups 1 and 2. The practice effect of the initial tests was thus a mean gain of about 7 pts. of I.Q.. Practice continued beyond this stage in Group 1 resulted in a falling off of scores. The drop in mean I.Q. between the fourth and fifth tests was significant statistically, but this was reversed in the next test which was the first of the final tests. In the last test the mean I.Q. reached its highest value but the improvement of 0.7 pts. over the mean I.Q. for the third test was not significant.

In the control group the only significant gain was achieved on the third testing but it is not comparable with the gains in the other groups because the test was a different one.

In all three groups it was noted that there is a general tendency for standard deviations and correlations between tests to decrease when the mean I.Q. rises.

(IV) <u>The Effect of Practice combined with Coaching on Mean Scores.</u>

The average I.Qs. obtained by the Coaching Group in successive tests were as follows.

Table XIII

Group 2: Mean Scores in All Tests.

	Initial Tests		Practice Tests			Final Tests	
	T1	T2	T3	T4	T5	T6	T7
Mean I.Q.	115.7	118.5	123.6	124.8	125.7	125.7	126.0
S.D.	7.6	7.0	6.7	6.5	6.9	6.7	6.1

Table XIV gives the results of analysis of the above data.

Table XIV.

Group 2: Significance of Mean Differences between Successive Tests.

	T2-T1	T3-T2	T4-T3	T5-T4	T6-T5	T7-T6
D_M	2.8	5.1	1.2	0.9	nil	0.3
r	.62	.57	.66	.68	.50	.45
P=	.01	.01	nil	nil	nil	nil

Thus, in this Group, there was no significant gain between any two successive tests after coaching began. Of the total mean gain of 10.3 pts. made from first to last testing, 7.9 pts. were made before the first coaching lesson (which followed T3). However, the gain of 2.4 pts. achieved between the third test and the last test is significant at the 1% level.

It was again noted that standard deviations and correlations between tests were lower at the end of the experiment than they were at the beginning.

(V) The Effect of Practice and Coaching at Different Levels of Ability.

(a) Within Groups in Consecutive Tests.

The general tendency already noted for the standard deviations of the scores for each group to decrease with increase of mean I.Q. indicated that unequal gains were being made at different levels of I.Q. Following the method of 'equivalent levels' used by Peel (1952) the scores at eight percentile levels were calculated for each group in each test. From these scores (given in Appendix III) the gains at these equivalent levels were determined. In the following tables these gains are given as cumulative gains in points of I.Q., each being calculated from the equivalent percentile level in the first test.

Table XV

Group 1 (Practice): Gains at Different Levels of Initial Ability.

%ile	T1(IQ)	T2-T1	T3-T1	T4-T1	T5-T1	T6-T1	T7-T1
95	135.8	-0.9	nil	nil	2.4	1.9	2.4
87.5	129.8	2.1	3.9	3.9	4.5	4.6	5.3
75	124.8	2.1	5.7	5.7	4.3	4.5	7.8
62.5	120.2	1.7	8.3	7.4	6.4	6.6	9.7
50	118.0	1.0	8.4	6.9	4.2	6.5	7.5
37.5	115.8	0.4	7.7	8.3	2.9	7.0	6.5
25	112.2	1.9	7.7	8.3	4.0	8.8	7.1
12.5	108.3	2.7	7.9	8.7	4.4	9.1	8.0
Mean	119.0	1.9	6.4	6.0	4.1	6.3	7.1

DIAGRAM 1.

GROUP 1: Effect of Practice at Different Levels.
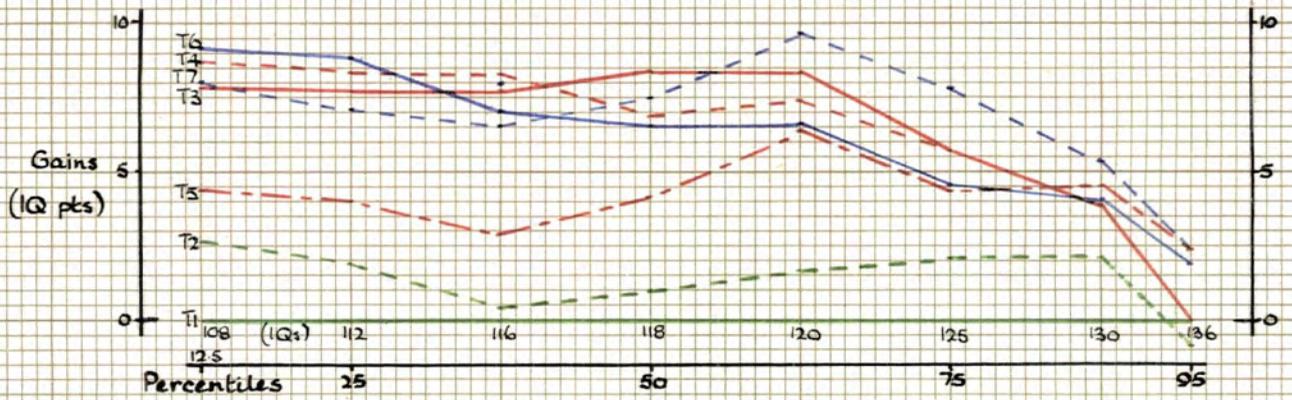
DIAGRAM 2.

GROUP 2: Effect of Practice and Coaching at Different Levels.
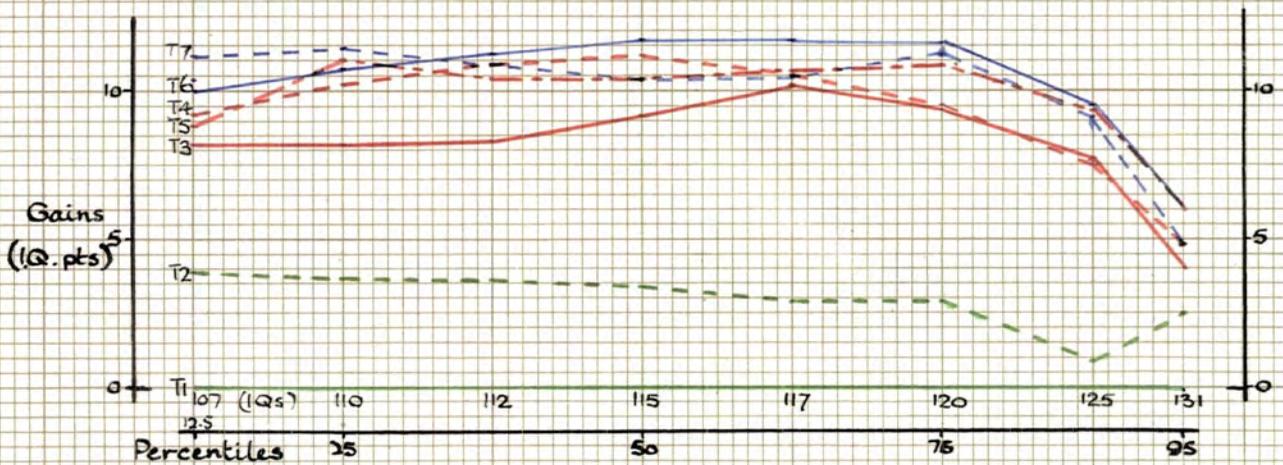
Table XVI

Group 2 (Coaching): Gains at Different Levels of Initial Ability.

