Training to reason : an investigation into the possibility of training in seeing relations of evidence / by Marjorie Hill.

Contributors

Allee, Marjorie Hill, 1890-1945.
University of Western Australia.

Publication/Creation

Melbourne : Melbourne University Press, 1936.

Persistent URL

https://wellcomecollection.org/works/h2x6bmc8

License and attribution

Conditions of use: it is possible this item is protected by copyright and/or related rights. You are free to use this item in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you need to obtain permission from the rights-holder(s).

wellcome collection

Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

AUSTRALIAN COUNCIL FOR EDUCATIONAL RESEARCH

TRAINING TO REASON

BY

MARJORIE HILL

M
10071

MELBOURNE UNIVERSITY PRESS
in association with
OXFORD UNIVERSITY PRESS
1936

EDUCATIONAL RESEARCH SERIES, NO. 44. TWO SHILLINGS

3250.

THE
CHARLES MYERS
LIBRARY

Spearman
Collection

NATIONAL INSTITUTE
OF
INDUSTRIAL
PSYCHOLOGY

22502817510

GHD

TRAINING TO REASON

ALDWYCH HOUSE, W.C.2

EDUCATIONAL RESEARCH SERIES, NO. 44.

TRAINING TO REASON

AN INVESTIGATION INTO THE POSSIBILITY OF TRAINING IN SEEING RELATIONS OF EVIDENCE

BY

MARJORIE HILL, B.A., Dip. Ed.

FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF WESTERN AUSTRALIA

MELBOURNE UNIVERSITY PRESS
IN ASSOCIATION WITH
OXFORD UNIVERSITY PRESS
MELBOURNE LONDON EDINBURGH NEW YORK
CAPETOWN BOMBAY TORONTO, ETC.
1936

Registered at the General Post Office, Melbourne, for transmission through the post as a book

WELLCOME LIBRARY
General Collections
M
10071

G H D

Wholly set up and printed in Australia by Brown, Prior, Anderson Pty. Ltd., Printcraft House, 430 Little Bourke St., Melbourne, C.1, 1936

ACKNOWLEDGMENTS

THIS investigation was made possible by the generosity of the Australian Council for Educational Research, which supplied the necessary financial aid and for which I now offer my thanks.

I wish, too, to express my gratitude to Mr. Wallace Clubb, B.A., the Director of Education of the Western Australian Education Department, for permission to enter the Perth schools; and to certain members of the teaching staffs and headmasters of those schools who put their classes at my disposal, and who showed me the greatest kindness and consideration regardless of the trouble and inconvenience to which I put them.

I am very grateful also to the students who helped to administer the tests, and to my father, both for his help in the trying work of checking results and for his suggestions.

Especially I wish to thank Mr. George McIntyre, B.SC., who, when I was confronted with a difficulty in the statistical part of the work, gave a great deal of time and thought to the matter, and finally evolved a formula for my use, the value of which will be realized by referring to the appendix.

But in particular my thanks are due to Dr. H. L. Fowler, of the Psychology Department of the University of Western Australia, for his continued and unstinted help and especially for his cheery encouragement which never failed to dispel all dejection.

CONTENTS

Digitized by the Internet Archive
in 2017 with funding from
Wellcome Library

https://archive.org/details/b29932063

Chapter I

THE PROBLEM

THIS work deals with an old problem, namely, the transfer of training, but deals with it, I think, in a new way.

The problem, briefly, was to discover whether 'reasoning' could be trained. 'Reasoning,' for the purpose of this research, was taken to be the cognizing of the relation of evidence and the eduction of correlates dealing with this relation.[1]

Those who are familiar with Spearman's theory will remember that, all cognition of which one's mind is capable is regarded as brought about, firstly, by awareness of one's own experience and then by the eduction of relations and correlates.

The process of educing relations may be explained briefly by saying that, when a person has two or more items in mind, he tends to perceive a relationship between them. These relationships may be those of space, time, identity, attribution, causation, constitution, likeness, conjunction and the psychological relationship.

The present research is concerned with but one of these, namely, the perceiving of the relationship of evidence or, rather, with the possibility of training children to see the relationship of evidence.

The procedure adopted was as follows. Four tests were constructed which called for the cognizing of this relationship. These tests were then given to five groups of children, after which one group was trained in one type of evidential material; another group trained in a different kind of evidential material, and so on. The fifth group, however, was not trained at all but was used as a control for the purpose of comparison.

After the four groups had been trained with their respective kinds of material they were tested again. It was hoped to discover if there had been any improvement from the first testing to the second, and whether being trained with one type of material would affect the ability to deal with a different type. For instance, would training a child with logical material have any effect on his ability to solve situations or arithmetical problems? Would training in problematic arithmetic have a beneficial or detrimental effect on the ability to interpret facts?

1. See Spearman: *The Nature of Intelligence and the Principles of Cognition; The Abilities of Man.*

Chapter II

THE LITERATURE

MANY experiments have dealt with some aspects of the transfer of training but, so far as I can discover, comparatively few have dealt with the problem of training in reasoning and none have approached the matter in the manner set forth in this report.

The only other work which I could find which is in any way similar is a research by Winch.[1] In that investigation, however, problem arithmetic was the only kind of training material used, the aim being to discover if this sort of training would improve ability to deal with problem arithmetic and logical material. The logical material was presented almost entirely in syllogistic form.

The procedure adopted in the present work differs from that usually used in experiments of this kind in that the same tests were given to all children for both the preliminary and final testing.

This procedure is similar to that followed by Gates.[2] But the probable error in his experiment has been calculated on the basis of assumptions which cannot be accepted for the present study.

It was in an endeavour to discover some means of calculating the probable error that the assistance of Mr. G. McIntyre was sought. How he overcame this difficulty will be explained in a later section.

Professor Laycock[3] used problematic situations somewhat similar to those in Test 4 in the present work, both for testing and training, but his test consisted of comparatively few situations and the method of training was very different. Both from this work and from Strasheim,[4] valuable suggestions were obtained for the construction and conduct of Test 4.

Throughout references will be found to Professor Spearman's publications[5]; indeed, it was his work which afforded the inspiration for this research.

1. W. H. Winch: 'The Transfer of Improvement in Reasoning in School Children.' *British Journal of Psychology*, Vol. XIII, pp. 370-381.

2. Gates, Arthur I, and Van Alstyne, Dorothy: 'General and Specific Effects of Training in Reading.' *Teachers' College Record*, Vol. XXV, pp. 98-123.

3. S. R. Laycock: *Adaptability to New Situations.* (Warwick & York), 1929.

4. J. J. Strasheim: *A New Method of Mental Testing.* (Warwick & York), 1926.

5. Op. cit.

Chapter III

CONSTRUCTING THE TESTS

IN compiling the tests the aim was to construct tests of increasing difficulty so that all the children could do some of the test, but none could do all. Consequently, the test would be beyond the range of the cleverest children and thus allow for measurement of improvement should any take place.

The tests were first constructed tentatively then tried out on an average class of fifty children. It was sometimes found necessary to alter the wording of questions, or the methods of recording answers, or the spacing and arrangement of the problems, as well as increasing the difficulty of the tests. In this way some of the tests had to be modified three or four times.

The method of administering the tests and the preliminary instructions to the children were also carefully revised and standardized as the result of this preliminary work.

Forty-five minutes were allowed for the working of each test.

Chapter IV

THE TESTS[1]

THE four tests which were used finally were (1) Logic; (2) Problematic Arithmetic; (3) Fables; and (4) Situations.

(a) Test 1

Test 1 was the logic test. This consisted of a number of questions arranged in groups; each group being composed of a different type of question. These types were based, for the most part, on logical classifications. For instance, such types as definitions, selection, classification, division, absurdities and syllogisms all appeared in the test although, of course, they appeared in a simple form suited to the comprehension of the children.

Thus definition consisted of giving one name for blue, red, green, yellow.

In the selection group the testees were required to choose the attributes which are indispensable to a given object as, for instance, choosing what a spider always has from the words: web, legs, colour, insects, sting.

In the classification type the children had to strike out the words which did not belong to the class presented.

Logical division appeared in solving family relationships.

Most of these types will be found in different intelligence tests, although the actual material used in this particular test is original with the exception of the absurdities which appear in Burt's Absurdities Test.[2]

The types were carefully set out in their groups and each group was confined to one page as it was found that, otherwise perseveration caused some wrong answers. For instance, if the classification and definition groups were put on the same page both were answered in the same way regardless of the instructions preceding each group.

Furthermore, the test was made out in two parts. The first part (pages 1-9) consisted of seven types and the second part (pages 10-18) comprised the same types set out in the same way but made up of different examples. In this way children who worked very slowly, and who therefore did not finish the test, would attempt some of all the different types.

1. See Appendix 2.

2. Burt, having intimated that these could be used by anyone interested or desirous of testing with them, this permission was utilized.

The test appears a long one, but in reality, there is not a great deal of reading matter, the bulky appearance of the test sheets being due to the spacing required to counteract the effect of perseveration.

To reduce the recording of the answers to a minimum all that was required was the placing of a mark, or a number, or a word on the test sheet.

(b) Test 2

Test 2 consisted of fifty problems in arithmetic, graded in difficulty and ranging from very simple to more complex problems.

As the children who acted as testees were from standards IV and V of the Education Department of Western Australia, the problems set were within the requirements of the curriculum for these classes.

An endeavour was made to keep to problems which depended for their solution mainly on the children's reasoning ability rather than on the methods and forms being taught in the classes at the time.

Space was provided in the test sheets for the working of problems so that, in marking the tests the examiner would be enabled to judge whether a wrong answer was due to faulty reasoning or to a mechanical error in working.

(c) Test 3

Test 3 was one in which the testees were required to arrive at a generalization from the facts given. The material used was Æesop's Fables and certain proverbs. These were set out as short stories simple enough for these children, who were asked to write down in each case the lesson which the story taught. As there was considerable reading matter in this test, and the answers had to be recorded in a sentence rather than by a mark or number, the number of problems wes reduced to thirty.

This test was, like the other tests, graded in difficulty, the order of difficulty being determined from the preliminary trials.

(d) Test 4

This was a Problematic Situations test. The material used was somewhat similar in nature to that used by Professor Laycock but, whereas he used three somewhat elaborate situations, the present test consisted of thirty situations which were rather more briefly expressed.

Each situation was expressed as concisely as possible without sacrificing lucidity and interest. The wording in each case was made such that only one solution would satisfy the conditions.

Many ingenious solutions were given by the children in the preliminary trials when the tests were being constructed so that most of the problems had to be reconstructed many times before the final wording was decided upon.

As with Test 3 there was a good deal of reading matter in this test and the recording of the answers was somewhat lengthy so that the number of problems was again limited to thirty.

Chapter V

THE PRELIMINARY TESTING

THE tests having been made the next step was to administer them to the selected classes.

As has been mentioned, it was decided to conduct the investigation with children drawn from standards IV and V.[1] Five schools were chosen and, with the permission of the headmasters, the children of standards IV and V of these schools participated in the experiment. The numbers in each class were approximately 55, so that the group drawn from each school comprised about 110 children.

For the purposes of the experiment, however, it was necessary to have groups of equal intelligence. To equate the groups for this factor Spearman's 'Measure of Intelligence' was administered to all the children concerned and comparable groups selected from the resulting scores.

In each case the test was administered by the experimenter at the same time of day.

The conditions for the reasoning tests were also carefully arranged. At 9.15 a.m. on Monday Test 1 was given to all classes. At 9.15 on Tuesday Test 2 was given to all classes. Similarly Tests 3 and 4 were given on Wednesday and Thursday.

As these were not oral tests there was not the same necessity for having the same examiner throughout as was the case with the intelligence test. However, in order that they should be given under comparable test conditions with no possibility of interference or suggestions (however well intentioned) from class teachers, the administering of the tests was carried out by students taking the Diploma in Education at the University.[2]

These supervisors were instructed to see that the cover sheets of the tests were properly filled in, that all testees started work together, that they were stopped at the end of forty-five minutes, that the tests were all collected and returned to the investigator and that there was no collaboration or interference. Furthermore, no copies of the tests were left in the schools and the class teachers were asked not to discuss the tests with the children in view of the fact that such discussion might affect the final testing.

1. The average ages for these classes would be 10 and 11 respectively.
2. I am glad to acknowledge the very real assistance offered by these students.

Chapter VI

THE SELECTION OF GROUPS

AS already indicated the selection of equal groups was arranged by the administration of Spearman's Group Test of Intelligence, but, for various reasons, not all the children so selected could be included in the experiment.

During the training period a record of the attendance of the children was kept and the papers of those who attended less than 90% of the lessons were discarded.

Moreover, because of the nature of the formula used, it was necessary to have the papers of the children who were present at both the preliminary and final testing. Thus, of the 110 children tested and trained in each school, many were discarded for one reason or another so that, finally, only 60 could be used to form the group whose papers were used in the final analysis.

That is to say, there remained five groups each composed of 60 children of approximately equal intelligence and age,[1] who attended both the preliminary and final testing and who, in the case of the trained groups, attended 90% of the training lessons.

These groups we shall designate the Control, Group 1, Group 2, Group 3, and Group 4.

The average intelligence score for each group is given below:—

Control	Group 1	Group 2	Group 3	Group 4
88·6	88·9	88·7	88·8	88·9

1. The children in the five groups were equated individually for age and intelligence so that the variation above the average was identical in the various groups.

Chapter VII

THE TRAINING PERIOD

THE training period lasted for ten weeks. Two half-hour lessons were given each week to the groups which were to be trained. Thus Group 1 was given twenty lessons on the material of Test 1, i.e., logical reasoning. Group 2 was given twenty lessons on the material of Test 2—problem arithmetic. Group 3 was given twenty lessons on the material of Test 3—fables; and Group 4 was given twenty lessons on situations.

