

IMMEDIATE MEMORY IN SCHOOL CHILDREN.

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I. *The problem stated.* II. *The method of experiment employed and its validity.* III. *Preliminary experiments made in 1901.* IV. *Experiments made in 1902 with statistical tables.* V. *Suggested conclusions.*

I. Professor James¹ writes: "One's native retentiveness is unchangeable. It will now appear clear that all improvement of the memory lies in the line of elaborating the associates of each of the several things to be remembered. No amount of culture would seem capable of modifying a man's general retentiveness. This is a physiological quality, given once for all with his organization, and which he can never hope to change."

The importance of this question both psychologically and pedagogically need hardly be emphasized.

Far-reaching pedagogical inferences are being made. To take one instance, Mr Graham Wallas, Chairman of the School Management Committee of the London School Board, said, in an address to the Froebel Society, July 1901, "Now that we have abandoned the hope that the actual sensitiveness and retentiveness of the memory can be much increased by education, etc....."

It seemed to me that experiments on school children might help to throw some light on the psychological question involved, and accordingly I have endeavoured to determine:—

1. Whether pure memory, that is, memory of percepts associated only in time and space, is improvable by practice.
2. Whether such memory tends to improve with age, or not.
3. Whether such memory has any relation to general intellectual proficiency, and, if so, what relation.

¹ *Principles of Psychology*, vol. I. p. 663. The differences of type in the original have not been reproduced.

II. The method employed was to expose to view sets of 12 consonants for a period of twenty-five seconds, after which they were reproduced in writing by the children.

Some preliminary questions arise as to the validity of this method.

(i) Are associative factors other than those of time and place really excluded by such a method?

I do not wish to prejudge this question so far as adults are concerned, but I think that such associative factors did not influence the children. In the first place the time of exposure was extremely short.

Moreover, with a view of definitely testing this particular point, I gave a series of similar exercises to another group of children, and was unable, even on prolonged questioning, to discover any such factor. Three girls out of forty thought of words suggested by some of the consonants. These girls, however, also asserted that the words came to mind whilst I was questioning, and that they had not thought of them when learning the consonants. One girl remembered that she had thought of h-y-m-n whilst learning the third line of one of the tests, though only three of these letters were given and then in a different order. It is, perhaps, significant that, on turning to her paper, I found this line omitted, though the two preceding lines were correctly given.

(ii) Are we not testing immediate reproductive power only and not final retentiveness? This is a distinction of degree rather than of kind, for one is reproduction after short periods, and the other after longer periods. There may be no direct relation between retentiveness for short and for long periods; the popular notion 'easy come, easy go' may be correct. If, however, we are entitled to assume that success in school examinations implies retentiveness for long periods, and, if it can be shown that in most cases the children who are most successful with the tests given do best in these examinations, some indirect evidence is afforded that retentiveness for long and short periods vary together.

III. A first series of experiments was carried out in June 1901.

A set of consonants, of which the following is an example,

<i>s</i>	<i>k</i>	<i>m</i>	<i>w</i>
<i>b</i>	<i>f</i>	<i>l</i>	<i>h</i>
<i>g</i>	<i>t</i>	<i>r</i>	<i>n</i>

was suddenly exposed to view. Audible repetition was not permitted. At the end of the twenty-five seconds the card of consonants was removed and the children wrote down as much as they could remember.

Two minutes elapsed and a second test was given, then a third. After the third test a change was made; and for the next three tests an interval of twenty-five seconds was enforced after the card had been removed before the consonants were written down. The papers were then collected and marked on the following scale :

1. Three marks for each letter in its right position. 2. Two marks for each letter one remove to the right, or left, or above, or below. 3. One mark for each letter two removes to the right, or left, or above, or below.