%ile	T1(IQ)	T2-T1	T3-T1	T4-T1	T5-T1	T6-T1	T7-T1
95	131.0	2.5	4.0	4.8	6.0	6.0	4.8
87.5	124.7	0.8	7.7	7.5	9.3	9.5	9.1
75	119.7	2.9	9.4	9.5	10.8	11.6	11.2
62.5	117.0	2.9	10.2	10.5	10.6	11.7	10.5
50	114.5	3.4	9.2	11.2	10.4	11.7	10.4
37.5	112.2	3.6	8.3	10.8	10.4	11.2	10.8
25	109.8	3.7	8.2	10.2	11.0	10.7	11.4
12.5	107.3	3.9	8.2	9.2	8.9	10.0	11.2
Mean	115.7	2.8	7.9	9.1	10.0	10.0	10.3

The gains at equivalent levels, from test to test are
illustrated graphically in the diagrams facing this page.(Diags 1 & 2)

From a comparison of these two diagrams it seems that the
practice effect due to the first test (which is shown by the
graphs for T2) is a gain of two or three points fairly evenly
spread throughout the range of I.Qs. under consideration. It also
appears that the practice effect due to the first two tests (shown
by the full red lines for T3) is a gain of about eight points
over the lower half of the range of I.Qs. and affecting about
75% of the boys; there is a maximum value averaging about nine
points at about (initial) I.Q. 118, and above that region there
is a fairly rapid falling off of gains. The very close similarity
between the graphs for T3 gains in the two groups is striking.

A comparison of the graphs for tests subsequent to T3 shows clearly that the effect of the coaching programme,which followed T3 for Group 2, was a maintenance or slight improvement of previously attained gains throughout the whole range of ability; whilst continued practice alone, in Group 1, resulted in a falling off of scores,in one or more of the tests,at all levels except the very top of the range.

(b) <u>In the Final Tests.</u>

The gains made at different levels between initial and final testing in each of the Moray House Tests so used were calculated from the data given in Appendix III, and are given in the following tables.

Table XVII.

Gains at Different Levels on Retesting in MHT 52. (All Groups).

%ile	Group 1		Group 2		Group 3	
	Initial IQ	Gain	Initial IQ	Gain	Initial IQ	Gain
95	135.8	1.9	131.0	6.0	137.6	-1.9
87.5	129.8	4.0	124.7	9.5	130.7	1.8
75	124.8	4.5	119.7	11.6	125.9	3.0
62.5	120.2	6.6	117.0	11.7	122.9	2.4
50	118.0	6.5	114.5	11.7	120.1	2.9
37.5	115.8	7.0	112.2	11.2	117.1	3.6
25	112.2	8.8	1o9.8	10.7	113.6	3.3
12.5	108.3	9.1	107.3	10.0	109.0	4.1
Mean	119.0	6.3	115.7	10.0	120.2	2.7

DIAGRAM 3.

M.H.T. 52 : Gains at Different Levels on Retest.
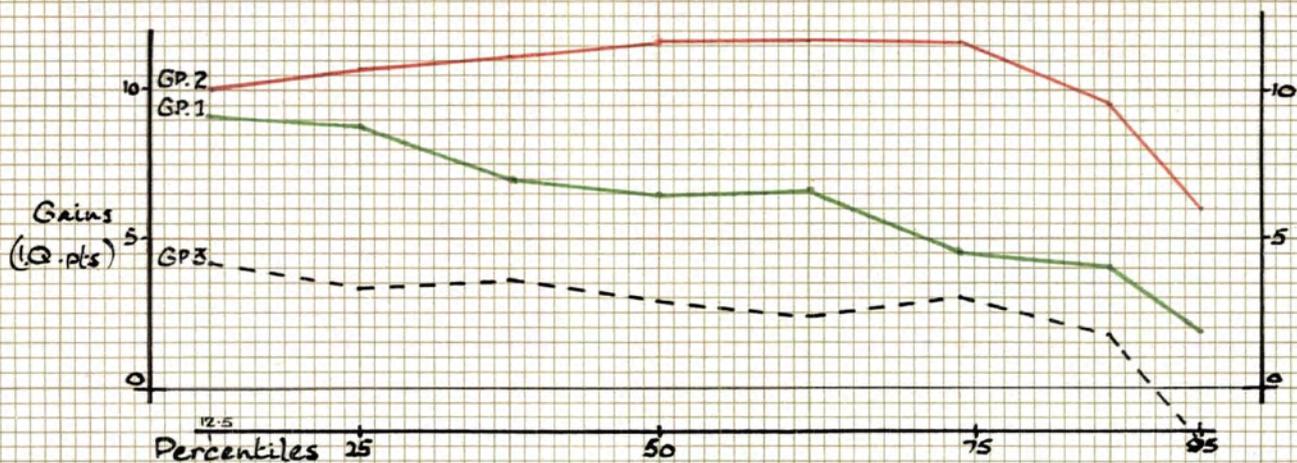
DIAGRAM 4.

M.H.T. 51 : Gains at Different Levels on Retest.
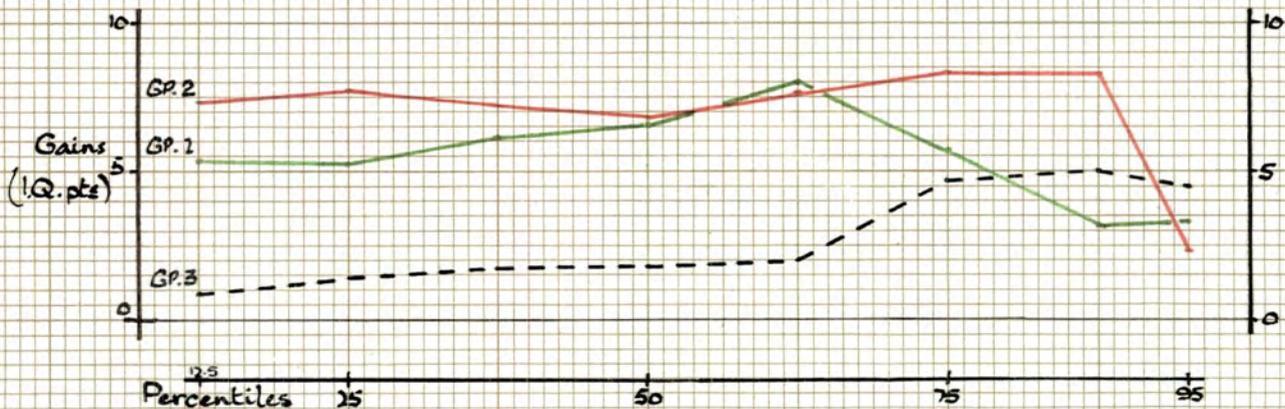
Table XVIII.

Gains at Different Levels on Retesting in MHT 51. (All Groups).