The preparation of the training material involved a great deal of work. For the training of Group 1, for instance, twenty lessons were prepared covering all the types found in Test 1. Lessons were given on solving number series, on solving relationships by drawing family trees, and on selection and definition. Syllogisms were solved graphically by means of Euyler's Circles. Large numbers of absurdities were treated, the children being encouraged to discuss and point out wherein the absurdity lay. Irish jokes, bulls and humorous stories provided a fund of this sort of material.

Similarly the lessons for Group 2 consisted of material covering all types of problems found in the test. The children were first given lessons in breaking up the problems into statement and question. They were required to write down for each problem 'what was asked' and 'what was given.' After a certain amount of practice in analysing problems, lessons were given in choosing methods of solving the problems. Here, after analysing a sum the children wrote down how to do it. They did not actually work the sum out for no figuring was required at this stage. Later, however, lessons were given on specific types of sums and the children were required to work out the problems completely, but the steps of analysing and the deciding of the method to be used were stressed throughout.

The training material for Group 3 consisted, as did Test 3 itself, of Æsop's Fables and simple proverbs. The lessons were taken in many ways. In some the fables were told simply and the class discussed and decided on the meaning and nature of the lessons taught. Eight to ten fables would be treated in a lesson in this way. At other times proverbs would be treated in a similar manner.

After the class had become familiar with many fables and proverbs and had had considerable practice in discovering the lessons taught, lessons were given in matching proverbs. Here

the class was presented with a number of proverbs and was required to pick out those with similar meanings, as, for instance, 'A living dog is better than a dead lion,' and 'A bird in the hand is worth two in the bush.' Somewhat similar were lessons in which a proverb had to be matched with a fable.

In other lessons the children would write their own ending to a fable. They would be told the lesson that was to be taught, then given the characters and situation, and from this had to make a suitable ending which would teach the required lesson. In Spearman's phraseology, they were required to educe a correlate. From this children were led to make their own fables. They decided on the lesson they proposed to teach, chose their own characters and made the story, which was then read to the class. The rest of the class would then decide what the lesson was that was taught by this particular story.

All this work was designed to give practice in discovering the meaning or 'lessons' taught by different fables and proverbs. Moreover, during the training period children were led to see that the meaning of the fables and proverbs had a wide application. Thus, in the story of 'The Fox and the Crow,' the lesson taught is not so much 'The crow should not have taken any notice of the fox,' as that 'We should not listen to flatterers.'

The training material for Test 4 was the most difficult to prepare as it was almost impossible to discover sources from which to obtain sufficient material for the lessons. Thirty situations had been used for Test 4 and it was necessary to discover or invent a further 120 or so to use as training material since 6 or 7 situations were used in each of the twenty lessons.

The situations were classified into different groups. For instance, some dealt with sending messages, some with leaving a trail, some with crossing a space. The children were led to see that many dissimilar situations were solved in a similar way, perhaps, by substituting one thing for another or, perhaps, by distracting attention, etc.

The children were taught to examine the situation and find out what solution was desired. They would then formulate a possible solution and examine the problem again to see if this hypothesis, which had been formed, would fit in with all the facts given. If it would not it had to be either modified or discarded and a new hypothesis tested out in the same way.

Chapter VIII

THE FINAL TESTING

AT the end of the practice period the tests were given again to all groups. They were administered in exactly the same way as during the preliminary testing. That is, they were given to each group simultaneously by the students who had administered them before.

All the marking of both the preliminary and final test sheets was done by the investigator; a somewhat arduous task, as in many cases the answers had to be read carefully before being judged and so could not be marked mechanically.

While marking Test 2, i.e., the arithmetic test, wrong answers were studied by means of marginal workings to discover whether the error was due to an error in reasoning or whether it was merely a mechanical slip. As it was reasoning ability that was being tested mechanical errors were overlooked where the reasoning was sound.

With Test 3 a scale had to be adopted for the purpose of marking as it was found that the answers varied a great deal. An investigation was made of the types of answers given and a scheme of awarding marks for these types arrived at. The tests were then marked with reference to the scale.

A similar procedure was adopted with Test 4, but here, although the answers set down varied in many ways, they could usually be judged as either right or wrong according to whether they fulfilled the conditions as laid down in the problem set.

The marking of this test proved to be rather more entertaining than is the case with most tests for a good deal of unconscious humour was evidenced. For instance, it was suggested by one child that a party of men could escape from a bush fire (No. 24, Test 4) by walking sideways! Other solutions to this problem were that 'the men could run to the nearest house for a hose'; or 'climb the trees and swing from bough to bough'; or, 'dig up the grass with the matches.'

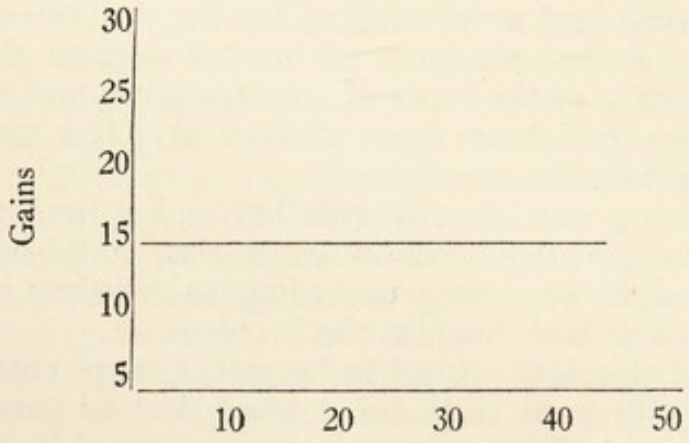
Chapter IX

TREATMENT OF RESULTS

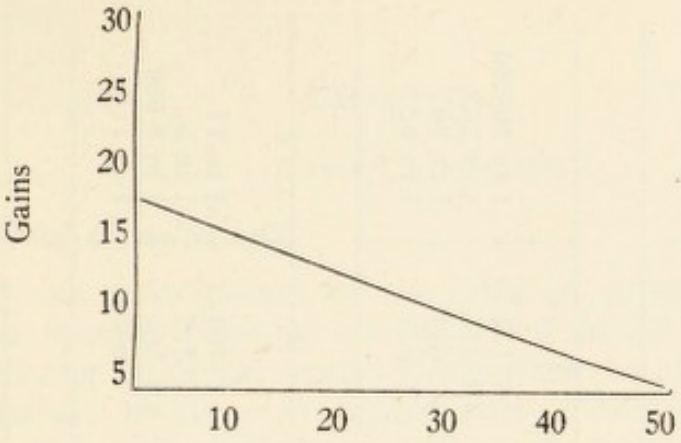
THE test papers of the selected testees having been marked and the results recorded the statistical part of the work was undertaken.

Here it might be well to offer a brief explanation of the method adopted but, for a more detailed study of the procedure the reader is referred to the appendix, which contains Mr. McIntyre's analysis.

In the experiment conducted by Gates (*Teachers' College Record*) the assumption is made that the average gains are independent of the initial scores. That is to say, a child who scored say, 20, at the first testing would gain as much, on the average, as a child who scored say, 70, at the first testing; and one who scored 30 would gain, on the average, as much as one who scored 60, so that if this were presented graphically, the line of the gains would be practically parallel to the line of the initial scores.



This assumption may be sufficiently accurate for groups which happen to have the same mean for the initial scores but, in this work, this was not the case, and it was found that, on examining the results of Test 1 for both control and training groups after smoothing by the moving average method, there was a definite tendency for low initial scores to be accompanied by high gains. That is, children who scored low on the initial testing gained more than those who had scored highly at the initial testing, so that the line of the gains was not parallel to the line of the initial scores but at an angle to it, thus:—



Initial Scores.

There was then a definite relationship between this line of regression and the line of the initial scores. This relationship was denoted by the regression equation.[1]

By means of this regression equation the amount of gain a group would be expected to make could be determined from the control group scores.

It is assumed that the other groups would have gained at least as much as the control had they not been trained. If then the amount that a group could be expected to gain (as predicted by the regression equation) plus the initial score of a group is subtracted from the final score the remaining amount of gain should be due to training. Thus:—

Final score — (expected gain + initial score) = gain due to training.

or

Experimental gain — expected gain = gain due to training.

Having determined the difference between the experimental and expected gains it was then necessary to find the standard deviation of this difference and to determine the possibility that this difference might be due to chance.[2]

On referring to the table of results below it will be seen that the difference between the experimental and expected gains has been divided by the standard deviation of that difference so that the final figure is given in terms of the standard deviation. The last column gives the probability that as great or a greater difference than that obtained between the experimental and expected gains could have been due to sheer chance selection.

It will be remembered that Group 1 was trained in the material of Test 1; Group 2 in Test 2; Group 3 in Test 3 and Group 4 in Test 4.

1. Appendix 1.
2. See Appendix 1.

Table of Results

Group	Mean Initial	Mean Final	Difference between Experimental and expected gains	Standard deviation of difference	Difference / S.D. of difference	Probability
TEST 1 (LOGIC).						
Control	57	71·32				
Group 1 (Logic)	64·89	79·89	+2·6	1·4836	+1·752	1 in 12
Group 2 (Arithmetic)	59·77	73·8	+0·4	1·2709	+0·3148	1 in 1·3
Group 3 (Fables)	60·96	74·16	−0·14	1·3020	−0·1075	1 in 1·0
Group 4 (Situations)	56·05	69·57	−1·02	1·2452	−0·8214	1 in 2·4
TEST 2 (ARITHMETIC).						
Control	19·45	25·3				
Group 1 (Logic)	21·73	23·9	−3·22	0·7781	−4·151	1 in 30,120
Group 2 (Arithmetic)	20·66	28·5	+2·24	0·7692	+2·911	1 in 263
Group 3 (Fables)	17·76	21·9	−1·99	0·7726	−2·574	1 in 90
Group 4 (Situations)	20·83	24·65	−1·74	0·7704	−2·258	1 in 42
TEST 3 (FABLES)						
Control	17·4	24·0				
Group 1 (Logic)	25·32	28·11	−2·68	1·573	−1·704	1 in 11
Group 2 (Arithmetic)	23·78	27·41	−2	1·535	−1·302	1 in 5
Group 3 (Fables)	18·18	30·12	+5·44	1·412	+3·856	1 in 8,660
Group 4 (Situations)	17·81	25·21	+ ·86	1·411	·6094	1 in 1·8
TEST 4 (SITUATIONS)						
Control	13·65	15·51				
Group 1 (Logic)	13·75	16·1	0·57	0·5367	1·062	1 in 3·4
Group 2 (Arithmetic)	13·35	16·86	1·67	0·5385	3·101	1 in 518
Group 3 (Fables)	13·05	16·06	1·12	0·5395	2·076	1 in 26
Group 4 (Situations)	14·41	19·61	3·52	0·5371	6·553	1 in 5,000,000

Chapter X

CONCLUSIONS

(a) *General Conclusions*

FROM an examination of the table of results it will be seen that specific training has occurred in all sets of material. Thus, training in logical material improves the ability to deal with this material; training in problematic arithmetic improves the ability to deal with problematic arithmetic; training in fables helps the ability to handle fables, while training in situations helps the ability to solve situations.

The improvement obtained by training in logic is not so great, however, as is the case with the other materials. It may be that, in order to do this test children were required to depend more entirely on their native intelligence or 'g.'[1]

Most probably the explanation lies in the fact that a definite specific factor or 's' was called into play when Tests 2, 3 and 4 were dealt with; whereas Test 1 was made up of a number of types of questions, and presumably there is a specific ability for each type, but these, being pooled, tended to neutralize each other so that the test became almost entirely a measure of 'g' alone. In other words the logic test was a 'broader' test than the others and, as Spearman has shown,[1] the 'broader' or more varied the test, the higher is its correlation with 'g'; and the more children have to depend on their native intelligence or 'g' to perform a certain task, the less is the possibility of improving that task by training.

When we come to consider the effects of training in one kind of material on other types the most surprising result is given by the group trained in logic. It will be seen that training in logic had a most pronounced negative effect on arithmetic; a result which, in view of the probability figures, is too evident to be disputed. It has, also, a negative effect on fables, while the improvement in situations is less with the logic group than is the case with groups trained in other types of material.

A possible explanation of the adverse effect of logical training is that the training in this material may have produced a more cautious and hesitant attitude. It may have created a tendency to examine problems more closely; possibly even making the testees look for a 'catch' and, consequently, the performance of the tests was hindered. Additional training, however, might have had the effect of making the testees more sure with a consequent improve-

1. Spearman: *Abilities of Man.*

ment in other tests. If this is the correct solution we have evidence of an attitude being transferred.

Training in fables, too, has a negative effect on arithmetic, some effect on situations, but practically no effect on logic.

Training in arithmetic, besides having a positive effect on arithmetic, has a pronounced effect on situations.

Training in situations improves situations very much, has a negative effect on arithmetic, but no effect on the other tests.

One of the most outstanding points is that training in all types of material (except arithmetic) has a negative effect on arithmetic; but particularly unfavourable is the effect of training in logic on arithmetic. It is difficult to see why this should be so, for although it may be argued that arithmetic is the only one of the four subjects chosen which is found on the school curriculum, and that this, in some way, might make the arithmetic results different from the other results; it must be remembered that this would affect the control group just as much as the other groups and it was on the control group that the amount of gain to be expected was calculated.

I do not think that a difference in the classroom teaching of arithmetic between the control and experimental groups would account for the differences found with this subject. Certainly it is difficult to estimate differences in teaching ability, but, so far as I could judge, the teachers in the selected classes were comparable in their ability. In all the schools one class was taken by a young, ambitious, energetic teacher; and one by an older, capable, experienced teacher, all of whom were highly recommended by their headmasters.

It will be remembered, too, that the problems set in the tests were designed to depend for their solution on the children's reasoning ability rather than on the methods being taught in the classes at the time.

Again, it may be argued that arithmetic is not a function of the relation of evidence but of conjunction. But the arithmetic used here was problem arithmetic, which depends greatly on reasoning. So that it is clear that the relation of evidence was called into play.