Specimen of test given				Specimen of a marked paper			
<i>m</i>	<i>t</i>	<i>d</i>	<i>x</i>	³ <i>m</i>	³ <i>t</i>	⁰ <i>l</i>	¹ <i>r</i>
<i>v</i>	<i>l</i>	<i>y</i>	<i>m</i>	² <i>l</i>	² <i>v</i>	³ <i>y</i>	³ <i>m</i>
<i>s</i>	<i>z</i>	<i>b</i>	<i>r</i>	² <i>z</i>	² <i>b</i>	¹ <i>s</i>	¹ <i>x</i>

23 marks out of a possible 36.

One set of experiments was made with Standard VII, numbering 25, the highest class of a girls' school. The ages of the pupils ranged from 12 years 1 month to 15 years 11 months.

Another set was made with Standards VI and VII, numbering 33, the highest class of a boys' school. The ages of these boys ranged from 11 years 9 months to 14 years 2 months.

The following is a brief summary of the results.

1. No clear difference in the results appeared between the method which (*a*) allowed no time to elapse before writing down the consonants after the observation, and that which (*b*) allowed 25 seconds to elapse before writing them down after the observation.

All subsequent experiments, therefore, were made without this interval.

2. In the girls' school, where the pupils were all of the same standard, there was a considerable improvement in memory as the age increased from 13 to 14, and a slight fall from 14 to 15.

3. In the boys' school, where there were two standards in one class, the boys of 12 years of age were rather superior to the boys of 13. But out of the 19 children who were 13 years of age five only were in Standard VII, the remaining 14 being in Standard VI. Separating the standards it was found that the average mark for the boys in Standard VII, who were 13 years old, was 24, for those in Standard VI, who were

13 years old, 21·8, for those in Standard VI who were 12 years old, 22·8.

4. Comparing the boys and girls of the same ages and of the same standard, it was found that Standard VII boys of 13 years of age averaged 24 marks for memory, and the girls of Standard VII who were 13 years of age averaged 20·9 marks.

General conclusion from the above two sets of experiments.

The slightness of range in age and standard and the little difference between the figures obtained for the standards and ages given made it obvious that, if the questions proposed in the introduction to this paper were in any way to be answered, a much wider range of age and standard would be necessary.

The experiments, however, indicated that no difference existed, for the purposes of these observations, between the method of making the test with and without an interval between making the observations and writing them down. Nor did it seem that the conclusions on the points raised would be affected by the differences between boys and girls.

IV. A second series of experiments was commenced in June 1902. Thirty-nine girls were chosen ranging from Standard II to Standard Ex-VII, and from the age of 8 years to the age of 14 years 4 months. They were chosen on an age basis without reference to their proficiency in school studies. In the first test of June 5th, at 10.30 a.m., 25 seconds were allowed for memorizing, and the letters were written down immediately after. Two minutes elapsed between the commencement of writing one test and beginning to memorize the next. Ten tests were given. One week later, June 12th, at the same time in the morning, to the same children, a second series of ten tests was given. Three weeks later, on July 3rd, at the same time, to the same children, a third series of tests was given, the number on this occasion being extended to fifteen. The papers were marked as in the preceding exercises.

The tabulated results will, obviously, afford a means of determining the progress, if any, of individual pupils, and also the variation due to age and standard. But, so far, no material had been collected bearing on the relation between immediate memory and general intellectual proficiency. An attempt was therefore made to compare these mnemonic results with the marks obtained by the pupils for their school exercises and examinations, over the space of one year. First, a series of examinations was taken in Reading, Arithmetic, Dictation and English Composition. These marks were averaged and will be found in the

TABLE I.

Showing (a) Improvement of individual pupils, and (b) A comparison between memory marks, marks for specified examinations, and position in class for all subjects.