%ile	Group 1		Group 2		Group 3	
	Initial IQ	Gain	Initial IQ	Gain	Initial IQ	Gain
95	134.9	3.3	133.5	2.3	133.9	4.5
87.5	131.9	3.2	125.5	8.3	130.3	5.0
75	126.9	5.7	122.6	8.3	125.3	4.7
62.5	121.9	8.0	119.9	7.6	122.3	2.0
50	119.0	6.5	117.9	6.8	119.2	1.8
37.5	116.2	6.1	115.8	7.2	116.2	1.7
25	114.1	5.2	113.5	7.7	113.4	1.4
12.5	111.0	5.3	111.2	7.3	110.6	0.9
Mean	120.9	5.2	118.5	7.5	119.8	2.7

The gains shown in these two tables are illustrated graphically in Diagrams 3 and 4.

In both of the above tables, and in the accompanying diagrams, data for Group 3 are included for the sake of completeness. It must be noted, however, that in neither test does this group entirely fulfil the function of a control, in that one other testing took place between test and retest in each case.

Since the Group 3 figures cannot be critically regarded in this context the units of the horizontal axes in the diagrams remain percentiles as in the previous graphs. This is permissible because, on the evidence of either of the initial tests, when Group 3 is excluded, the other two may be treated as random.

In these graphs percentiles were preferred as abscissa

DIAGRAM 5.

Total Gains at Different Levels.
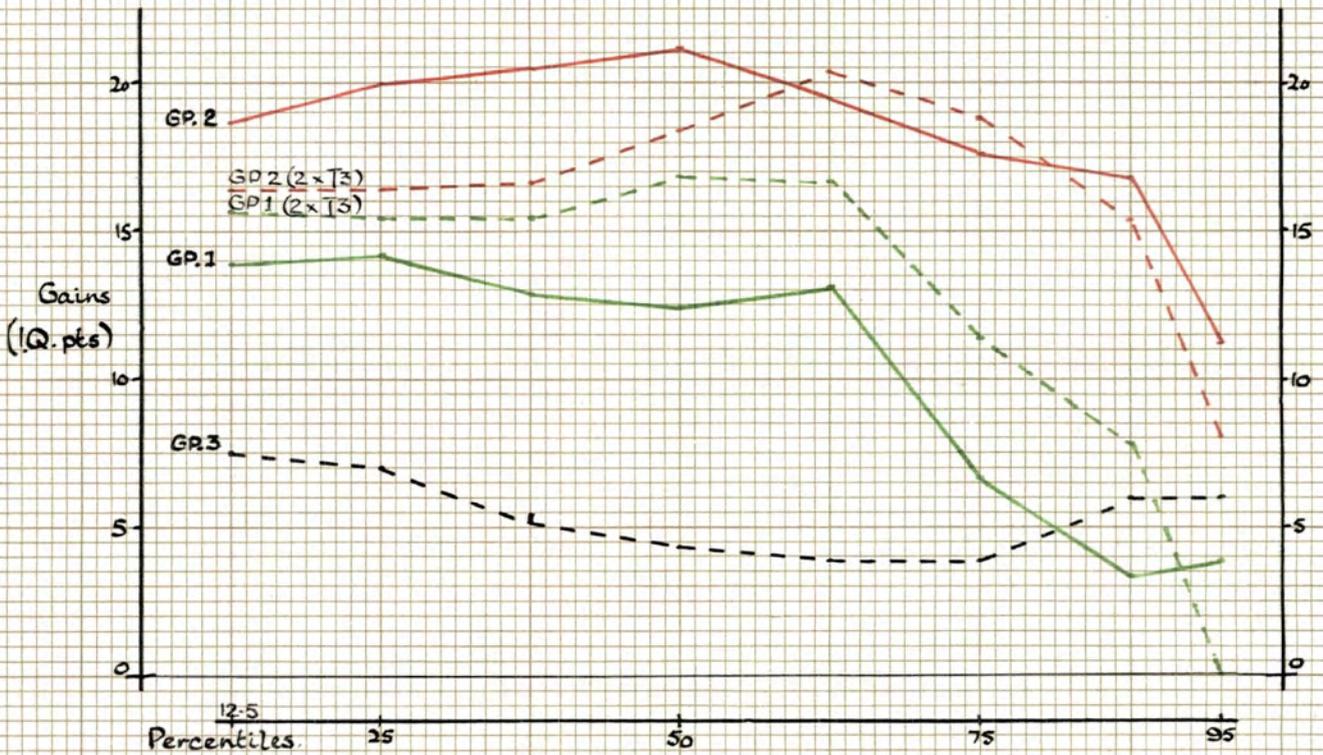
units, rather than I.Qs., because the proportion of boys showing particular gains may more easily be inferred when the former are used.

A comparison of Diagrams 3 and 4 suggests that the effects of coaching may be ephemeral. The boys who made up Group 2 had their third and last coaching lesson the day before they were retested in MHT 52, and the gains there achieved were very substantially higher than those in Group 1. Retest in MHT 51 followed a week later and the gains made in Group 2, in comparison with those achieved in Group 1, were much reduced.

Diagram 5 shows the total gains made in the two tests at different levels of average initial I.Q., which was (calculated from the total scores from T1 and T2 for each individual). The data for these graphs are given in Appendix IV. The red and green dotted lines represent the gains achieved at the third test by the experimental groups; these gains have been doubled to facilitate comparison. This diagram further illustrates the superiority of coaching with practice over practice alone as a means of improving test scores at all the levels of ability under consideration.

(VI) The Effect of Age on Improvement of Score.

At the end of the experiment the ages of the boys ranged from 10 years 10 months to 11 years 10 months. The average total gains, made between the combined initial tests and the combined final tests, were calculated for those above and those below the average age in each group with the results which are given in Table XIX.

Table XIX.

Comparison of the Gains made by Younger and Older Boys.

Group		Age Range		Totals
		10.10 - 11.3	11.4 - 11.10	
1	No. of boys	34	22	56
	Sum of Gains	431	214	644
	Mean Gain	12.7	9.7	11.5
2	No. of boys	25	31	56
	Sum of Gains	471	513	984
	Mean Gain	18.8	16.6	17.5
3	No. of boys	27	31	58
	Sum of Gains	162	153	315
	Mean Gain	6.0	4.9	5.4

Thus in all groups the younger boys showed greater average gains than the older ones. The differences are not significant statistically at the 10% level.

(VII) <u>The Effects of Practice and Coaching on Individual Performance</u>.

(a) <u>Individual Attainment of Maximum Score</u>.

The stages at which individuals first reached their maximum score are shown in Table XX, on the next page.

Table XX.

Individuals Reaching their Maximum I.Q. at Each Test.

Group	T1	T2	T3	T4	T5	T6	T7
1	2	4	14	6	7	13	10
2	1	1	7	10	15	10	12
3	3	10	-	-	-	18	17

These figures show that the amount of test-experience necessary for the attainment of maximum score varies considerably from boy to boy. They also clearly show that improvement of scores continues for longer when coaching is allied to practice.

(b) <u>Individual Variability of Score.</u>

Table XXI.

Variation of Individual Differences in Score between Test and Retest.