Only in two instances is there evidence for positive transfer: training in fables has improved ability to deal with situations; and training in arithmetic has had a pronounced effect on skill in dealing with the same material. In both cases it would appear that what has been transferred is the method of attack. In the former case it must be remembered that during the training in fables[2] the children were first of all encouraged to draw general

2. See Appendix 3.

conclusions from fables—conclusions which were to be generally applicable to psychological relationships among human beings. They were then required to match proverbs and fables, and later on to construct or complete fables: in each case they had practice in eduction of relations and in the eduction of correlates with material which was similar to that used in Test 4. Here again the psychological relation is being used—all the situations deal with human beings and their problems. Unfortunately, however, for this explanation the reverse effect is not noticed. Training in situations does not affect ability to deal with fables. It appears, therefore, that it must be method of attack which is transferred. The method used in dealing with fables has been more effective for situations than that employed with situations when applied to fables. This differential result shows quite clearly, however, that it is not a general improvement in reasoning ability or it would have been evident in both directions.

In the second case a similar result may be noted. It will be remembered that the group trained in arithmetic was trained to analyse each problem and break it up into its component parts. Having found 'what was asked' they had to go back and, from 'what was given,' decide on the method of solving the problem. The group trained in situations, after discovering what was required by the problem, had to form an hypothesis and then go back and test it by means of the conditions of the problem.

Now training in arithmetic seems to have brought about an improvement in dealing with situations. On the contrary, training in dealing with situations has produced no corresponding gain in the arithmetic test. On the contrary, it has produced an adverse effect. It is quite clear from the argument used above that these results cannot be caused by similarity in the material in the two tests. It is equally sure that it is not due to increase in reasoning ability generally. It can only be caused by the methods employed. Why is it then that the method used in arithmetic increased the score in situations, and that the reverse effect follows from employing the method used in situations?

In the former case, it will be remembered, the children were asked to write down the things required and what data were given and then to solve the problem. This, it appears, had a good effect when dealing with situations. It probably resulted in greater attention to the facts given and so prevented hasty jumping to conclusions.

On the other hand the method employed in handling situations has proved detrimental in dealing with arithmetic. Here the whole test situation was reacted to, attention not being drawn to the

elements of the situation as in arithmetic, a fact which probably accounts for the adverse effect in that test.

Once again, then, it would appear that method of attack has been carried over. And incidentally we have hit upon a fact important for pedagogy. It is very problematical whether method of attack used on certain material will be advantageous or disadvantageous with other material. Training in the hope that good effects will be produced is of little use. The method used should be such that it is designed to assist in the other material if positive results are to be obtained.

The practice effect of the tests themselves from the first testing to the second testing cannot be held responsible for the improvement in any group since the practice effect would be the same for the control group as for other groups and the amount which the control gained was subtracted from the gains of the other groups in order to give their experimental gains.

Summarizing these results it may be said that they conform with reasoning material results already arrived at in other investigations into formal training.

There is no general increase in ability to reason. There is specific gain and this gain is not transferable except in cases where method of attack facilitates the handling of the new type of material. Negative transfer is similarly explicable.

(b) *Bearing on Teaching*

It has been maintained from time to time that children should be taught to reason and that certain subjects are beneficial in training their reasoning abilities. Surely the most beneficial subject for this purpose would be logic, yet, as this experiment has shown, logic has the most detrimental effect upon other material.

It would appear that it is useless to depend on one subject to improve another for improvement can be obtained only by specific training (except where a method of attack or attitude can be found common to two or more subjects).

As arithmetic is the only one of the four subjects dealt with here which is a school subject it would be of most interest to educationalists and teachers. The results show that training in problem arithmetic does improve arithmetic, but those who maintain that arithmetical reasoning will improve one's reasoning ability will get no support from this investigation. In teaching problem arithmetic the aim should be to improve problem arithmetic only. Teaching it for any other purpose is useless and anyone who hopes thereby to improve any reasoning power as a whole will be doomed to disappointment.

It may be argued by those who advocate that training in arithmetic is beneficial, apart from improving arithmetic itself, that this was the only subject that did show positive transfer since the group trained in arithmetic improved in solving situations. But this improvement, as has been shown, was due to similarity of method of attack and not to any quality in the arithmetic itself. Any subject with a similar method would serve quite as well as training to improve situations.

This is in accordance with Thorndike's findings[3] when he says that 'studies taken make little or no difference upon gain made during the year in power to think.'

He goes on to say that the traditional theory that the amount of general improvement in performance due to study was large, and that some studies, particularly mathematics and languages, produced more improvement than others was not borne out by the facts. This investigation has confirmed these conclusions for different types of reasoning and has thus found no support for the general contention that reasoning can be trained in degrees at all commensurate with popular opinion. And this has been shown to be true for what is often regarded as the principal reason for education, the training of the reasoning capacity. The general tenor of this investigation has been to confirm these conclusions. No evidence of general improvement has been found—a result we should expect to find if Spearman's position is correct.

Finally, Spearman's conclusions in regard to the relation of evidence can be noted here. He found that the relation as a whole correlates highly with 'g' and we may assume that this ability is innate and untrainable. He also goes on to show that there is no group or special factor broad enough to include the whole class of evidential relations, although, he adds, that there may be special logical and arithmetical abilities. These, however, may not be innate but acquired by training or habit.

Sleight, in dealing with the transfer of training, after reviewing the results of various investigations on the subject of memory training, concludes: 'Specific memory training is specific in its effects. There is no general memory function which can be developed by feeding it on any one material. With the establishing of this fact the whole house of cards known as formal memory training collapses. And, if this be the case with memory, it may be equally so with the functions known as judgment, observation, etc.'

The present investigation has shown that this is the case with reasoning.

3. E. L. Thorndike: 'Mental Discipline in High School Studies.' *Journal of Educational Psychology*, Vol. XV, pp. 1-22, 83-98.

(c) *Sources of Error*

Support is given by this investigation to the findings of Laycock and Strasheim, namely, that error is produced by reproduction taking the place of eduction. While marking the tests it was found that reproduction had played its part in many ways.

The answers were all given in good faith and the intelligence score of none of the children included in the groups was below normal, yet some answers revealed a remarkable lack of ability to grasp the essential points and to realize the absurdities involved in the answers given. A case in point was another solution of the bushfire problem previously quoted, in which it was suggested that the men could use the matches to burn their clothes off and then there would be nothing left for the bushfire to burn! Or again, in the case of the man trapped in a burning building (Test 4, No. 8), where it was stated that 'he could call to the people in the street that they were wanted on the telephone, then he could ring them up and tell them he was in the burning building.'

In both these instances the testees have realized that, in one case the matches and in the other the telephone wires have been the keys to the situation; but they have failed to take into account other facts and so have drawn the wrong conclusions. In other words they have grasped one or two fundaments only and so could not arrive at the correct result evidenced by all the fundaments. There were many answers of this type where the formation of 'short relationships' were applied where the formation of higher level relationships were needed.

Another interesting point which came to light during the marking of Tests 3 and 4 was that, while marking the final tests of the groups which had been trained in the material of these tests, it was found that, in some instances, the testees had reproduced some fact which they had learned during the training period and offered it as a solution in cases where it did not apply at all. For instance, in training on Test 4 material the solution to one of the training problems had been: 'The man could pretend he was looking for his dog.' This was then offered as a solution for No. 26 in Test 4.

Reproduction interfered in other ways, too, for often something familiar in the problem would apparently recall some story heard previously which would then be offered as a solution. For instance, in the situation in which a little girl was lost (Test 4, No. 11) the answer given was: 'The God of the Underworld had taken her,' a reference evidently to the story of Pluto and Proserpine.

In Test 3 precepts which had been instilled into the children at some time or another were often given as answers to questions. Thus (Test 3, No. 4) 'You shouldn't make noises with your teeth' or 'Little ones should have eyes but not ears' (Test 3, No. 17) or

'Always get as much fresh air as possible' (Test 3, No. 13). One somewhat elaborate answer to No. 8 was worded: 'That evil is a very horrid weed to be planted in our garden the heart. We must uproot it as soon as possible.'

Reproduction also took the form of merely repeating the story as 'The hare went to sleep and so the tortoise won.'

Although reproduction was responsible for the errors produced, and, in some cases even hindered training, as where wrong answers were due to a carry-over and wrong application of facts learned in the training period, it would also appear to be responsible for the one instance in which training in one branch of reasoning did improve another; that is, in the case where training in arithmetic provided a method of attack which could be carried over and used for solving situations.

Strasheim found that 'dull-old' children often relied upon reproduction for their solutions to problems and it would have proved interesting to have examined these types of answers in conjunction with the intelligence score and age of those testees who submitted the answers; but this was beyond the scope of the enquiry. Many answers took the concrete form as: 'The old woman was too greedy' (Test 3, No. 4), showing that the children had difficulty in thinking abstractly and were unable to arrive at the form 'We should not be greedy.' This, too, was probably characteristic of the 'dull-olds.'

BIBLIOGRAPHY

1. SPEARMAN: *The Nature of Intelligence and Principles of Cognition* (McMillan, 1923).
2. SPEARMAN: *The Abilities of Man* (McMillan, 1927).
3. SLEIGHT: *Educational Values and Methods* (Oxford University Press, 1915).
4. LAYCOCK: *Adaptability to New Situations* (Warwick & York).
5. STRASHEIM: *A New Method of Mental Testing.*
6. WINCH: 'The Transfer of Reasoning in School Children' (*B.J.P.*, Vol. XIII).
7. GATES: *Teachers' College Record* (Vol. XXV).
8. THORNDIKE: 'Mental Discipline in High School Studies' (*J.E.P.*, Vol. XV).
9. FOWLER, D. BROOKES: 'Transfer of Training in Relation to Intelligence' (*J.E.P.*, Vol. XV, pp. 413-422).

Appendix I

STATISTICAL ANALYSIS

THE report of an experiment in the *Teachers' College Record,* Vol. XXV, pp. 98-123, on which the procedure of the present experiment was based, makes mention of the major assumptions in calculating the gains and probable errors of the gains. One of these assumptions was that the gains were independent of the initial scores. This assumption was possibly correct for this particular experiment. It is not, however, a valid assumption to apply to the results of the present investigation, because there is on each of the four tests for the control or trained groups a negative and significant correlation between the gains and the initial scores. If, then, one compares two groups which are each given the initial and final tests, without training in each case, one would expect the group which scored most in the initial test to obtain the smaller gain. It becomes necessary to allow for this factor in determining the significance of the difference in gains of trained and control groups when the mean initial scores of the two groups are not identical.

The plotted regression line of gains against initial scores for each of the tests was practically linear. In view of the small number in each group a linear relationship between the two variables was assumed. To avoid confusion the discussion from this point on will be confined to a single test.

From the control group scores a regression equation giving expected gains when no training is given, in terms of initial scores, was determined. This equation may be denoted by

$$Y - M_2 = b_{21}(X - M_1)$$

where X is an initial score on the test;

M_1 is the mean of initial scores for the control group;

Y is the expected gain when no training is given, corresponding to X;

M_2 is the mean of the gains for the control group.

Let X_a, Y_a be the initial score and gain for an individual in a trained group (a), and e_1Y_a be the expected gain as determined by the control group of a person scoring X_a.

Then substituting e_1Y_a and X_a for Y and X in the above equation

$$e_1Y_a - M_2 = b_{21}(X_a - M_1),$$

averaging for all individuals in the trained group (a)

$$\overline{e_1 Y_a} - M_2 = b_{21}(\overline{X_a} - M_1)$$

whence $\overline{e_1 Y_a} = b_{21}(\overline{X_a} - M_1) + M_2$ where $\overline{X_a}$ is the mean initial score of the trained group. The deviation of the mean gain of the trained group from the expected gain as determined by the control group is therefore

$$\overline{Y_a} - \overline{e_1 Y_a} = \overline{Y_a} - b_{21}(\overline{X_a} - M_1) + M_2.$$

It is now necessary to determine the significance of this difference.

Suppose some other group had been taken as control. Then some other regression equation would have been derived. This new equation may be denoted by

$$Y - (M_2 + \beta) = (b_{21} + \lambda)[X - (M_1 + \alpha)]$$

where α, β, λ are increments in M_1, M_2, b_{21} respectively. The expected mean gain, $\overline{e_2 Y_a} = (b_{21} + \lambda)[\overline{X_a} - (M_1 + \alpha)] + M_2 + \beta$. The deviation of this expected mean gain from the expected mean gain determined from the regression equation of the actual control group is

$$\begin{aligned} e_2\overline{Y}_a - e_1\overline{Y}_a &= \{(b_{21} + \lambda)[\overline{X_a} - (M_1 + \alpha)] + M_2 + \beta\} \\ &\quad - [b_{21}(\overline{X_a} - M_1) - M_2] \\ &= -b_{21}\alpha + \lambda(\overline{X_a} - M_1) - \lambda\alpha + \beta. \end{aligned}$$

The standard deviation squared of the expected mean gains about the expected mean gain established by the actual control group is equal to the sum of the squares of N such deviations divided by N where N is some large number.

The sum of the squares of the deviates is the sum of squares and products. The variation in λ is determined on the usual chance basis (see Kelley: *Statistical Method,* 1924, p. 176). λ can be considered independent of α and β, which, on the other hand, are correlated.

α is the deviation in the mean initial score of an equally suitable group for control purposes from the mean initial score of the actual control group.

β is the corresponding difference in the mean gain.