Name	Standard	Average Memory mark				Average for examinations	Position in Class
		1st 10 tests, June 5	2nd 10 tests, June 12	3rd 10 tests, July 3	Average, 3 days		
M. P.	Ex-vii.	25.5	30.3	32.7	29.5	29.5	4th of 26
A. H.	"	15.3	18.9	26.7	20.3	23.2	19th " "
A. C.	"	25.6	32.6	33.6	30.6	26	12th " "
M. M.	"	25.6	33.2	31.7	30.1	26.5	16th " "
M. L.	"	27.1	30.2	34	30.4	27.2	8th " "
K. R.	vii.	27.3	30.7	32.7	30.2	22.5	15th of 37
A. J.	"	22.3	23.5	—	22.9	25	18th " "
F. H.	"	21.8	22.8	29.4	24.6	25	20th " "
W. K.	"	27	30.8	31.3	29.7	22	30th " "
A. L.	"	28.6	31.8	—	30.2	24.7	10th " "
D. O.	vi.	19.8	27.7	32.6	26.7	26.5	10th of 30
E. E.	"	31	34	35.3	33.4	26.2	10th " 35
W. G.	"	29	32.8	35.8	32.5	32.5	2nd " "
E. S.	"	29	30.9	34.7	31.5	25.2	20th " 30
H. W.	"	25.3	34.9	—	30.1	30	5th " 35
A. R.	v.	13.5	22.2	23.9	19.8	27	17th of 50
H. D.	"	18.3	26.8	34.1	26.4	30.2	5th " "
V. A.	"	18.3	20	24.9	21	24	30th " "
E. L.	"	23.3	26.3	27.9	25.8	25.7	25th " "
H. H.	"	18.8	19.4	20.9	19.7	22.7	27th " "
F. D.	iv.	21.3	23.2	26.1	23.5	31.2	8th of 59
D. Y.	"	23.8	26.3	27.6	25.9	32	14th " "
E. A.	"	23	26.2	27.2	25.4	33.7	6th " "
W. W.	"	16.8	21.7	22.5	20.3	30.7	12th " "
M. C.	"	18.3	25.7	29.6	24.5	35.7	2nd " "
F. P.	"	25	26	—	25.5	23.2	22nd " "
H. W.	iii.	12.6	17.4	18.1	16	30.2	18th of 66
D. J.	"	15.6	17.8	15.5	16.3	30	20th " "
D. H.	"	10	15.4	19.2	14.8	32	8th " "
M. M.	"	11.8	17.7	24	17.8	28.2	9th " "
M. H.	"	19	18.4	22.3	19.9	28.2	4th " "
F. P.	"	15.6	19.6	19.1	18.1	27	54th " "
D. W.	ii.	16.6	18.7	—	17.6	27.7	18th of 62
E. H.	"	12.1	13.7	—	12.9	14.6	23rd " "
D. C.	"	9.1	—	15	12	—	—
N. S.	"	13.6	17.2	18.2	16.3	22.7	15th " "
E. M.	"	16	17.6	15	16.2	19.7	26th " "
M. G.	"	11.8	17	20.9	16.5	15.2	60th " "

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seventh column of Table I. As, however, it might fairly be objected that the subjects above enumerated were more especially such as required 'good memory,' it was thought advisable, in addition, to take the actual position of each pupil in her class, taking into account the year's examinations in all subjects, oral and written, and allowing also for the estimate of the teacher in charge of the class. The results thus obtained are shown in the eighth column of Table I.

Conclusions from Table I.

1. That there is a marked and almost invariable improvement in individual pupils.

2. That when the memory marks of the selected girls and their position in class are compared, we find,

(a) That general mental ability is accompanied by 'good memory.'

(b) That, with two exceptions, no girl whose memory mark is relatively low has a high place in class.

(c) That 'good memory,' though usually accompanied by general proficiency, is not invariably so, as there are four cases in which high memory marks are obtained by girls whose positions in class are low.

The general relation, however, between memory, age, standard and position in class, is more clearly indicated in the following summary.

TABLE II.

Showing improvement with age and standard, and the average position of the selected girls in their classes.