Test	Group	Individual Differences in Score:			%age with Higher Final Scores.
		Range	Mean	S.D.	
MHT 52 (T6-T1)	1	-10 to 24	6.3	6.4	84
	2	-4 to 22	10.0	6.2	94
	3	-10 to 13	2.7	6.3	63
MHT 51 (T7-T2)	1	-13 to 24	5.2	7.0	80
	2	-7 to 25	7.5	7.0	85
	3	-10 to 21	2.7	6.2	67
TOTAL I.Q. SCORE.	1	-8 to 34	11.5	10.0	88
	2	-7 to 37	17.5	9.5	97
	3	-17 to 32	5.4	9.9	70

Table XXI shows the range of individual differences in score
between the initial and final tests and also the proportion of
individuals whose final scores exceeded initial scores. These
results show that there are large individual differences in
scores between tests in all groups. There is no significance
statistically in the difference between the standard deviations
of the differences in any of the three sets of scores. It is
therefore concluded that coaching and practice had no effect on
the range of individual variability of I.Q.

(c) <u>Individual Response to Coaching and Practice.</u>

The tendency for the correlation between successive tests
to decrease in Groups 1 and 2 (see Tables VIII and XIV) as the
experiment proceeded suggested that individuals were responding
differently to coaching and practice. In Group 1 the correlation
of .70 between the two initial tests fell to .52 when the same
tests were later repeated; in Group 2 the fall was from .62 to .45;
whereas, by contrast, the figures for the control group were .76
and .73.(see Table XII).

Table XXII, on the next page, shows the correlations
between the initial and final results in each of the tests used,
and also those between the initial and final total scores.

Table XXII.

Correlations between Initial and Final Testings.

Test	Group	Correlation
MHT 52 (T6-T1)	1	.66
	2	.57
	3	.74
MHT 51 (T7-T2)	1	.63
	2	.43
	3	.79
TOTAL I.Q. SCORE	1	.74
	2	.69
	3	.80

These figures show that the test-retest correlation was lowered when practice was given between testings, and lowered further when the practice was combined with coaching. The trend is a fairly clear one and reaches significance at the 1% level in the difference between the correlations for MHT 51 in Groups 2 and 3.

It has been shown in the previous sub-section that the range of individual variability is unaffected by coaching or practice, but it follows from the above results that this apparent consistency is accompanied by appreciable differences in individual response to coaching and practice. The possible effects of this variation in individual response are considered in the following sub-section.

(d) Effects at the Borderline.

If we assume that selection for grammar schools is based on the results of two intelligence tests and that all boys with an average I.Q. of 115 or over are selected, then the numbers which would be selected in each Group on the results of the initial tests and the final tests are given in Table XXIII.

Table XXIII.

Numbers with Average I.Q. of 115 and over.

Group	Initial Tests	Final Tests	Increase
1	39	52	33%
2	32	55	72%
3	40	49	22%

There are, however, few areas where the provision of grammar school places is on a large enough scale to provide one for every child above a certain minimum score. Under most authorities the borderline is fixed to select a definite number of children and it is, therefore, not so much the individual's I.Q. as his place in the ranking order of I.Qs. that determines whether or not he is considered for selection.

In the previous sub-section it has been shown that individual response to coaching and practice varies appreciably. It follows that the individuals selected for a fixed number of places on the basis of unpracticed and uncoached performance in tests would form a somewhat different group from those who would be selected on the basis of scores after coaching and practice.

In order to find the effect which practice and coaching
might have had on selection from the boys who took part in the
experiment, ranking orders were drawn up from the initial I.Q.
totals and the final I.Q. totals for the three groups.

As far as total scores from the two initial tests are
concerned, the three groups show no significant differences and
may therefore be regarded, in terms of 'intelligence', as repres-
entative samples of the top 15% of the age-group, which percentage,
taken together, they very largely comprise.

The grammar school borderline was actually set to select
just over 10% of the whole age group, therefore in each of the
groups approximately two thirds of the boys would be selected.
Let us assume that there were 39 places available for each group.
The question is, taking the groups separately, how many of these
places would be filled by different boys if selection were based
on final rather than initial scores?

The answers were obtained from the ranking orders and are
as follows:

Group 1:
(56 boys) Seven boys placed above the borderline in the
initial order as 28th, 29th, 30th, 32nd, 35th,
36th, and 37th, would be replaced by boys orig-
inally placed 40th, 41st, 43rd, 44th, 45th, 46th,
and 55th.

Group 2:
(56 boys) Eight boys placed above the line initially as
13th, 19th, 27th, 29th, 31st, 32nd, 36th, and
39th, would be replaced by those placed 40th,

41st, 45th, 46th, 47th, 49th, 50th, and 56th.

Group 3:   Five boys placed 23rd, 26th, 32nd, 33rd, and 38th,
(58 boys)
                  would give place to those placed 41st, 43rd, 47th,

                  49th, and 50th.

Since in the actual allocation of these boys to secondary
schools the total I.Q. score made up only one third of the total
allocation score for each boy, the above results are entirely
hypothetical, and, in any case, no really significant conclusions
could be drawn from such data. In particular, in this context,
Group 3 must be regarded not as a control group but as one having
had less test-experience than the others during the course of the
experiment.

Taking everything into account however, the results do
suggest that approximately 15% of the grammar school intake is
likely to be different if selection is made after, rather than
without, a preliminary programme of coaching and practice.

Section V.

Discussion of the Results.

Section V.

Discussion of the Results.

The problem was to investigate the effects of unassisted practice, and practice accompanied by coaching on the I.Q. scores of boys who were near or above the 11-plus borderline.

Both the practice and coaching used in the experiment were minimal in kind, the boys in the practice group were not told their scores and the standardised coaching method was intended to represent the least that would be attempted if coaching were officially approved in the schools. In this sense the gains recorded are probably the least that would be achieved with official coaching and practice. At the same time, however, in all comparisons with the results of other researches it must be remembered that the boys taking part in this experiment had I.Qs. well above normal.

The practice effect of a single test, as shown by the scores in the second selection test, were gains of 1.9 and 2.8 pts. in the experimental groups, and a loss of 0.4 pts. in the control group. These 'gains' are less than those recorded by most other workers and it is possible that practice effect is inhibited to some extent when, as here, the tests are worked in the atmosphere of an actual selection examination. Support for this suggestion is afforded by the fact that the gains achieved by the two experimental groups, (after selection was completed and the results known to the children) between the second and third tests were

4.5 and 5.1 pts. of I.Q., giving total gains at this stage of
6.4 and 7.9 pts. respectively. These latter gains are much the
same as those obtained by Wiseman and Wrigley, and Donaldson,
and rather more than Dempster (1954) found at the same stage.

Further practice produced gains at some levels of I.Q.
in the fourth test, but continued beyond this point it resulted
in no further significant gains and at some levels scores fell
off to a significant degree. As others have recorded, a 'spurt'
in the final tests (when it was known to the boys that the exper-
iment was almost over) enabled maximum scores to be reattained
at most levels. This maximum practice effect at the third or
fourth testing conforms with the findings of Wiseman and Wrigley,
Dempster, and others.

The differential effect of practice at various levels of
ability was observed and it was of the same order as that reported
by Peel (1951, 1952), giving boys with an initial I.Q. of about
120 a slight advantage (up to about 2 pts. of I.Q.) over those
with a lower I.Q. and progressively greater advantage over those
with a higher initial I.Q.