The deviations between the mean initial scores of the five selected experimental groups are too great, for the first three tests at least, to be attributable to random sampling in the field tested and are much more likely due to difference in educational opportunity. So that instead of taking $\sigma_\alpha = \frac{\sigma_1}{\sqrt{N}}$ where σ_1 = standard deviation of initial scores in the control group, and N the number of cases in this group, a value for σ_α is determined from the five

initial mean scores for the five selected groups. This is a fairer assumption and does take some account of the variability of educational status in the different groups. This stretching of the distribution of α's leads to a higher correlation between α and β—taking the standard deviation of an array of β's corresponding to a particular value of α to be constant and equal to $\frac{\sigma_2}{\sqrt{N}}\sqrt{1-r^2_{12}}$ where r_{12} is the correlation between the initial scores and gain for the control group.

The regression line of β's on α's is given by

$$\beta = b_{21}\alpha$$

so that the correlation surface of α's and β's is

$$Z = \frac{1}{2\pi\sigma_\alpha \sigma_{\text{array }\beta\text{'s}}} e^{\frac{-(\beta - b_{21}\alpha)^2}{2\sigma^2_{\text{array }\beta\text{'s}}}} e^{\frac{-\alpha^2}{2\sigma^2_\alpha}}$$

$$\text{Whence } \sigma_\beta = \frac{\sigma_{\text{array }\beta}}{\sqrt{1-r^2_{\alpha\beta}}} = \frac{\sigma_2}{\sqrt{N}} \frac{\sqrt{1-r^2_{12}}}{\sqrt{1-r^2_{\alpha\beta}}}$$

$$r_{\alpha\beta} = \frac{b_{21}\sigma_\alpha}{\sqrt{\frac{\sigma^2_2}{N}(1-r^2_{12}) + b^2_{21}\sigma^2_\alpha}}$$

Reverting to the expression for the standard deviation squared of the expected gains from the expected gain determined by the control group, the average of the squares and products with the variations in α, β and λ limited as above is

$$b^2_{21}\sigma^2_\alpha + \sigma^2_{b_{21}}\cdot(\overline{X}_\alpha - M_1)^2 + \frac{\sigma^2_2}{N}\cdot\frac{1-r^2_{12}}{1-r^2_{\alpha\beta}}$$

$$- \frac{2b_{21}\cdot\sigma_\alpha\cdot\sigma_2\sqrt{1-r^2_{12}}\cdot r_{\alpha\beta}}{\sqrt{N}\sqrt{1-r^2_{\alpha\beta}}} + \sigma^2_{b_{21}}\sigma^2_\alpha.$$

The standard deviation of the mean gains of groups similar to the control group and with the same initial mean score is

$$\frac{\sigma_2}{\sqrt{N}}\sqrt{1-r^2_{12}}.$$

If the mean score of the control group had been $\overline{X}_\alpha$ the standard deviation of mean gains would be about the same. The standard deviation of the mean gains for the trained groups each with mean $\overline{X}_\alpha$ would also be about the same value. We may then take the standard deviation squared of the mean gains for trained groups each with initial mean $\overline{X}_\alpha$ as $\frac{\sigma^2_2}{N}(1-r^2_{12})$.

The standard deviation squared of the difference between the gain of the trained group and the expected gain from the control group is then

$$b^2_{21}\sigma^2_a + \sigma^2_{b_{21}}(\overline{X_a} - M_1)^2 + \frac{\sigma^2_2}{N} \cdot \frac{1 - r^2_{12}}{1 - r^2_{a\beta}}$$

$$- 2 \frac{b_{21}\sigma_a\sigma_2 \cdot \sqrt{1 - r^2_{12}} \cdot r_{a\beta}}{\sqrt{N}\sqrt{1 - r^2_{a\beta}}} + \sigma^2_{b_{21}}\sigma^2_a + \frac{\sigma^2_2}{N}(1 - r^2_{12})$$

where σ_1 = standard deviation of initial scores in the control group

σ_2 = standard deviation of gains in the control group

$$\sigma_a = \sqrt{\frac{\Sigma \text{ Deviations}^2 \text{ of means from mean of means for 5 grou}}{5 - 1}}$$

$$= \tfrac{1}{2}\sqrt{\Sigma(\text{Deviations})^2}$$

$$\sigma_\beta = \frac{\sigma_2}{\sqrt{N}} \frac{\sqrt{1 - r^2_{12}}}{\sqrt{1 - r^2_{a\beta}}}$$

$$\sigma_{b21} = \frac{\sigma_2}{\sigma_1} \sqrt{\frac{1 - r^2_{12}}{N}}$$

$$r_{a\beta} = \frac{b_{21}\sigma_a}{\sqrt{\frac{\sigma^2_2}{N}(1 - r^2_{12}) + b^2_{21}\sigma^2_a}}$$

If σ_a be taken as $\frac{\sigma_1}{\sqrt{N}}$ the expression for the standard deviation squared of the difference simplifies to

$$\sigma^2_{b_{21}}\left[(\overline{X} - M)^2 + \frac{\sigma^2_1}{N}\right] + \frac{2\sigma^2_2}{N}(1 - r^2_{12})$$

The values derived from the simple and more elaborate expressions did not differ by more than 5%.

Appendix II

THE TESTS

TEST 1

Answer as many of these questions as you can. If you find one that is too hard go on to the next one.

Look at this row of figures:—

1 2 3 4 5 6 ....

You can see that to finish the row properly we had to put 7 and 8 on the two dotted lines. Now try for yourself. Look at each row of figures below and on the two dotted lines write the figures that should come next.

1.	2	4	6	8	10	.....	.....	
2.	15	13	11	9	7	.....	.....	
3.	7	0	6	0	5	0	.....	.....
4.	4	7	10	13	16	.....	.....	
5.	4	8	12	16	20	.....	.....	

Put in the proper figures in the blank spaces.

1.	10	15	20	.....	30	35	.....
2.	10	9	8	7	.....	.....	4
3.	10	12	14	.....	18		
4.	13	10	7	.....	1		
5.	24	20	16	.....	8		

Read each group of words and cross out the one word which does not belong in the group.

For example, in the following group 'John' is crossed out because it is a boy's name and the others are all girls' names.

Mary Kate Jane ~~John~~ May

Now try to do these:—

1.	ring	necklace	necktie	brooch	armlet
2.	boot	shoe	stocking	slipper	sandal
3.	mountain	peak	mound	valley	hill
4.	book	newspaper	letter	pen	
5.	rose	swan	lily	carnation	kangaroo-paw

Look at this group of words:—

orange apple pear strawberry ..... fruit .....

You can see that they are all fruit so we put the word 'fruit' in the answer space. Do the same with the groups below. After each group write the name of that group:—

1.	blue	red	green	yellow	.....
2.	milk	water	tea	lemonade	.....
3.	bread	orange	meat	cheese	.....
4.	chair	table	bookcase	cupboard	.....
5.	pen	pencil	chalk	crayon	.....

Draw a line under the two words which tell what a thing always has. For instance, in the following example lines have been drawn under 'legs' and 'colour' because a spider must always have those, but it need not have the other things.

A spider always has:—

web legs colour insects sting

Now try to do these:—

1. Bread always has:—
   flour slice taste butter currants
2. A book always has:—
   covers pages print pictures jokes
3. A mountain always has:—
   height snow trees top rivers
4. A plant always has:—
   roots flowers perfume stem thorns
5. The sea always has:—
   salt beach water ships foam

1. Tom has a cousin Jack, a sister Mary and two brothers called Dick and Harry.

Now answer the following questions about these people:—

1. Who is Dick's sister? .....
2. Who is Mary's cousin? .....
3. Who is Jack's brother? .....
4. How many brothers has Harry? .....
5. How many cousins has Jack? .....

2. How many great-grandfathers could you have?

Answer.....

3. Fred Grant is an only child, but he has three cousins, Tom, Dick and Mary. How many cousins has Mary?

Answer.....

4. Mr. Brown is Fred Grant's uncle. Mr. Brown has two brothers and three sisters. How many uncles and aunts has Fred altogether?

Answer.....

5. Mr. and Mrs. Smith have a son and two daughters. Their youngest daughter has a little girl. What relation is Mr. Smith's son to the little girl?

Answer.....

Answer as many of these questions as you can. Put a tick (√) against the right answer.

1. Dick runs faster than Jack.
   Harry runs slower than Jack.
   Which is the slowest of the three?

   Dick.
   Jack.
   Harry.

2. Alice is cleverer than May.
   May is cleverer than Rose.
   Who is the cleverest?

   Alice.
   May.
   Rose.

3. Harry was as tall as Tom and Tom was as tall as John. Was Harry taller than John?

   Yes.
   No.

4. There is a large dam in one of the fields of Mr. Smith's farm. Mr. Smith's farm is as big as King's Park. Which is bigger, the dam or King's Park?

   The dam.
   King's Park.

5. Three books are lying in a row. A red one is on the left of a blue one, and a green one is to the left of the red. Which book is in the middle?

   Red.
   Blue.
   Green

6. A table is on the right-hand side of a chair and a sideboard is on the right-hand side of the table. Is the sideboard on the right-hand side of the chair or on the left-hand side of the chair?

   Right-hand side.
   Left-hand side.

7. A train left Fremantle to go to Perth and at the same time a train left Perth to go to Fremantle, but the train from Fremantle to Perth travelled the faster. Where do you think they met?

   Exactly in the middle.
   Nearer Fremantle.
   Nearer Perth.

8. I want to buy some fruit from a man. I don't like very small fruit and I can't carry a very large parcel of fruit. Neither he nor I have a knife. The only kinds of fruit the man has are grapes, strawberries, apples and an uncut watermelon. What shall I buy?

   Grapes.
   Strawberries.
   Apples.
   Watermelon.

9. Johnny lived too far from school to walk and there were only three other ways which he could go. He could go by train or by tram-car. The bus was too expensive and if he travelled in a train he became train-sick. How did Johnny go to school?

   Walking.
   Train.
   Bus.
   Tram-car.

10. 'Mother has promised me a penny if my roses have flowers before hers do,' said little Mary. Mary's mother always kept her promises, but Mary did not get the penny; whose roses do you think had flowers first?

Mary's.
Her Mother's.

Here are some sentences that are silly. Put a tick (√) against the best answer that tells you why it is silly. Mark only the one best answer in each case. Below is an example showing you the way to do it.

I know a road from my house to the city which is downhill all the way to the city and downhill all the way back again.

This is silly because:—

There is no road to the city.	( )
If it was downhill one way it must be uphill the other.	(√)
I do not live in the city.	( )

Now try to do these:—

1. A soldier writing home to his mother said: 'I am writing this letter with a sword in one hand and a pistol in the other.'

This is silly because:—

You don't write with a sword.	( )
Soldiers don't write when they are fighting.	( )
Both his hands were full so he couldn't write.	( )

2. It is said that a town in Greece contains two relics of St. Paul; his skull when he was a boy and his skull when he was a man.

This is silly because:—

A man can have only one skull.	( )
St. Paul never lived in Greece.	( )
St. Paul died when he was a boy.	( )

3. An old gentleman complained that he could no longer walk round the park as he used to do; he could now go only half way round and back again.

This is silly because:—

Old gentlemen don't walk round parks.	( )
Half way and back is as far as all the way round.	( )
The old gentleman was a cripple.	( )

4. A soldier in the march complained that every man was out of step except himself.

This is silly because:—

They were badly-trained soldiers.	( )
They should all step off with the right foot.	( )
He was out of step himself.	( )

5. In the year 1915 more women got married than men.

This is silly because:—

More men than women get married. ( )
The same number of women get married as men. ( )
1915 was not a leap year. ( )

6. Light comes from the sun. Feathers are light, therefore feathers come from the sun.

This is silly because:—

The word 'light' is used with different meanings. ( )
Light comes from the moon as well. ( )
The sun is heavy. ( )

7. A hunter who had used up all his bullets was chased by a bear. A bright idea struck him. He would climb a tree. When he got to the top he remembered that the bear could also climb a tree, but he got out of his difficulty by pulling the tree up after him.

This is silly because:—

He should have killed the bear. ( )
He could not pull the tree up when he was on it. ( )
The tree was not big enough. ( )

8. A boy who wanted to go to the pictures, but had no money, thought it would be a good plan to walk in backwards for the man at the door would think he was going out and would not ask for his ticket.

This is silly because:—

It is wrong to go to pictures without money. ( )
The man asks people for their tickets when they are going out. ( )
The man could see he was moving in instead of out. ( )

9. There is a tree in America which is so tall that it takes two men and a boy to see the top.

This is silly because:—

They should have climbed up the tree. ( )
Trees do not grow as tall as that in America. ( )
Two men and a boy together could see no farther than one man. ( )

10. This is a sad and bitter world. We never strew flowers on a man's grave until he is dead.

This is silly because:—

A man hasn't a grave until he is dead. ( )
It is sad to strew flowers on a grave. ( )
The flowers die, too. ( )

Answer as many of these questions as you can. If you find one that is too hard, go on to the next one.

Look at this row of figures:—

1 2 3 4 5 6 ....

You see that to finish the row properly we had to put 7 and 8 on the two dotted lines. Now try for yourself. Look at each row of figures below and on the two dotted lines write the figures that should come next.

1.	5	9	13	17	21	.....	.....	
2.	43	36	30	25	21	18	.....	.....
3.	3	1	5	1	7	1	.....	.....
4.	1	2	4	7	11	16	.....	.....
5.	12	13	11	14	10	15	.....	.....

Put in the proper figures in the blank spaces:—

1.	2	4	8	.....	32				
2.	1	3	9	27	.....				
3.	9	10	8	11	.....	12			
4.	1	5	6	2	5	6	.....	5	6
5.	1	2	0	3	4	0	.....	.....	.....

Read each group of words and cross out the one word which does not belong in the group.

For example, in the following group 'John' is crossed out because it is a boy's name and the others are all girls' names.

Mary Kate Jane ~~John~~ May

Now try to do these:—

1. chicken beetle ant bee fly
2. England London Italy Germany France
3. leaves flowers seeds green branches
4. cricket football tennis riding farming
5. flood torrent deluge wind downpour

Look at this group of words:—

orange apple pear strawberry ..... fruit .....