Standard	No. tested	Average age	Average Memory mark				Average position in Class
			1st 10 tests	2nd 10 tests	3rd 10 tests	Average, 3 sets	
Ex-vii.	5	14 yrs. 3 mths.	23·8	29·0	31·7	28·1	41st of 100
vii.	5	13 " 5 "	26·3	27·9	31·1	28·4	50th " "
vi.	5	12 " 3 "	26·8	32·0	34·6	31·1	27th " "
v.	5	11 " 4 "	18·4	22·9	26·3	22·5	41st " "
iv.	6	10 " 5 "	21·3	24·8	26·6	24·2	18th " "
iii.	6	9 " 0 "	14·1	17·7	19·7	17·1	28th " "
ii.	6	8 " 2 "	13·2	16·8	17·2	15·7	45th " "

These figures show clearly a general improvement rising with age and standard. It is significant, perhaps, in this connexion, that the common opinion among teachers, to be found also in text-books of

pedagogy, is that this 'rote' memory, which we are here testing, is strongest at about 10 years of age, and then diminishes.

It will be seen that, in those cases where the memory mark of a younger section is higher than that of an older section, the pupils in the former are considerably above average intellectual proficiency, as shown by their position in their classes.

The very high mark in Standard IV is explained by the position in class of the selected girls. They are an exceptionally capable group.

The Standard VI group is again of unusual capacity.

In order to bring the relationship between 'rote' memory and general proficiency to a more conclusive test, a fourth series of exercises was given. Ten sets of consonants were used, the time of exposure was 25 seconds, and the intervals between the tests were as before. Girls were selected from two divisions of Standard VI, six from the upper, and six from the lower. None of them had been submitted to any of these tests before. The summarized results are given in Table III.

TABLE III.

Name	Age	Average Memory mark	Position in Class
UPPER DIVISION :			
L. W.....	12 yrs. 11 mths.	30.6	1st of 35
M. G.....	12 " 9 "	29.3	3rd " "
M. S.....	12 " 11 "	26.1	6th " "
E. S.....	13 " 3 "	24.8	8th " "
F. M.....	12 " 0 "	29.1	9th " "
G. B.....	14 " 4 "	21.9	11th " "
	Av. 13 yrs. 0 mths.	Av. 26.9	
LOWER DIVISION :			
E. H.....	14 yrs. 0 mths.	19.9	25th of 30
E. W.....	12 " 6 "	18.3	26th " "
M. G.....	14 " 0 "	20.6	27th " "
M. P.....	13 " 3 "	14.1	28th " "
D. R.....	13 " 0 "	26.2	29th " "
O. R.....	12 " 6 "	15	30th " "
	Av. 13 yrs. 2 mths.	Av. 19	

The summary seems conclusive as to the relations, above suggested, between general proficiency and good memory. The only girl with a low memory mark in the upper section is much older than the others

in that section, and in the lower division we have a case (D. R.) in which good memory is not accompanied by high position in class.

I lay stress on the suggestion that general intellectual proficiency is usually accompanied by 'good memory' (using the term in the limited sense given in these experiments), since Professor Ebbinghaus¹, using an auditory test, finds that the children in the lower part of the classes experimented upon were superior in memory to children who were higher in class.

A different relation between visual memory and general proficiency may exist from that which obtains between auditory memory and general proficiency. In German schools, however, the oral teaching is greatly in excess of that in English schools; and I have myself been profoundly impressed by the ability of the German school child to answer questions and perform calculations which were presented to him orally.

It would be inferred from this, if practice has the same effect on auditory memory as it appears to have on visual memory, that the more instructed children should show superiority. This inference is, however, contradicted by the results of Professor Ebbinghaus' experiments.

In any case, apart from the value, if any, of the conclusions arrived at, my experiments yield a body of facts concerning immediate memory in English school children obtained by a method which renders comparison easy.

V. Recapitulation of conclusions suggested by these experiments.

1. That 'pure memory' is markedly improvable by practice.
2. That this memory improves with age within the limits chosen, but principally in so far as increased age itself implies increase of general proficiency.
3. That there is generally a direct relation between 'good memory' of this kind and intellectual proficiency, so far as this can be measured by success in school studies.

¹ "Ueber eine neue Methode zur Prüfung geistiger Fähigkeiten und ihre Anwendung bei Schulkindern," *Zeits. f. Psychol. u. Physiol. d. Sinnesorgane*, 1897, Bd. xiii. S. 401.