The effect of practice combined with coaching in raising
the mean score by just over 10 pts. of I.Q. is only slightly less
than that found by Donaldson with abler children, and it is
similar to Dempster's 1951 figure of 9½ pts. for a group of
average ability. The results of the coaching group also confirm
the findings of Donaldson and Dempster that coaching combined
with practice has a significantly greater effect on improving
scores than does practice alone.

Coaching was found to have a fairly steady effect over the lower range of I.Qs. investigated but there was again a falling off of gains above about I.Q. 125. As long as coaching was continued scores remained high and there was no falling off in mean score as there was in the practice group. A graphical comparison of the results in these two groups for the last two tests, after coaching ceased, suggests that the effect of coaching may be short lived, and this is confirmed by the reduced significance of the gains ascribable to coaching as such in these tests (see Table VI, p. 33).

When the results of the two final tests were interpreted as total gains on the summed I.Qs. from the initial tests it was found that practice resulted in a total mean gain of $11\frac{1}{2}$ pts. and that coaching superimposed on the same practice increased the gain to $17\frac{1}{2}$ pts. Since the corresponding gain in the control group was $5\frac{1}{2}$ pts., apparently the effect of adding coaching to practice was to double the gains produced by the latter. Analysis of variance showed all these gains, and the differences between them, to be highly significant.

The gain of $5\frac{1}{2}$ pts. made by Group 3 must, however, be considered to include some practice effect in common with the other two groups. We must, therefore, properly conclude that tha effect of coaching, in a programme of combined practice and coaching, is something rather less than a doubling of the gains due to practice.

The gains due to coaching as such are therefore substantial; not so substantial as Vernon originally claimed them to be, but much larger than Wiseman and Wrigley would allow. It seems that,

in the present experiment at least, the function of coaching is to sustain and increase the gains which result from unassisted practice.

The results of this investigation suggest that younger boys may benefit more from coaching and practice than older boys within the same age-group. If this were clearly established by further experiment the re-standardisation of tests may be necessary before they could be used satisfactorily in areas in which universal coaching and practice were the rule.

The object of this research was not merely to establish the methods by which the greatest average increase in I.Qs. might be attained but also to determine the effects of such methods on individuals. It was confirmed that the amount of test-experience necessary for the attainment of maximum score varied considerably from boy to boy.

As in all other similar researches individual variation in score from test to test was high. Individual differences in score between test and retest covered approximately the range from -10 pts. to 20 pts., giving a standard deviation of differences of over 6 pts. This range of individual differences in score remained much the same in coached and uncoached, practised and unpractised groups. One result of this large variation was that in each group some boys had final scores lower than initial scores: in the control group the proportion was 30%, in the practice group it was 15%, and in the coaching group it was 5%.

That this consistency of variability of individual gains
in the three groups concealed real differences in individual
response to coaching and practice was shown by a comparison of
test-retest correlations for the groups. This correlation was
highest in the control group, lower in the practice group, and
lowest in the coaching group. The differences in test-retest
correlation between groups were lower when total initial and total
final scores were compared rather than scores from a single test.
Even so, when ranking orders from these total scores were
compared, it appeared that about 15% of the group selected for
grammar schools would be different if selection were made after
coaching and practice.

This proportion is, of course, likely to be greater if
there is more than a 10% allocation to grammar schools and if
official coaching and practice were to include objective tests
of attainment in English and Arithmetic as well as Intelligence
tests.

Dempster (1954) summarises the viewpoint of those who
support official coaching and practice thus:

> "Anything which gives some children an unfair start
> over the others, as differential coaching appears to be
> bound to do, must be met by countermeasures".

Donaldson (1954) recognised that, if children differ
considerably in their ability to increase their scores, then
large-scale coaching would be liable to alter the prognostic
power of the tests. She pointed out that only a follow up inquiry
could give an authoritative answer to the question whether

prognosis is increased or decreased.

It has been shown in this inquiry that boys do differ considerably in their abilty to improve their scores and that the educational progress of a fairly large proportion of them would be affected by universal coaching and practice preparatory to selection for secondary schools. The question of prognosis remains to be answered.

Section VI.

Summary of Conclusions.

Section VI.

Summary of Conclusions.

1. This inquiry was concerned with the effects of unassisted practice, and of practice together with coaching, on the scores made in two intelligence tests by boys near or above the 11-plus borderline for grammar school entrance. The two tests used had formed part of their actual allocation examination.

2. A mere repetition of the two tests, after an interval of some months, resulted in a total mean gain of $5\frac{1}{2}$ pts. of I.Q. with about 70% of individuals having higher scores.

3. The effect of three practice tests was to raise the total mean score by $11\frac{1}{2}$ pts and to increase about 85% of individual scores when the tests were repeated.

4. The effect of three hours' coaching in addition to three practice tests was to raise the mean gain to $17\frac{1}{2}$ pts. and to produce individual gains in 95% of cases.

5. The effect of coaching in addition to practice is to sustain and improve gains caused by practice. This effect is powerful but may be of relatively short duration.

6. Test-retest correlation decreased after practice and coaching indicating variation in the response of individuals to such experience. The variation was greatest in the coached group.

7. Where there is provision of grammar school places for about 10% of the children, about 15% of the individuals selected would be different if selection were made after coaching and practice.

8. Younger boys benefit more than older boys from coaching and practice.

9. Analysis of gains at various stages in the experiment showed that individuals differed considerably in the amount of test-experience necessary to produce maximum score.

10. On the average, gains due to practice ceased at the third test when the mean gain was about 7 pts. of I.Q., with a maximum gain of about 9 pts. at I.Q. 120 and a falling off of gains above that level.

11. When coaching was added to practice gains continued up to the last test at which stage the mean gain was over 10 pts. of I.Q. This gain was fairly evenly spread from (initial) I.Q. 108 to 125, above which score the gains decreased though not so rapidly as in the practice group.

12. The practice effect of one test on another was apparently reduced when both were taken under actual selection examination conditions.

Bibliography.

Bibliography.

DEMPSTER, J.J.B., (1952): 'Group Intelligence Tests - An Inquiry into the Effects of Coaching and Practice'. Schoolmaster and Woman Teacher's Chronicle, 3 Jan. 1952.

DEMPSTER, J.J.B., (1954): 'Symposium on the Effects of Coaching and Practice in Intelligence Tests. III - Southampton Investigation and Procedure'. Brit. J. educ. Psychol.,24,1.

DONALDSON, M.C., (1954): 'Effects of Coaching and Practice on Intelligence Test Scores'. Unpublished paper read to the Scottish Branch of the British Psychological Society on 30 Jan 1954.

DUNLAP, K. and SNYDER, A., (1920): 'Practice Effects in Intelligence Tests'. J. exp. Psychol.,3,396.

EMMETT, W.G., (1952): 'The Use of Intelligence Tests in the 11-plus Transfer Examination'. London: University of London Press Ltd., pp. 8.

HAMMOND, D., (1953): 'Preparation for I.Q. Tests'. Times Educational Supplement, 12 Jun 1953.