You can see that they are all fruit so we put the word 'fruit' in the answer space. Do the same with the groups below. After each group write the name of that group:—

1. duck sparrow hen lark .....
2. Australia England Japan India .....
3. gold iron copper silver .....
4. diamonds rubies pearls emeralds .....
5. snow ice hail sleet .....

Draw a line under the two words which tell what a thing always has.

For instance, in the following example, lines have been drawn under 'legs' and 'colour' because a spider must always have those, but it need not have the other things.

A spider always has:—

web legs colour insects sting

Now try to do these:—

1. Fruit always has:—
   juice taste plums core skin

2. A shoe always has:—
   leather sole lace tongue shape

3. A dictionary always has:—
   words meanings cover chapters pictures

4. A dog always has:—
   paws bark hair collar name

5. A box always has:—
   wood nails weight lid space

1. Two years ago Jane was two years younger than Mary. How many years younger than Mary is she now?

Answer.....

2. John is twice as tall as William would be if William were twice as tall as he really is. Who is the taller, John or William?

Answer.....

3. Hilda is as old now as Ann was two years ago. Who is older, Hilda or Ann?

Answer.....

4. If all kangaroos have pouches, are all the animals that have pouches kangaroos?

Answer.....

5. If mulberries are green when they are red, are all red mulberries green?

Answer.....

Answer as many of these questions as you can. Put a tick (√) against the right answer.

1. Every boy who played football in the school team wore a badge. John wore a badge; did he play football or not?

Yes.
No.

2. There was an outbreak of typhoid fever at Burton. Strangely enough whole families contracted the disease while other families escaped quite free. The germs of typhoid are generally carried in impure water or milk. All the houses of Burton are supplied by the Metropolitan Water Company, but some families use water from the public fountain as well.

The town of Burton is supplied by three dairies, one of which, it was found, sold impure milk, but many of the families which used this milk did not get typhoid fever.

What do you think was the source of the outbreak of typhoid at Burton?

The Metropolitan Water Supply.
The public fountain.
The impure milk.
The other milk.

3. More than half the boys in the football team can play cricket and more than half the boys in the football team can swim. Do you think there are any boys in the team who can both play cricket and swim or do you think there are no boys in the team who can both play cricket and also swim, or is it impossible to tell?

Some boys can both play cricket and swim.
No boys can both play cricket and swim.
It is impossible to tell.

4. If the only places in town where you can buy apples are fruit shops, and all the fruit shops in that town are in York Street, would it be true to say that the only places in that town where you can buy apples are in York Street?

Yes.
No.

5. Mary was ill so her mother sent for the doctor. The doctor said that if Mary had a sore throat she might have bad tonsils, influenza or diphtheria. If she was coughing it might be influenza or diphtheria. If there was a white coating in her throat it would probably be bad tonsils or diphtheria. Mary's throat has a white coating and she has been coughing. What do you think is the matter with her?

Bad tonsils.
Influenza.
Diphtheria.

6. Rice and Potatoes must have plenty of moisture in order to grow well, but where it is dry rye and cotton can be grown. Rice and cotton grow only where it is hot and potatoes and rye only where it is cool.
In southern Hemel it is very hot and damp. What do you think grows there?

Potatoes.
Rye.
Rice.
Cotton.

7. Father has just come home smoking a new brand of cigarettes. He has had his hair cut and there is mud on his boots, which he would not have got by walking on paved streets. The only places he can have been to are Norton, Burley, Eastbay and the City, and he hasn't had time to go to more than one of these. There are tobacconists only in Norton, Eastbay and the City. There are hairdressers only in Eastbay, Burley and the City. The streets in the City are all paved, but in the other places they are not. Where do you think Father has been?

Norton.
Eastbay.
Burley.
The City.

8. I started from the church and walked 150 yards. I turned to the right and walked 50 yards. I turned to the right again and walked 150 yards. How far was I from the church?

Answer.....

9. There are four roads here. I have come from the north and want to go to Hillview. The road to the right leads somewhere else. Straight ahead it leads only to the beach. In which direction is Hillview?

North.
South.
East.
West.

10. Bill and Tom both went from a town called A to a town called B. Bill walked first to a town called C, and then he rode on a bicycle from C to B; but Tom walked on a road from A to B which did not pass through C. Can you tell who went the shorter way?

Answer.....

Here are some sentences that are silly. Put a tick (√) against the best answer that tells you why it is silly. Mark only the one best answer in each case. Below is an example showing you the way to do it.

I know a road from my house to the city which is downhill all the way to the city and downhill all the way back again.

This is silly because:—

There is no road to the city.	( )
If it was downhill one way it must be uphill the other way.	(√)
I do not live in the city.	( )

Now try to do these:—

1. A man said to his shoemaker: 'You blockhead, I told you to make one of the shoes larger than the other and instead of that you have made one of them smaller than the other.'

This is silly because:—

The shoes should have been the same size.	( )
If one were larger the other would have to be smaller.	( )
He should have bought his shoes somewhere else.	( )

2. A sailor who was told to pull in a rope from the sea found it so long that he gave it up in disgust, saying that somebody must have cut the end off.

This is silly because:—

He should have kept on pulling.	( )
You can't cut the end off a rope.	( )
There would still be an end on the rope.	( )

3. The moon is more useful than the sun for it gives us light in the night when we really need it, while the sun gives us light in the day when we don't need it.

This is silly because:—

We go to bed at night.	( )
The moon is not useful.	( )
The sun makes the daylight.	( )

4. A forgetful man once tied a knot in his handkerchief to remind him of something, but he suddenly remembered that the last time he did this he could not recall what it was he had to remember, so this time he tied

two knots to make sure. The first knot was to remind him that he had to remember something; the second to remind him of what that something was.

This is silly because:—

The second knot would not help him any more than the first one. ( )
You remember without knots. ( )
Knots do not help you to remember. ( )

5. A man saw an advertisement: 'Buy one of Simpkin's stoves and save half your coal.' He bought two so as to save all of it.

This is silly because:—

Simpkin's stoves don't save coal. ( )
If he used two stoves he would use twice as much coal. ( )
Coal is not used in stoves. ( )

6. A speaker at a meeting said: 'We must all save. The man who generally buys four suits of clothes a year should be satisfied with three; the man who buys three should be satisfied with two, and so on.

This is silly because:—

You can't save when you buy suits. ( )
The speaker was wearing a suit himself. ( )
The man who buys one suit would have to buy none. ( )

7. A man once said: 'Friday is such an unlucky day. I would hate to be run over by a motor car on a Friday.'

This is silly because:—

Friday is not an unlucky day. ( )
It would be just as unlucky to be run over on any other day. ( )
He had a motor car himself. ( )

8. 'I don't like onions,' said a boy, 'and I'm glad I don't, for if I did I should be eating them all day and I hate the beastly things.'

This is silly because:—

If he liked them he would not hate them. ( )
He couldn't eat onions all day long. ( )
Onions have a nasty taste. ( )

9. 'I have always noticed,' remarked the old man, 'that if I do not die in March I am all right for the rest of the year.'

This is silly because:—

People do not die in March. ( )
The old man was very healthy. ( )
March is no more dangerous than any other month. ( )

10. Some years ago it was proposed to move Sunday from the end of the week to the middle so as to divide the week into two parts.

This is silly because:—

You can't move Sunday. ( )
There would still be a week from one Sunday to the next. ( )
Sunday is a holiday. ( )

TEST 2

Write each answer on the answer line. If you find a sum is too hard, go on to the next one.

(The original test papers included a column on the right for working.)

1. Tom walked to Guildford; it is 16 miles from his home. If he walked at 3 miles an hour, how long would he take to get there?
   Answer.....
2. If Tom owes me 19/2 and I owe him 14/-, how much must he still pay me?
   Answer.....
3. If a horse trots 48 miles at the rate of 6 miles per hour, how long does it take him to do the journey?
   Answer.....
4. A girl bought 7 packages of post-cards and, when she unwrapped them, found she had 84 cards altogether. How many cards were there in each package?
   Answer.....
5. The children of a school had a sports day. There were 650 children at the sports and 215 of them did not enter in any race. How many children did enter a race?
   Answer.....
6. A box of chalk in which there were 144 pieces lasted a year. If each teacher used 48 pieces, how many teachers were there in school?
   Answer.....
7. My book-shelf is 3½ feet long; how many books will it hold if each is 2 inches thick?
   Answer.....
8. Share 2/1 equally among 10 boys.
   Answer.....
9. The answer to a 'take-away' sum is £4/4/8, and the top line is £9/8/6. What is the second line?
   Answer.....
10. I had three shillings for tram fares and I spent threepence a day for a week. How much had I left at the end of the week?
    Answer.....
11. If half an inch equals ninepence, how long would you make a line that was equal to 10/6?
    Answer.....
12. I have an empty album that will hold 100 snaps. I have used six rolls of film and each roll takes six snaps. How many more must I take to fill the album?
    Answer.....
13. A man had 640 nuts; one out of every eight was bad; how many good ones were there?
    Answer.....

14. How much had a man left out of a ten-pound note after spending £2/16/8 on Monday and twice as much on Tuesday?
Answer.....

15. If apples were 4 for threepence, how many could I buy for 3 shillings?
Answer.....

16. Two girls played a number game; one girl made 36 points, the other 12 points. The score of the winner was how many times the score of the girl who lost?
Answer.....

17. How much shall I need to give a half-crown, a shilling and a sixpence to each boy if there are 18 boys?
Answer.....

18. When oranges were three for a penny, how many could I buy for two shillings and sixpence?
Answer.....

19. A dealer exchanged a truck load of potatoes for 9 tons of coal worth £1/9/6 a ton. What was the value of the potatoes?
Answer.....

20. How many words are there in a book of 60 pages at 30 lines to a page and 9 words to a line?
Answer.....

21. One boy can do a piece of work in 924 days. How long will it take 7 boys to do it if they work at the same rate?
Answer.....

22. My brother is 32 years old. I was born when he was 10. Add both our present ages together.
Answer.....

23. I posted a letter each day in January, and each letter bore a twopenny stamp. How much did the postage amount to?
Answer.....

24. If the railway fare is 3½d. a mile, what will it cost 9 people to travel 7 miles?
Answer.....

25. What is the difference between one-half and one-quarter of 16/4?
Answer.....

26. A farmer bought 11 pigs at £1/1/10 each, and sold the lot for £20. How much did he gain?
Answer.....

27. Mary had three times as much money as John. John had ninepence more than Tom. Tom had 1/6. How much had they altogether?
Answer.....

28. If it takes 156 trees to plant two acres of land, how many trees will be needed for 13 acres?
Answer.....

29. A farmer who had already sold 167 cases of apples from his orchard, hired 9 boys to pick the apples left on the trees. Each boy picked 24 cases of apples. What was the total number of cases the farmer got from his orchard that year?
Answer.....

30. John had 15/2, Dick had 12/8, and Mary had 13/5. With this money they bought their mother a present and received 2/6 back as change. How much did the present cost?

Answer.....

31. During a year a room in a school used 6 boxes of chalk, each holding 144 sticks. There were 48 children in the room. If each child had been given his share at the beginning of the year, how many sticks would each have received?

Answer.....

32. On a bicycle trip a party of boys rode 12 miles the first hour, 14 miles the second, 10 miles the third, and 9 miles the fourth. Then they stopped for the day. If they rode as many miles on each of the seven days, what was the total length of the trip?

Answer.....

33. A man bought 100 dozen oranges. After throwing away 10 dozen bad ones, he put the rest into cases. Each case held 120 oranges. How many cases did he use?

Answer.....

34. How many dozen walnuts at a halfpenny each are worth a dozen bananas at a penny halfpenny each?

Answer.....

35. I must be at the station twenty minutes before my train starts. It starts at twenty-five to one. When should I be there?

Answer.....

36. At the rate of 18 inches per minute how long would it take a snail to crawl 3½ yards?

Answer.....

37. If I left home at ten past ten this morning, and I reached Perth at a quarter to twelve, how long did the journey take?

Answer.....

38. A man walked two miles in thirty minutes. How many hours would fifteen miles take him?

Answer.....

39. If I buy two pounds of apples for eightpence, how much shall I pay for nine pounds?

Answer.....

40. A wall is 30 feet long and four feet high. How much would it cost to whitewash it at a penny a square foot?

Answer.....

41. If you divide £1/16/- into two shares so that one share is 4/- more than the other, how much is the smaller share?

Answer.....

42. A group of children took turns in counting the motor cars that passed a school. They counted 165 cars in 5 hours. Six months later they counted 42 cars in an hour. How many more cars passed the school each hour than at first?

Answer.....

43. If a postman walked twelve miles a day for 6 days a week and 6 miles on Sunday, how many miles will he walk in a year?

Answer.....

44. A man spends £1/18/6 each week out of his weekly wage of £2/4/-. How much does he save in twelve weeks?

Answer.....

45. A girl read 100 pages in both her reading and her history books. By counting she found there were 2,586 letters on one page of her history book and 2,491 letters on a page of her reading book. How many more letters had she read in one book than in the other?

Answer.....

46. I paid 12/6 for a ham at 10 pence a pound. How heavy was the ham?

Answer.....

47. If an aeroplane can fly from here to Burton in 45 minutes, how long would it take to fly to Whitegate? (Distance to Burton, 40 miles; to Whitegate, 36 miles.)

Answer.....

48. At the Christmas entertainments for poor children 2,500 presents were given away the first night and 1,894 presents the second night. If there were 26 schools in the city and each gave an equal share, how much did one school give?

Answer.....

49. A man earns £5 per week and saves a quarter of that much every fortnight. How much does he spend in a month?

Answer.....

50. The number of second class passengers in a train was three times the number of first class passengers, and the number of third class passengers was half the number of second class. There were seven first class passengers. If the third class passengers paid threepence each, how much did the third class passengers pay altogether?

Answer.....