JAMES, W.S., (1953): 'Symposium on the Effects of Coaching and Practice in Intelligence Tests. II - Coaching for All Recommended'. Brit. J. educ. Psychol., 23,155.

JOHRI, S.R., (1939): 'The Effect of Coaching and Practice on Intelligence Tests'. M.Ed. Thesis. University of Leeds Library.

MCINTOSH, D.M., (1944): 'The Effect of Practice in Intelligence Test Results'. Brit. J. educ. Psychol., 14,44.

MCRAE, H., (1942): 'The Inconstancy of Group Test I.Qs.'. Brit. J. educ. Psychol., 12,59.

PEEL, E.A., (1951): 'A note on Practice Effects in Intelligence Tests'. Brit. J. educ. Psychol., 21,122.

PEEL, E.A., (1952): 'Practice Effects between Three Consecutive Tests of Intelligence'. Brit. J. educ. Psychol., 22,196.

PEEL, E.A., (1953): 'Footnote on "Practice Effects between Three Consecutive Tests of Intelligence"'. Brit. J. educ. Psychol., 23,126.

RODGER, A.G., (1936): 'The Application of Six Group Intelligence Tests to the Same Children and the Effect of Practice'. Brit. J. educ. Psychol., 6,291.

THORNDYKE, E.L., (1922): 'Practice Effects in Intelligence Tests'. J. exp. Psychol., 5,101.

VERNON, P.E., (1938): 'Intelligence Test Sophistication'. Brit. J. educ. Psychol., 8,237.

VERNON, P.E., (1952): 'Intelligence Testing'. Times Educational Supplement, 25 Jan and 1 Feb 1952.

VERNON, P.E., (1953): Letter to the Editor, Times Educational Supplement, 24 Apr 1953.

VERNON, P.E., (1954a): 'Practice and Coaching in Intelligence Tests'. Educational Forum, 18,269.

VERNON, P.E., (1954b): 'Symposium on the Effects of Coaching and Practice in Intelligence Tests. V - Conclusions'. Brit. J. educ. Psychol., 24,57.

WATTS, A.F., PIDGEON, D.A., and YATES, A., (1952): 'Secondary School Entrance Examinations'. London, Newnes Educational Publishing Co. , pp. 77.

WISEMAN, S., and WRIGLEY, J., (1953): 'Comparative Effects of Coaching and Practice on the Results of Verbal Intelligence Tests'. Brit. J. Psychol., 44, 83.

WISEMAN, S., (1954): 'Symposium on the Effects of Coaching and Practice in Intelligence Tests. IV - The Manchester Experiment'. Brit. J. educ. Psychol., 24, 5.

YATES, A., (1953): 'Symposium on the Effects of Coaching and Practice in Intelligence Tests. I - An Analysis of Some Recent Investigations'. Brit. J. educ. Psychol., 23, 147.

Appendix I.

Standardised Coaching Method.

Appendix I.

Standardised Coaching Method.

(The following instructions were given, under the above heading,
to those teachers in charge of boys in Goup 2.)

Though with some groups of boys it may be possible to correct
all the errors made in any test in a short time, it is essential,
if the coaching experiment is to have any scientific value, that
the standard procedure outlined below should be followed. The
time taken should be one hour, this allows time for all the
answers to be given slowly and all the mistakes explained.

Method for MHT 48.

1. Print clearly, on the blackboard, an alphabet to be used where
   necessary in illustrating answers.
2. Give each boy his marked script and say "We are going through
   the correct answers to this Test."
3. (a) Say, "The correct answer to Question 1 is N since N is the only
   letter which occurs more than twice in the word Concentration."
   (b) Read out slowly, from the Answer Key provided, the
   answers to Questions 2 - 7. Ask, "Has anyone any mistakes
   in these answers?" In each case of an error explain the
   correct answer as for Question 1 above. Each explanation
   should be brief yet include a statement of the principle
   or relationship involved.
4. (a) Say, "The words underlined in Question 8 should be 'towel'

and '<u>dry</u>', because just as a sponge is used to wash, so

a towel is used to dry."

(b) Read out slowly the answers to Questions 9 - 15 and proceed

as in 3 (b) above.

5. In a similar way <u>explain</u> the <u>first</u> answer to each group of

questions and any isolated answers. Read out slowly the correct

answers to the rest of the group of questions, and only where

mistakes have been made explain the correct answers.

On this basis the answers which <u>must</u> be explained are those

to the following Questions:

1,8,16,23,24,28,32,41,43,47,48,52,58,62,70,75,83,86,88,94,97.

(Similar instructions were prepared and used with MHT 49 and MHT 50.)

.Appendix II.

Test Results, Gains, and Ages.

In all tests, at all stages, the conversion tables were
extrapolated by simple arithmetical progression to allow
for conversion of raw scores of 99 and 100. Similarly the
tables were extended for the younger ages up to a maximum
of 140 for the I.Q. in each column.

Appendix II.

Test Results, Gains, and Ages.

GROUP 1. (Practice Group).

	Test Scores (I.Qs.)							Gains in I.Q.			
	Initial		Practice			Final					
Index No.	T1	T2	T3	T4	T5	T6	T7	T6-T1	T7-T2	Total	Age at T7
101	140	135	132	129	126	136	132	-4	-3	-7	11.8
102	140	131	140	137	140	139	140	-1	9	8	11.2
103	139	131	128	132	140	137	135	-2	4	2	11.6
104	135	134	131	134	140	133	132	-2	-2	-4	11.1
105	132	136	140	139	140	137	134	5	-2	3	10.10
108	129	134	132	134	123	131	134	2	0	2	11.5
110	134	129	135	128	130	130	132	-4	3	-1	11.0
112	128	133	135	125	128	129	137	1	4	5	11.7
113	130	130	130	133	136	138	136	8	6	14	11.5
114	128	130	128	131	126	125	132	-3	2	-1	11.8
117	130	126	133	126	131	135	123	5	-3	2	11.10
118	118	137	129	132	132	123	124	5	-13	-8	11.4
119	119	135	135	129	118	127	131	8	-4	4	11.7
120	128	125	137	130	123	129	132	1	7	8	11.1
121	128	123	131	137	133	118	130	-10	7	-3	11.1
122	120	130	119	124	109	129	128	9	-2	7	11.8
124	125	123	128	131	127	127	138	2	15	17	11.1
125	123	125	124	127	128	123	126	0	1	1	10.11
127	122	124	125	133	128	135	130	13	6	19	10.10

Group 1. (cont).

No.	T1	T2	T3	T4	T5	T6	T7	T6-T1	T7-T2	Total	Age
128	120	125	127	124	117	126	133	6	8	14	11.7
129	118	126	127	128	136	124	134	6	8	14	11.9
131	124	119	125	119	112	125	124	1	5	6	11.8
132	124	118	129	134	130	129	125	5	7	12	11.0
133	113	127	126	127	135	124	134	11	7	18	10.10
134	121	118	121	118	118	128	140	7	22	29	10.10
135	119	119	129	122	126	132	126	13	7	20	11.2
136	117	120	125	122	115	124	119	7	-1	6	11.7
137	117	119	134	120	114	113	124	-4	5	1	11.2
138	113	123	128	116	120	116	112	3	-11	-8	11.3
139	123	112	122	132	126	130	122	7	10	17	11.0
140	118	117	124	126	119	122	118	4	1	5	11.3
141	116	119	133	130	126	118	131	2	12	14	11.7
142	116	118	135	125	124	125	125	9	7	16	10.10
143	116	118	118	119	118	120	129	4	11	15	10.11
146	112	120	120	121	115	126	119	14	-1	13	11.0
147	118	114	128	123	118	127	115	9	1	10	11.1
148	116	115	121	121	112	124	119	8	4	12	11.2
149	118	113	114	121	118	123	117	5	4	9	11.3
150	117	114	118	122	123	123	123	6	9	15	10.9
151	109	120	129	122	128	124	128	15	8	23	11.0
152	109	120	125	121	124	125	119	16	-1	15	10.10
154	110	117	117	119	120	122	115	12	-2	10	11.1
155	114	112	127	135	127	123	136	9	24	33	10.10
156	112	114	130	123	114	117	127	5	13	18	11.3
157	109	117	129	126	126	127	133	18	16	34	11.7

Group 1. (cont).

No.	T1	T2	T3	T4	T5	T6	T7	T6-T1	T7-T2	Total	Age
158	107	119	122	126	125	131	123	24	4	28	11.4
160	110	115	118	120	119	114	122	4	7	11	10.10
161	115	109	128	121	120	120	119	5	10	15	11.2
162	113	109	113	118	109	117	112	4	3	7	11.3
164	111	109	111	114	107	124	120	13	11	24	10.10
165	111	109	116	120	112	119	118	8	9	17	11.6
166	107	113	118	110	120	121	119	14	6	20	11.4
167	109	109	117	118	114	124	120	15	11	26	10.10
169	105	112	109	113	117	114	114	9	2	11	11.6
170	102	114	112	122	117	124	124	22	10	32	11.0
172	107	106	108	112	114	111	117	4	11	15	11.5

N-56.

Means: 119.0   120.9   125.4   125.0   123.1   125.3   126.1   6.3   5.2   11.5   11.3

GROUP 2. (Coaching Group).

Index No.	Test Scores (I.Qs.)							Gains in I.Q.			Age at T7
	Initial		Practice			Final					
	T1	T2	T3	T4	T5	T6	T7	T6-T1	T7-T2	Total	
201	140	137	134	138	140	140	130	0	-7	-7	11.0
203	129	136	129	134	124	135	135	6	-1	5	11.6
205	133	125	136	139	140	129	139	-4	14	10	10.11
206	134	122	137	138	137	137	135	3	13	16	11.3
207	126	125	131	124	132	131	134	5	9	14	10.10
208	119	131	131	134	128	132	133	13	2	15	11.7
211	118	131	134	133	139	136	134	18	3	21	11.8
212	124	124	133	124	125	133	132	9	8	17	11.9
213	120	128	121	124	127	136	122	16	-6	10	11.5
214	126	122	129	126	124	129	126	3	4	7	11.7
217	121	123	128	127	129	131	124	10	1	11	11.8
218	125	119	126	127	132	133	135	8	16	24	10.11
219	117	127	125	128	134	119	122	2	-5	-3	11.1
220	120	123	132	129	130	134	125	14	2	16	11.0
221	123	120	127	135	125	132	129	9	9	18	11.2
222	116	126	122	128	134	132	132	16	6	22	11.0
223	123	117	124	127	123	121	127	-2	10	8	11.6
224	117	123	124	118	129	127	122	10	-1	9	11.9
225	121	118	127	123	133	118	125	-3	7	4	11.10
228	118	120	128	132	135	130	133	12	13	25	11.6
229	113	124	122	128	123	126	132	13	8	21	11.1
230	115	121	119	126	122	124	122	9	1	10	11.5
231	114	121	122	127	125	117	136	3	15	18	11.8
233	116	119	126	127	129	123	127	7	8	15	11.6

Group 2. (cont).

No.	T1	T2	T3	T4	T5	T6	T7	T6-T1	T7-T2	Total	Age at T7
234	112	122	132	127	126	130	128	18	6	24	11.0
235	113	120	129	128	127	131	123	18	3	21	11.4
236	116	116	118	113	114	121	117	5	1	6	11.6
237	115	116	129	132	133	126	125	11	9	20	11.9
238	110	120	125	120	113	125	120	15	0	15	11.5
239	110	120	120	120	124	127	123	17	3	20	11.7
240	113	117	119	118	115	125	118	12	1	13	11.2
242	120	110	120	124	122	117	116	-3	6	3	11.10
244	114	115	127	130	128	135	124	21	9	30	10.10
245	117	112	126	130	132	127	131	10	19	29	10.11
246	113	115	113	117	127	124	125	11	10	21	11.6
247	111	117	116	121	113	124	117	13	0	13	10.11
248	116	112	131	121	122	127	134	11	22	33	11.4
249	112	116	120	121	134	130	130	18	14	32	11.1
250	113	114	122	120	122	120	119	7	5	12	11.8
251	115	112	113	117	119	132	125	17	13	30	11.0
252	113	114	115	114	120	121	130	8	16	24	11.4
253	110	116	116	120	120	120	125	10	9	19	11.0
254	109	116	126	124	119	112	119	3	3	6	11.5
256	110	114	124	126	132	126	121	16	7	23	11.7
257	106	117	120	122	125	123	128	17	11	28	11.1
258	112	110	115	128	125	127	127	15	17	32	11.2
259	108	114	118	121	122	120	125	12	11	23	11.0
260	109	112	128	126	130	122	125	13	13	26	11.3
261	109	111	115	128	128	119	136	10	25	35	11.4

Group 2. (cont).

No.	T1	T2	T3	T4	T5	T6	T7	T6-T1	T7-T2	Total	Age at T7
262	108	112	114	117	117	114	118	6	6	12	11.1
263	109	110	116	112	122	120	119	11	9	20	11.5
264	106	113	119	119	119	112	121	6	8	14	11.5
265	109	109	121	123	123	116	119	7	10	17	11.2
266	106	111	119	111	113	116	113	10	2	12	11.3
268	105	111	119	115	119	121	123	16	12	28	11.10
270	104	107	111	126	115	126	122	22	15	37	11.9

N=56.

Means:	115.7	118.5	123.6	124.8	125.7	125.7	126.0	10.0	7.5	17.5	11.3

GROUP 3. (Control Group).

| Index No. | Test Scores (I.Qs.) | | | | Gains in I.Q. | | | Age at T7 |
| | Initial | | Final | | | | | |
	T1	T2	T6	T7	T6-T1	T7-T2	Total	
301	140	140	140	140	0	0	0	10.11
302	140	135	139	137	-1	2	1	11.3
303	132	132	130	132	-2	0	-2	11.9
304	137	126	133	133	-4	7	3	11.6
306	131	131	134	140	3	9	12	11.0
307	129	133	128	132	-1	-1	-2	11.4
308	129	132	123	122	-6	-10	-16	10.11
309	136	124	136	139	0	15	15	10.11
310	126	131	134	138	8	7	15	11.1
311	130	127	120	120	-10	-7	-17	11.6
312	138	116	129	119	-9	3	-6	11.8
313	130	124	123	120	-7	-4	-11	11.9
314	131	123	131	126	0	3	3	11.8
315	124	129	130	131	6	2	8	11.6
316	123	130	129	132	6	2	8	11.4
317	129	124	123	138	-6	14	8	10.10
318	124	128	127	128	3	0	3	11.0
320	127	124	130	138	3	14	17	11.1
322	125	124	122	124	-3	0	-3	11.4
323	124	124	129	128	5	4	9	11.1
324	125	123	132	123	7	0	7	11.3
325	119	129	123	121	4	-8	-4	11.4
326	125	122	123	134	-2	12	10	11.4
327	119	127	115	121	-4	-6	-10	11.10

Group 3. (cont).