TEST 3

Here are some short stories which try to teach us different lessons. Read each one carefully and then try to write down in a few words what lesson each story teaches us. If you find one that is too hard, go on to the next one.

1. Once a hare laughed at a tortoise because he was so slow. The tortoise then said he would run a race against the hare at once. So the tortoise started off, jogging along, without a moment's stopping, at his usual steady pace. The hare, who treated the whole matter as a joke, said she would first have a little sleep because she could easily overtake the tortoise afterwards. Meanwhile the tortoise plodded on and the hare, who overslept herself, reached the winning post only to see that the tortoise had got in before her.

What lesson does that story teach us?

.....

.....

2. An ant, who was drinking at a pool, fell into the water and was almost drowned; but a dove that was passing saw the ant's danger and, plucking off a leaf from a tree, dropped it into the water. The ant then climbed upon the leaf and so floated safely ashore. Soon afterwards a man was setting a trap to catch the dove, but when the ant saw what he was doing he bit the man's heel so that he dropped the trap. The dove, hearing the noise, was warned and so flew away safe.

What lesson does that story teach us?

.....

.....

3. An old crab said to a young one: 'Why do you walk crooked, child? Walk straight!'

'Mother,' said the young crab, 'show me the way, will you? and when I see you walking straight I will try and follow.'

What lesson does that story teach us?

.....

.....

4. An old woman kept a hen which laid an egg every morning. Thought the woman to herself: 'If I double the amount of food I give my hen she will lay twice a day.' So she tried her plan, and the hen became so fat and sleek that she left off laying at all.

What lesson does that story teach us?

.....

.....

5. On a cold frosty day an ant was dragging out some of the corn which he had laid out in summer-time. A grasshopper half perished with hunger asked the ant to give him some to save his life. 'What were you doing all summer-time?' asked the ant. 'Oh,' said the grasshopper, 'I was not idle, I kept singing all the summer long.' 'Well,' replied the ant, 'since you could sing all summer, you may dance all winter.'

What lesson does that story teach us?

.....

.....

6. A fox who had never seen a lion, when by chance he met one, almost died of fright. When he met him the second time he was still afraid, but managed to hide his fear. When he saw him the third time, he was so much emboldened that he went up to the lion and asked him how he was.

What lesson does that story teach us?

.....

.....

7. A thrifty old widow kept two servant maids whom she used to call up to their work at cock-crow. The maids did not like this early rising and so decided to kill the cock as he was the cause of all their trouble by waking their mistress so early. But after they had done this the old lady, who missed the cock, was so afraid of sleeping too late that she continually mistook the time of day and roused them up at midnight.

What lesson does that story teach us?

.....

.....

8. Three bulls fed together in a field in the greatest peace and friendliness. A lion had watched them for a long time in the hope of being able to kill one for his dinner, but he found there was little chance of his doing so as long as they kept together. He therefore began secretly to spread evil tales of one against the other until he had made them distrust each other. No sooner did the lion see that they avoided one another and fed each by himself apart, than he fell upon them singly and so made an easy prey of them all.

What lesson does that story teach us?

.....

.....

9. A wild boar was sharpening his tusks against a tree when a fox coming by asked him why he did so. 'For,' said the fox, 'I see no reason for it. There is neither hunter nor hound in sight, nor any other danger that I can see at hand.' 'True,' replied the boar, 'but when that danger does arise I shall have something else to do than to sharpen my weapons.'

What lesson does that story teach us?

.....

.....

10. A fox, who was closely followed by the hounds, saved himself by springing on to a wall. In order to get down on the other side he caught hold of a thornbush and arrived safely at the bottom with the exception of a few scratches which he received from the thorns, whereupon he became very angry with the thornbush for scratching him.

What lesson does that story teach us?

.....

.....

11. A rat who wanted to cross a river asked a frog to take him across. The frog, who secretly hated the rat, agreed to do so. He therefore tied the rat's foot to his foot and started to swim across. When he reached the

middle of the river, however, he stopped and refused to go any farther, hoping that the rat would drown. An eagle, seeing the rat in the water, swooped down and carried him off for his dinner, but as the frog was tied to the rat and could not escape, the eagle ate him up, too.

What lesson does that story teach us?

.....

.....

12. An ass undertook to run a race with a horse. The ass lost, as was expected, and got laughed at. 'I now see what was the matter with me,' said the ass. 'I ran a thorn into my foot some months ago and it still pains me.'

What lesson does that story teach us?

.....

.....

13. A tortoise once grew tired of spending all his days with his head in a hole and his house on his back and he grew envious of other animals that could roam around at pleasure, so he asked an eagle to teach him to fly. The eagle tried to persuade him not to do such a silly thing as it was against nature and commonsense, but the tortoise would not listen to him and so at last the eagle agreed. He took the tortoise up into the air and then let him loose, telling him to fly, but the tortoise, not being able to fly, fell plump upon a rock and was dashed to pieces.

What lesson does that story teach us?

.....

.....

14. An ass and an ox were pulling a waggon. While the ox was pulling with all his might he broke his horn, whereupon the ass complained that he was getting no help from his companion. The poor ox then pulled harder than ever and broke his other horn; finally he worked so hard he fell down exhausted and died. Then the ass had to pull the loaded waggon and the body of the dead ox by himself, and as the burden was too much for him, he, too, dropped down exhausted and died. The birds then flew over him, saying: 'If he had shared the work with the ox he would not have been killed with overwork himself.'

What lesson does that story teach us?

.....

.....

15. A man went lion hunting in a forest, where, meeting with a woodman, he asked him if he had seen any tracks of a lion, and if he knew where its den was. 'Yes,' said the man, 'and if you will come with me I will show you the lion himself.' At this the hunter turned very pale and his teeth chattered. 'Oh, thank you,' he replied, 'it was the lion's track, not himself, I was hunting.'

What lesson does that story teach us?

.....

.....

16. A countryman caught a hawk that was chasing a pigeon. The hawk pleaded for herself that she never did the countryman any harm, 'and, therefore, I hope,' she added, 'that you will do me none.' 'Well,' said the countryman, 'and pray what wrong did the pigeon ever do you? Now by reason of your own argument you should be killed.' And with that he killed the hawk.

What lesson does that story teach us?

.....

.....

17. Once a monkey, in his old age, became weak-sighted. He had heard men say that this could be cured by spectacles, so he got half-a-dozen pairs of spectacles, turned them now this way and now that, put them on the top of his head, fastened them to his tail, smelled them, licked them, still the spectacles had no effect on his sight.

'Goodness,' he cried, 'what fools they are who listen to all the nonsense men utter; they have told me nothing but lies about the spectacles.' And then he threw them hard upon a stone so that they were dashed to bits.

What lesson does that story teach us?

.....

.....

18. Once upon a time the mice, being sadly distressed by a cat, called a meeting to decide upon the best means of getting rid of this continual annoyance. Many plans were discussed until at last a young mouse got up and proposed that a bell be hung round the cat's neck, so that they would have notice of her coming and be able to escape. This suggestion was greeted with great applause and was agreed to by everyone. Then an old mouse, who had sat silent all the while, got up and said that he considered the suggestion very clever and would probably prove most successful; but he had one short question to ask, and that was, which of them would tie a bell on the cat?

What lesson does that story teach us?

.....

.....

19. A stag one day came to a pool and, as he stood drinking, he saw his form reflected in the water. 'What beauty and strength,' he said, 'are in these horns of mine; but how unseemly are these weak and slender feet!' Just then the huntsmen and hounds came that way. The feet, with which he had found so much fault, soon carried him out of the reach of his pursuers; but the horns, of which he was so vain, becoming entangled in a thicket, held him till the hunters again came up to him, and proved the cause of his death.

What lesson does that story teach us?

.....

.....

20. Once upon a time some people, wishing to protect their town against their enemies, called a meeting to decide upon the best means of doing so. A bricklayer said that no material was so good as brick for the purpose. A carpenter begged leave to suggest that timber would be far preferable.

Then a tanner stood up and said: 'Sirs, when you have said all that can be said, there is nothing in the world like leather.'

What lesson does that story teach us?

.....

.....

21. An ass had the misfortune to be met by a hungry wolf. 'Have mercy on me,' said the trembling animal. 'I am a poor sick beast; look what a thorn I have run into my foot.'

'Really, you quite grieve me,' replied the wolf. 'I feel myself compelled to put you out of your misery.' So he tore the pleading ass to pieces.

What lesson does that story teach us?

.....

.....

22. A man who had to cross a river sounded it up and down to try and find a place where it was easiest to cross. He found that where the water ran smooth it was deepest and shallowest where it made the most noise.

What lesson does that story teach us?

.....

.....

23. As a wolf was roaming over a farm he came to a field of oats, but, not being able to eat them, he left them and went his way. Presently, meeting a horse, he bade him come with him into the field. 'For,' says he, 'I have found some splendid oats; and I have not tasted one but kept them all for you, for the very sound of your teeth is music to my ear.' But the horse replied: 'A pretty fellow! If wolves were able to eat oats I suspect you would not have preferred your ears to your appetite.'

What lesson does that story teach us?

.....

.....

24. A wolf, looking into a hut and seeing some shepherds comfortably enjoying a leg of mutton, said: 'A pretty row these fellows would have made if they had caught me at such a supper!'

What lesson does that story teach us?

.....

.....

25. An oak and a willow were arguing as to which had the most strength, constancy and patience. The oak scolded the willow because it was weak and wavering and gave way to every blast that blew. The willow did not reply, but shortly afterwards a great storm arose. The willow bent and gave to the wind and still recovered itself without receiving any damage; but the oak was stubborn, standing upright against the fierce wind until at last it was uprooted.

What lesson does that story teach us?

.....

.....

Try to write down in a few words what these sayings mean:—

1. Make hay while the sun shines.

Answer.....

.....

2. There is no use in crying over spilt milk.

Answer.....

.....

3. A stitch in time saves nine.

Answer.....

.....

4. Empty vessels make the most sound.

Answer.....

.....

5. All is not gold that glitters.

Answer.....

.....

TEST 4

Answer as many of these questions as you can. If you find one that is too hard, go on to the next one.

1. A very rich man had a bull-dog to look after his home and keep away thieves. This dog was so fierce that no one could go near him except his master. Strangers dared not go near his kennel when he was chained there, but his master could play with him as though he were a puppy.

One day the rich man bought a diamond. He was afraid it would be stolen so decided to hide it. It was no use hiding it in the house because the servants would be sure to find it. If he buried it they would see the place where it was buried, and he did not want to carry it around with him.

Where was he to hide it?

.....

.....

2. In ancient times a brave man, called Perseus, killed a terrible monster and cut off its head. He used to carry this head in a bag wherever he went, but he never looked inside the bag because whoever looked at the monster's head was instantly turned to stone.

Once, when he was journeying back to his own country with the bag slung on his shoulder, he was surrounded by a band of robbers who were about to kill him. Perseus was brave but he could not fight so many men. As his enemies were all round him he could not escape.

What was Perseus to do?

.....

.....

3. Oto had been imprisoned in a cave by a blind witch. He could not get out because the witch sat at the door of the cave and felt everything that passed in or out, and there were no other openings in the cave.

The witch kept some pigs in the cave and every day she used to let them out to the fields in the morning and let them in at night.

Oto tried to go out with the pigs but the witch sat at the door of the cave and felt each one as it passed. When she felt the hair she knew it was a pig and let it go, but when Oto tried to crawl out she could not feel the hair on his back and so she would not let him pass.

How do you think Oto could get out?

.....

.....

4. Once there was a man who was so strong that, even when he was a baby, he could strangle huge snakes with his bare hands. Indeed, he often used to say that his strong hands were the best things with which to fight.

Once he set out to kill a lion, so he took his bow and arrows and went into the forest. When he reached the lion's cave he stole up on it and fired an arrow, but the lion's skin was so tough that the arrow would not pierce it. The lion awoke and rushed at the man, who immediately dropped his bow. As it could run faster than he could it was no use his running

away. There was no place he could hide and no trees he could climb. The lion was almost upon him. If he did not kill it, it would kill him.

How do you think the man killed the lion?

.....

.....

5. Mary and Jane used to go to the pictures so much that they became very clever at guessing what the actors on the screen were saying by just watching their lips. They used to have great fun at home—one saying things without making a sound, and the other guessing what had been said by watching her sister's lips.

Once they went to the pictures with their brother. Jane wanted to tell Mary something but she did not want her brother to hear. He was sitting between the two girls and she could not lean forward and whisper, nor could she get up and go around to Mary. Yet Jane managed to tell Mary what she wanted without letting him know.

How do you think she did it?

.....

.....

6. A robber lived on an island surrounded by a swamp which one could not wade or swim across. A king wanted to capture the robber but did not know how to cross the swamp with his army. They had no boats with which to row across and they could not build a bridge, although there was plenty of timber to make it, because the mud was too soft and boggy to put in poles to hold up the bridge.

How was the king to cross the swamp with his army?

.....

.....

7. A man who had escaped from some soldiers hid on a very high rocky cliff which he reached by a secret path. The cliff was so rocky that only goats could climb it; no one who did not know the secret path could get up.

The soldiers knew the man was on the cliff but, as they could not climb it they camped around the bottom of the cliff and decided to starve him out.

The man's sister knew also that he was hidden on the cliff, but she could not take food to him for the soldiers would not let her past them, and she did not know the secret path. Each day, as she took her goats out to the fields, she used to look up at the cliff and wonder how she could send food to her brother.

If she tied a parcel on one of the goats the soldiers might see the parcel.

How do you think she could send food to her brother?

.....

.....

8. A man had been trapped in a burning building. He was several stories from the ground and, as the bottom of the building was in flames he could not get down, although he could go up to the roof if he wished.

No one knew he was in the building so no one bothered to try and get him out. He rushed to the window of his room but he could not climb down as the lower part of the walls were burning.

Just opposite his window was another tall building and it was only about 6 feet away, but he could not see any way of getting across to this other building for he did not have a board to put across, and he could not jump. He looked up and saw telephone wires stretching from the roof of the building he was in to the roof of the one opposite, so he decided to telephone for help to the next building, but there was no one in it as everyone had gone out to look at the fire.

How do you think he could get across to the other building?

.....

.....

9. During the war a German machine gun was hidden in the stretch of land between the German and Australian trenches. This gun did so much damage that an Australian soldier decided that, with the help of 3 or 4 men he would try to capture it.

By crawling out one dark night he found that the gun was hidden underground in a 'dug-out' with several men to work it. He also found that, each morning at three o'clock a small party of German soldiers came from the German trenches with food for the machine-gun men in the dug-out.

These men in the dug-out would not let in any enemies, of course, but they knew that their friends came every morning at three o'clock, so when they heard them they let them in.

How do you think the Australian soldier could capture the gun?

.....

.....

10. Bill Smith had been wrecked on a lonely island, but he had managed to save some food, a coil of wire, a gun and some bullets from the wreck. He found a cave in which he could live, but was afraid there might be natives on the island who would steal up on him when he was asleep and kill him. He wished he had a burglar-alarm which would wake him if anyone came into the cave.

A burglar-alarm is so arranged that, if a burglar comes through the door, he trips on a wire stretched across the doorway and the wire rings a bell.

Of course Bill did not have a burglar-alarm, but he managed to make an alarm all the same.

How do you think he did it?

.....

.....

11. Once a little girl had wandered off to play by herself. As she went along she picked flowers and played number games by pulling off their petals. She was gone so long that her mother became worried and set off to find her, but she did not know which way her little girl had gone.

There were no footprints showing and the mother did not have a dog, nor could she get a black-tracker to follow the trail. There were no neighbours near who could help her.

How do you think she found where her little girl had gone so that she could follow and bring her back?

.....

.....

12. As Robin Hood was making his way home one day after a day's fishing, he discovered the woods were full of Norman soldiers who were searching for him. There was no time to lose so he rushed into a small hut nearby in which lived an old man. Robin knew that the hut would soon be searched and there was no place in it in which he could hide in safety, either inside or outside. There was no time to try and dig a hole in which to hide. If he walked out and tried to pass the Normans, he would be recognized by his suit of Lincoln green which he always wore.

He could not fight all the Normans himself, and he was too far from home to call his men.

What do you think he did?

.....

.....

13. As Jack Nelson was in the bathroom one morning his mother brought him a glass of medicine. Jack hated medicine and did not want to drink it; but his mother said he had to, and she would not leave the room until she knew it was all gone. Jack knew that he could not persuade her to let him off.

How do you think he could avoid taking the medicine?

.....

.....

14. An engine driver was driving his train down a long steep hill. He was travelling fairly fast when suddenly a chain snapped so that the second half of the train became unfastened and followed the first half down the hill. The driver dared not stop on the slope as the second half of the train would crash into the first half, and there would be a bad accident. Moreover, the second half as it raced down the hill was travelling faster and faster.

What was the driver to do?

.....

.....

15. A party of friends used to go hunting in the wilds. When they could not find any animals they used to look for a flight of birds circling in the sky then, knowing that the birds had been disturbed by something, they would make their way to the spot above which the birds had risen and, sure enough, they would find the animals which had disturbed them.

Once, when they were rather far from home, they became afraid that there were some Red Indians on their trail, so one man went out scouting on his own to try and find out where the Indians were. He discovered the Indians near a river where many wild ducks were feeding undisturbed by the silent red men. He could not attack the Indians on his own and he was too far from his friends to get to them in time to warn them, yet he wanted to let them know where the Indians were. He could not fire his gun.

How do you think he did it?

.....

.....

16. A man found some gold near a river and put it in a tin in order to hide it so that he could find it again when he came back that way. There were no trees nearby and if he buried it on land he would leave traces of freshly-dug soil, and someone else might find it. He had nothing with him except his food and tools.

How was he to hide the gold?

.....

.....

17. A man had been imprisoned in a room which was several stories above the ground. The only way by which he could escape was through the window, but he did not know how to reach the ground for of course he had no ladder or rope and, if he jumped, he would be killed. The walls of the building outside were perfectly smooth without any other windows and there were no waterpipes, creepers or trees growing under the window, so that he couldn't climb down. Apart from the bed in which he slept and a table, there was nothing in the room.

How do you think he could reach the ground?

.....

.....

18. Jim Green, a newspaper man, who had discovered some very important news, was most anxious to get it to his office as soon as possible. He knew there was a rival not far behind who was trying to overtake him, and get the news to another newspaper first. Jim could not go any faster and he did not know of any short cut he could take.

He was wondering how he could delay his rival when he came to a bend in the road and a notice which said that the part of the road beyond the bend was closed for repairs. He was just about to turn back to go by a different way when one of the road-men came and threw down the notice, saying they had just finished repairing the road and Jim could drive on. Then the road-men gathered up their tools and left.

At this point Jim thought of a way of stopping his rival from overtaking him and getting to town first.

How do you think he did it?

.....

.....

19. Mr. Jones was a blind man who used to go out walking guided by his dog.

One day when Mr. Jones was out for his usual walk, the dog saw a rabbit, chased it, and got caught in a trap, so that Mr. Jones was left far from home without his dog.

He decided to walk on to try and find help, but he also wanted to leave a trail so that, if his friends came to look for him, they could follow. He had nothing in his pockets that he could use, and he did not want to use any of his clothing. He was walking over grassland where there were no trees or stones, and the grass was so springy that no footprints were left. Moreover, he had nothing with which to make marks big enough to show on the grassy land.

How do you think he left a trail?

.....

.....

20. Pumas are wild animals, very much like lions, which live in South America. They are very fond of deer, which they hunt by creeping up on them unawares and springing upon them.

Deer, although they are shy creatures, are very curious, and, if they see anything strange will stand and watch it so long as it is a good distance away, so that they do not become frightened and run away. Deer are very swift runners, and if they know a puma is on their tracks, the puma has no chance of catching them. So pumas often hunt in pairs so that they can make a plan for catching the deer. They don't do it by lying in wait for the deer nor by going hunting in different directions.

How do you think they do it?

.....

.....

21. A party of men were out in the bush when they noticed the smoke of a bush fire behind them. As there was a strong wind blowing towards them they knew it would not be very long before the fire would catch up on them and, as they were on foot, they could not get away from it. There was no water within miles, nor any bare sandy patch where they could shelter. They could not dig a hole for they had nothing with which to dig. They could not get any help, it was useless to try to fight the fire with bushes, and all they had with them was a box of matches.

What do you think they could do to save themselves?

.....

.....

22. Once there was a king who kept three thousand cows in a huge stable which had not been cleaned for thirty years, and he ordered a man to clean it in a day. This man knew that the best and quickest way to get the stable clean would be to let great quantities of water flow over the floors so that it would carry away the rubbish as it drained away. There was plenty of water in a river which flowed nearby, but the man could not carry enough water in one day to clean such a huge stable. He could not use the cows to carry the water because he had not enough buckets or tins to fasten on to them, and he did not have a hose.

How was he to clean the stable in a day?

.....

.....

23. Two Australian men had escaped from a German prison but then they had to get out of Germany without being recognized as escaped prisoners. They dressed in ordinary clothes and one of them, who could speak German well, bought tickets so that they could travel to the coast, pretending they were ordinary people. The other man could not speak German, and if the people they met on the trains or in hotels discovered this, they would know instantly he was an escaping prisoner.

Of course he did not have to talk to people, but people were sure to talk to him and, if he did not answer or showed he could not understand, they would become suspicious.

What do you think he could do to prevent them from suspecting he could not speak German?

.....

.....

24. Several camel waggons, all heavily loaded with dates, were crossing a desert when a sandstorm arose. After the storm had passed it was found that the last waggon had become lost. The men in charge of the other waggons dared not stop to look for the lost one as there was a shortage of water; so they hurried on, but they decided to leave a trail so that the men with the lost waggon could follow after them. Of course, there were no trees or stones in the desert, and the sand was too soft to leave marks on it. They did not scatter their clothes along.

How do you think they left a trail?

.....

.....

25. Two English soldiers were escaping from Germany during the war by pretending to be Germans. They reached the coast safely and got on board a German boat but, when the captain of the boat asked them their names they did not tell him their real names. However, the captain of the boat found out they were using false names and asked them why they had not told him their real names. They had to make a sensible explanation of why they did not tell their own names so that the German captain should not guess they were escaping prisoners.

What do you think they could say?

.....

.....

26. A king was to be crowned in the cathedral and of course great crowds gathered to see the sights. The cathedral was so packed that not an extra seat could be had. The numerous ushers, who could be distinguished by the red bands which they wore on their arms, were kept busy showing people to their places and keeping back the crowd which had gathered outside.

One man who was not fortunate enough to have a ticket of admission, and who could not buy or borrow one, wanted very much to get into the cathedral to see the ceremony. He knew it was no use bribing an usher to let him in. He could not push in without a ticket, and he could not get in by a back way or through a window.

How do you think he could get into the cathedral?

.....

.....

27. Once there was a man who was kept strictly guarded in a prison. His friends wanted to send him a message, but as he was not allowed any visitors or parcels they could not send it that way, and they couldn't make friends with the guards. In fact they couldn't get into the prison at all.

They had an aeroplane in which they used to fly over the prison but they couldn't drop a message from it, because it would be seen by the guards, and of course they couldn't land in the prison yard.

How do you think they sent a message to their friend?

.....

.....

28. Once a lady let her house to a friend for a month. She left all the furniture and books for her friend to use and told her about one particularly good book that she wanted her to read. When she was going away she wished to leave the key of her desk so that the friend could find it, but she did not want the woman who came to clean the house to find it instead, so she wondered where to put it. If she put it where it could be seen easily the woman who cleaned would find it, and if she hid it too carefully the friend would not be able to find it. She had not time to send a message to her friend telling her where it was.

Where do you think she put the key?

.....

.....

29. An Australian soldier was in a wood not far from the Australian trenches, when suddenly he came face to face with four German soldiers.

It was too late to try and hide among the bushes because he had been seen. He had his gun, but then the Germans had their guns, too, and he could not fight four men by himself. If the Germans knew he was alone they would take him prisoner and he did not want that. It would be no use asking them to let him off and his own men were too far away to hear him if he called for help. He could not run away.

What do you think he could do?

.....

.....

30. A man wanted to send a message to a friend who lived many miles away, but he had forgotten the friend's address, so he could not write. He could not go to his friend because he did not know where to go. He could not telephone because he did not know where to telephone. He did not know anyone nearby of whom he could make enquiries and his friend did not have a wireless set.

How do you think he could get a message to his friend.

.....

.....

31. Once a man was stolen away and kept in a lonely deserted part of the country by some robbers. The robbers made him work for them; among other things they made him do their washing.

This he used to do in a stream nearby and then spread it on the ground to dry, but there was always one of the robber band watching him to see that he didn't escape.

One day as he was doing the washing he noticed an aeroplane circling overhead. He felt sure it belonged to his friends, who were searching for him, but he dared not shout, wave or signal with his hands, nor could he scratch a message on the ground, for the robber, who was sitting at a little distance away, would see him.

He was not armed and had nothing in his pockets.

How do you think he could send a message for help to the people in the aeroplane in such a way that the robber would not be suspicious?

.....

.....

Appendix III

TRAINING MATERIAL

TRAINING LESSONS FOR TEST 1

The first lessons were given on number series.

First Lesson

'When I count 1, 2, 3, 4, 5, you can tell what number is coming next. Now when I write 2, 4, 6, 8, can you tell what number will be written next?

'You will notice in this set of figures that 2 is added on to each figure in turn. We can make a set of figures by adding any number we like. Suppose we want to add 5 each time; then we can choose any number to start with, say 7, and add 5. That gives us 12. If we add 5 again we have 17; so we can make a series, 7, 12, 17, 22, etc.

'Now look at these sets of figures and find out what figure is added. Then you will be able to tell what figure is coming next.'

Several examples of number series were then presented. Each series was made by adding a certain figure and the children were required to write down for each set how it was made and the figure which would come next. Thus:—

4, 8, 12, 16
13, 15, 17, 19
7, 10, 13, 16, etc.

Similar lessons were given on series made

by subtracting a figure, e.g.: 14, 11, 8, 5;
on multiplying by a figure, e.g.: 6, 8, 54, 162;
on interpolating a figure, e.g.: 1, 7, 1, 10, 1, 13;
and on double series, e.g.: 11, 15, 16, 19, 21, 23.

Following on number series, lessons were given on definition, classification and selection. Sample sets are given below:—

Definition

Tell what kinds of things these are:—

1. Rose, orchid, lily, daffodil.
2. Rose, orchid, ivy, wheat.
3. Bee, grasshopper, ant, butterfly.
4. Lion, horse, cat, worm.
5. Cap, bowler, helmet, top-hat.
6. Wardrobe, desk, bed, sideboard.
7. Cricket, baseball, swimming, hunting.
8. Brick, cement, timber, stone.
9. Boat, car, aeroplane, horse.
10. Coal, electricity, gas, wood.

Selection

Draw a line under the two words which tell what a thing always has.

1. A school always has: walls, hat-pegs, blackboards, classrooms.
2. A game always has: captain, ball, rules, players, onlookers.
3. A dressmaker always has: fashion, money, material, pattern, ribbon.

4. A knife always has: blade, handle, corkscrew, edge, sheath.
5. A house always has: rooms, bathroom, doorways, telephone, fire.
6. An egg always has: bacon, yolk, shell, shape, chicken.
7. A newspaper always has: news, pictures, advertisements, sport, name.
8. A steamship always has: passengers, engine, hull, captain, sails.
9. A window always has: curtain, spots, frame, blind, pane.
10. A town always has: school, people, river, mayor, buildings.