No.	T1	T2	T6	T7	T6-T1	T7-T2	Total	Age at T7
328	123	123	122	122	-1	-1	-2	11.0
331	121	122	123	121	2	-1	1	11.3
334	121	120	118	118	-3	-2	-5	11.10
336	119	120	126	123	7	3	10	11.7
337	122	117	133	118	11	1	12	11.2
338	116	122	129	130	13	8	21	11.8
339	117	120	119	124	2	4	6	11.4
342	124	112	135	133	11	21	32	11.7
343	116	119	127	125	11	6	17	11.7
344	118	117	116	120	-2	3	1	11.0
345	122	112	117	115	-5	3	-2	11.7
346	117	117	113	128	-4	11	7	11.4
347	118	116	125	115	7	-1	6	11.9
348	118	116	123	117	5	1	6	11.4
350	113	118	117	118	4	0	4	10.11
351	116	114	115	118	-1	4	3	10.10
352	114	115	118	119	4	4	8	10.10
353	111	117	109	111	-2	-6	-8	11.3
354	113	113	123	115	10	2	12	11.8
355	113	112	119	110	6	-2	4	11.6
356	112	112	123	113	11	1	12	11.4
357	110	114	121	115	11	1	12	10.10
358	109	115	121	117	12	2	14	11.3
360	118	105	112	110	-6	5	-1	11.7
364	112	111	115	123	3	12	15	11.4
366	109	112	121	120	12	8	20	11.3

Group 3. (cont).

No.	T1	T2	T6	T7	T6-T1	T7-T2	Total	Age at T7
367	111	109	120	110	9	1	10	11.1
368	112	107	121	113	9	6	15	11.4
369	106	112	111	122	5	0	5	11.0
370	108	109	113	114	5	5	10	11.7
371	102	115	114	109	12	-6	6	11.3
372	107	110	115	113	8	3	11	11.1
373	105	110	111	115	6	5	11	11.7
374	105	108	102	105	-3	-3	-6	11.3
N-58								
Means:	120.2	119.8	122.9	122.5	2.7	2.7	5.4	11.4

Appendix III.

I. Qs. at Eight Percentile Levels in Successive Tests.

Appendix III.

I. Qs. at Eight Percentile Levels in Successive Tests.

GROUP 1. (Practice Group).

%ile	T1	T2	T3	T4	T5	T6	T7
95	135.8	134.9	135.8	135.8	138.2	13717	138.2
87.5	129.8	131.9	133.7	133.7	134.3	133.8	135.1
75	124.8	126.9	130.5	130.5	129.1	129.3	132.6
62.5	120.2	121.9	128.5	127.5	126.6	126.8	129.9
50	118.0	119.0	126.4	124.9	122.2	124.5	125.5
37.5	115.8	116.2	123.5	122.7	118.7	122.8	122.3
25	112.2	114.1	119.9	120.5	116.2	121.0	119.3
12.5	108.3	111.0	116.1	117.0	112.7	117.4	116.3
Mean I.Q.	119.0	120.9	125.4	125.0	123.1	125.3	126.1

GROUP 2. (Coaching Group).

%ile	T1	T2	T3	T4	T5	T6	T7
95	131.0	133.5	135.0	135.8	137.0	137.0	135.8
87.5	124.7	125.5	132.4	132.2	134.0	134.2	133.8
75	119.7	122.6	129.1	129.2	130.5	131.3	130.9
62.5	117.0	119.9	127.2	127.5	127.6	128.7	127.5
50	114.5	117.9	123.7	125.7	124.9	126.2	124.7
37.5	112.2	115.8	120.5	123.0	122.6	123.4	123.0
25	109.8	113.5	118.0	120.0	120.8	120.5	121.2
12.5	107.3	111.2	115.5	116.5	116.2	117.3	118.5
Mean I.Qs	115.7	118.5	123.6	124.8	125.7	125.7	126.0

GROUP 3. (Control Group).

%ile	T1	T2	T6	T7
95	137.6	133.9	135.7	138.4
87.5	130.7	130.3	132.5	135.3
75	125.9	125.3	128.9	130.0
62.5	122.9	122.3	125.3	124.3
50	120.1	119.2	123.0	121.0
37.5	117.1	116.2	120.7	117.9
25	113.6	113.4	116.9	114.8
12.5	109.0	110.6	113.1	111.5
Mean I. Qs	120.2	119.8	122.9	122.5

Appendix IV.

Differential Effects of Practice and Coaching - Initial and

Final I.Q. Totals.

Appendix IV.

Differential Effects of Practice and Coaching -

Initial and Final I.Q. Totals.

GROUP 1. (Practice Group)

%ile	Initial I.Q. Total (T1+T2)	Final I.Q. Total (T6+T7)	Gain	Initial I.Q. (average)
95	269.6	273.5	3.9	134.8
87.5	263.5	266.8	3.3	131.75
75	252.1	258.8	6.7	126.05
62.5	241.7	254.8	13.1	120.85
50	237.5	249.9	12.4	118.75
37.5	233.0	245.8	12.8	116.5
25	227.5	241.7	14.2	113.75
12.5	220.5	234.3	13.8	110.25
Means	239.9	251.4	11.5	119.95

GROUP 2. (Coaching Group)

%ile	Initial I.Q. Total (T1+T2)	Final I.Q. Total (T6+T7)	Gain	Initial I.Q. (average)
95	257.8	269.0	11.2	128.9
87.5	248.7	265.5	16.8	124.35
75	242.3	259.9	17.6	121.15
62.5	236.3	255.8	19.5	118.15
50	230.5	251.7	21.2	115.25
37.5	227.0	247.5	20.5	113.5
25	223.5	243.5	20.0	111.75
12.5	219.3	238.0	18.7	109.65
Means	234.2	251.7	17.5	117.1

GROUP 3. (Control Group)

%ile	Initial I.Q. Total (T1+T2)	Final I.Q. Total (T6+T7)	Gain	Initial I.Q. (average)
95	268.9	274.9	6.0	134.45
87.5	258.8	264.8	6.0	129.4
75	252.3	256.1	3.8	126.15
62.5	244.9	248.7	3.8	122.45
50	238.0	242.3	4.3	119.0
37.5	232.2	237.4	5.2	116.1
25	226.0	233.0	7.0	113.0
12.5	219.3	226.8	7.5	109.65
Means	240.0	245.4	5.4	120.0