Classification

Pick out the words which do not belong in these groups:—

1. Glass, crockery, china, silverware, pottery.
2. Wool, hair, feathers, scales, teeth.
3. Tomatoes, peas, lemons, beetroot, beans.
4. Custard, curry, roast, stew, baked meat.
5. Steamer, submarine, warship, yacht, row boat.
6. Chocolates, bananas, caramels, toffee, chewing gum.
7. Hammer, saw, engine, nail, axe.
8. Jacket, gloves, watch, dress, socks.
9. Day, month, year, week, calendar.
10. Banquet, feast, ceremony, dinner, meat.

In teaching logical division family relationships were used. The children were taught to draw family trees for each problem and to read off their answers from them. Sample sets of these problems and of syllogisms and absurdities used are given also.

Family Relationships

1. Mr. Brown has three sisters and a son. What relation is his son to his sisters?
2. Tom's father has a brother who has a little girl. What relation is Tom to the little girl?
3. Mr. Smith has three cousins who are all sisters. The youngest one has a little girl. What relation are his other two cousins to the little girl?
4. Mrs. Jones had three daughters and a son. Her eldest daughter married John Smith. How many sisters-in-law has John Smith?
5. What relation is Mr. Smith to his wife's sister's child?
6. The brother of Tom's father has a daughter who has a son. What relation is this son to Tom?
7. John's father's mother had three daughters. What relation are they to John?
8. What relation is the only daughter of Jim's grandmother on his mother's side to Jim?
9. Bob's mother has a daughter. What relation is this daughter's husband to Bob?
10. What relation is the sister of Jack's grandmother on his father's side to his father?

Syllogistic problems were studied by means of Euyler's Circles. Besides dealing with problems similar in construction to those in the test, problems were presented in simple syllogistic form as in the following set.

1. All the men of the town rode away.
   John is a townsman.
   Did John ride away?
2. Only the men of the town rode away.
   John rode away.
   Is John a townsman?

3. Some of the townsmen rode away.
   John is a townsman.
   Can you tell if John rode away?
4. All men who fight are soldiers.
   This man fights.
   Is he a soldier?
5. All men who fight are soldiers.
   All soldiers wear uniforms.
   Can you tell if all the men who fight wear uniforms?

Further practice was given by presenting the premises and requiring the children to draw the conclusions.

What can you find out from these sentences?

1. All clever children pass their examinations.
   He is clever.
2. Only children are admitted for half price.
   Tom was admitted for half price.
3. Only children are admitted for half price.
   Tom is a child.
4. All the books chosen by you are sold.
   You chose a reading book.
5. All corridor trains are fast trains.
   All corridor trains have first class carriages.

TRAINING LESSONS FOR TEST 2

First Lesson

'Now class, I want you to look at this sum' (the following sum had been written on the blackboard: If a kitten in a basket weighs 18 ozs. and the basket alone weighs 5 ozs., how much does the kitten weigh?). 'Read the sum through carefully and tell me what it asks you to find out? Now tell me what the sum says about it. Write down what the sum asks you to do, then write down what it says about it or what it tells you.

'Now read through these sums and write down what each one asks you to do and what it tells you. Don't work the sums out.'

The following sums were written on the blackboard and the answers written by the class checked and discussed:—

1. There were 37 children present; nineteen were boys. How many girls were there?
2. Mrs. Wright bought two pieces of material at a sale; one was 2 yards 14 inches and the other 1 yard 28 inches. How much was there in both pieces?
3. Mary had 8/2, John 9/5 and Alice 3/9. With this they bought their mother a present and received 1/4 back as change. How much did the present cost?
4. Jim had 28 marbles. He won 1, gave away 5, then lost ½ of what he had. Of those he had left 3 were green and the rest blue. How many blue ones had he?
5. In a running jump Bill jumped 14 ft. 9 ins. and Jack 12 ft. 11 ins. How much farther did Bill jump than Jack?
6. If there are 15 trees in a row and 12 rows in an acre, how many trees in an orchard of 7 acres?
7. Two rolls of material were cut into dress lengths each 4 yards long. If there were 96 yards in one roll and 84 in the other, how many dress lengths would be cut?

The second lesson was given on similar lines.

Third Lesson

We have been practising finding the different parts of a sum, to-day we are going to talk about doing the sums. From the question part of the sum we find out how we are going to do it. From the telling part we find the figures we are going to use.

Look at this sum:—Joe had three turkeys which he sold at Christmas. One weighed 11 lbs. 7 ozs., one weighed 9 lbs. 3 ozs. and one 11 lbs. 3 ozs. How much did they all weigh?

Notice that the question part lets us know that we have to add up and the telling part tells us the figures we have to add.

Look at this sum:—A man had 12 doz. oranges. He sold 4½ doz. and threw away 10 bad ones. How many had he left?

Read the question part carefully so that you know what the sum asks, then you will see whether you have to divide, add, subtract or multiply. Who can tell how the sum should be done? Now look at the telling part to see what figures you have to use. Now write down how to work out the sum.

Read through these other sums and find the question and telling parts, then write down how to do each sum. Do not work the sums out.

Ten further examples were then presented.

The fourth lesson was conducted on similar lines.

The remainder of the lessons were devoted to the actual working of problems similar to those found in the tests. These were divided into groups. Each group consisted of one type of problem only and two lessons were devoted to teaching it. During the first part of each lesson the method of doing the type of problem selected was taught; while in the second half of the lesson practice in working problems was given.

Groups consisted of problems in addition, subtraction, multiplication, division, quotation, time, scales and proportion.

A list of some of the problems dealing with quotation is given:—

1. The cost of 4 lbs. of sugar is 1/4. How much a lb. is that?
2. If milk were 2/- a gallon, what would I pay for 1½ pints?
3. Electric light is 5d. a unit. If my light bill was 9/2, how many units did I use?
4. A man paid 3/9 for 9 lbs. of apples. How much would he pay for 5 lbs.?
5. If ice cream is bought at 4/2 for 25 cones, what would they cost per doz.?
6. If wheat were 8/3 a bag, how much would 2 bushels cost?
7. If pears are twice as dear as apples and I paid 6d. for three lbs. of apples, what would I pay for 8 lbs. of pears?
8. If a newsboy received 2d. for every 10 papers he sold, how many would he have to sell to make 2/6?

TRAINING LESSONS FOR TEST 3

Fables

First Lesson

'I am going to tell you a little story and I want you to listen carefully so that you can tell me afterwards what lesson the story tries to teach us.' Æsop's Fable of the 'Miller and the Donkey' was then told to the class. After some discussion on the lesson which the story taught the teacher went on.

'Now I am going to tell you another story and this time I want you to write down what the lesson is that the story teaches.' 'The Milkmaid and Her Plans' was then presented and the answers written and checked. Similarly such fables as 'The Countryman and Hercules,' 'The Fox and the Crow,' 'The Fox and the Crane,' and 'The Dog and His Shadow' were dealt with.

The second lesson was somewhat similar, the fables used being 'Mercury and the Woodman,' 'The Widow and the Sheep,' 'The Boy and the Berries,' 'The Vain Jackdaw,' and 'The Tree and the Axe.'

Proverbs

In the fourth and fifth lessons proverbs were used instead of fables. Proverbs for the first set being:—

Too many cooks spoil the broth.
Do not judge a book by its covers.
Putting the cart before the horse.
A man may roll up his sleeves yet do nothing.
A burnt child shuns the fire.
A bird in the hand is worth two in the bush.

Matching

In the fifth and sixth lessons the children were required to match proverbs. A number of proverbs having been written on the blackboard the children were asked to read them through and pick out those with similar meanings. These were then written down in pairs.

Some of the proverbs used in this way are given below:—

You are teaching an eagle to fly.
You are taking coals to Newcastle.
A bird in the hand is worth two in the bush.
Half a loaf is better than no bread.
A man must plough with the oxen he has.
Cut your coat to suit your cloth.
A golden saddle does not improve the horse.
An ape is an ape even if he wear a fine ring.

Somewhat similar lessons were given on matching fables and proverbs.

Ending Fables

In some lessons the children were required to construct an ending for a fable so as to teach a given lesson. Thus they might be told the following story and asked to finish it so that it would teach us not to be greedy.

A very small mouse squeezed through a hole into a cupboard where he found many good things to eat. But he ate and ate. . . .

Making Fables and Proverbs

The next series of lessons dealt with making the whole fable. For instance one child chose to teach that use is better than beauty and wrote the following fable:—

'A peacock and a sparrow were out walking. The peacock was spreading his tail and boasting of his fine feathers. Just then a hunter came along. The sparrow flew away, but the peacock could not fly so the hunter saw the bright feathers and shot him.'

In these lessons the children chose the lesson they proposed to teach and wrote a fable accordingly. Later they made proverbs in a similar way.

Completion

In another series of lessons the children were presented with a story, such as the following, and were required to fill in the gaps with a suitable proverb.

Bob and his eldest brother, Jim, wanted to go fishing one Saturday. They decided to set out very early because one could get much better fishing in the early morning when no one was about. As Jim said, . . .

As they were getting their things together Bob became very dissatisfied with his tackle and grumbled about not having enough hooks, a new line, or a good rod, but Jim told him to make the best use of it he could and to be satisfied with what he had. 'Remember,' he added, . . .

After they had been fishing some time Jim caught some fish but Bob had none. Bob became very impatient and complained that it was not a good spot for fish and he had not the right bait. 'Well,' said Jim, 'I have caught some. If you haven't it is probably your own fault . . . .

At last Bob got a bite; he became very excited and called to Jim who came running, giving advice, telling Bob what to do and fussing around trying to help. Between them they let the fish get away. Jim was very sorry he had got in the way. 'If I had left you alone,' he said, 'you probably would have caught it. I should have remembered that . . . .

Finally, Bob did catch one tiny fish, but it was so small that he became disgusted and threw it back into the river saying he would catch a much bigger one soon. 'If you don't catch any at all,' said Jim, 'you will be sorry you threw the little one away because . . . .

As the water was very clear Bob could see a large fish swimming around the bait and he was delighted. 'It will take the bait in a minute,' he thought, 'and then I will catch it and take it home and we will have it for tea. Won't Mother be pleased?' But he was very disappointed when he saw the fish, which he was so sure he would catch, swimming away, and he thought . . . .

Later, however, he had more luck and by the end of the afternoon he and Jim had caught quite a lot between them. As they had more than they could use, they called on their friend Sam Smith on their way home to give him some fish; but, when they reached Sam's home, they discovered Sam's father kept a fish shop, so the Smiths had all the fish they needed. When Sam saw they had brought him fish he exclaimed: . . . .

When the boys took the fish home their mother was very pleased, but one of them was a strange kind of fish which she had never seen before. 'That fish doesn't look as if it would be very nice to eat,' she said, 'but it might be better than it looks, and,' she added, '. . . .

TRAINING LESSONS ON TEST 4

Each lesson consisted of a group of five or six situations which could all be solved in a somewhat similar way. The children were told that this was so and were asked to try and find what it was that was common to the set.

The last two lessons consisted of mixed types introducing all the different types used previously.

In every lesson each situation was presented separately. It was first read through to discover what was wanted, a hypothesis was formed and the situation was read through again to see if this hypothesis would fit in with the given conditions.

The answers were then written down and checked. Wrong answers were discussed, the children being encouraged to point out wherein lay the error.

Sets of situations were devised, each set being graded in difficulty, and depending on similarity of solution. Thus sets were made on hiding places, on leaving trails, on sending messages, on crossing spaces, on distracting attention and substitution.

One of the 'substitution' sets is appended:—

1. Soldiers who were recovering from their wounds in hospital often wanted to go out at night when they were nearly well, but they could not do so because they had to be in bed early.

Every night a nurse would go around the wards to see that the soldiers were in bed. If she saw a still form lying in the bed she thought the soldier was asleep and passed on without disturbing him. One soldier wanted to go out very much one night but he was afraid the nurse would miss him if she did not see him in bed.

What do you think he did?

2. John Brown was captured by some horse thieves and taken away to their hiding place in a forest; at night each one rolled himself on a rug and slept under the trees with one man sitting at the camp fire on guard.

John planned to crawl into the bush one night and escape while the rest were sleeping; but he knew that if the man on guard saw there was no one lying where he was supposed to be asleep, then the guard would immediately give the alarum and John would be captured before he had time to get away properly.

What do you think John could do so that the guard would not realize he was gone?

3. Once, during a war, the English wanted to learn something about their enemies. Just at that time they captured one of the enemy soldiers. They thought they would learn what they wanted from him, but he would tell them nothing. One English soldier offered to try and get into the enemy lines by crawling across the stretch of land between the English and enemy trenches when it was dark and so find out what he could. But it was no use his doing that because the enemy would recognize him when he got into their lines by his uniform; or, if he wore ordinary clothes, they would think he was a spy.

What do you think the English soldier did so that he could get into the enemy lines and learn what he wanted?

4. Long ago there was a young lady who had a twin brother whom she loved very much.

When they grew up the brother went to fight for King Charles, but he was beaten and had to hide from his enemies. He hid in his sister's house for a while until one day, when his sister was out on one of her long rides, she learned that the enemy soldiers were coming next day to search the house for her brother. That meant that he could stay in the house no longer, but, if he left it he would be recognized by his uniform and handed over to the enemy.

He thought of trying to disguise himself but his sister did not have a man's suit of clothes for him to wear and she dared not buy or borrow one for fear spies would guess she was getting them for her brother. He dared not wait until dark.

How do you think he escaped?

5. In olden days, when kings fought in battles, there was one king who was such a great fighter that the enemy was always afraid to attack the particular part of his army where he was. They would see his golden armour and shield with his special crest and avoid that part of the field; but, where he was not they would attack and defeat his men.

He felt that if only he could be in several parts of the field at once, they would be too afraid to attack at all; but of course he could not be in several places at once.

What do you think he did?

Wellcome Library

Brown, Prior, Anderson Pty. Ltd., 430 Little Bourke Street, Melbourne, C.1.