

RELATION OF QUICKNESS OF LEARNING AND RETENTIVENESS

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From many different points of view educators are working to individualize teaching. Investigations of individual differences in learning abilities and in retentiveness of learners should result in differentiating the length of the study period for different members of a class, and the amount and frequency of reviews needed to fix permanently in mind what has been learned. Educational and psychological tests have furnished innumerable curves showing the distribution of learning abilities in a homogeneous group of learners, but apprehension is only half the story. Retention must be secured. What is the relation of speed of learning to retentiveness?

Norsworthy, Pyle, Lyon, and others have studied the relation of the rate of learning to retentiveness. They agree that those who learn quickly retain a larger number of units than those who learn slowly, and in some cases, as large a proportion of what has been learned, as those who learn slowly. Lyon finds some exceptions to the last statement. In the case of meaningful material (prose or poetry) the quick learners sometimes retain an even larger percentage of what they learn than the slow learners, while in the case of mechanical material, such as numbers, the quick learners do not retain as large a percentage of their gains as the slow learners do of theirs.

The present investigation is confined to one kind of subject-matter, prose, and goes beyond the results of the investigators mentioned: first, by using longer selections; secondly, by using larger groups of subjects; and, thirdly, by attempting to define more precisely the relation of rate of learning to the amount retained. Another purpose was to ascertain whether the material is suitable for use as laboratory experiments for college classes.

To a normal school class of 56 students a geographical selection of 250 words was given in mimeograph form.

It described the character of the Philippine Islands and people. The first five lines will suffice as a sample:

(¹) The Filipinos as a race are not vicious. / (²) Their common crimes are rather slight offenses, such as the theft of articles of small value. / (³) Gambling is perhaps the chief vice, / (⁴) and a Filipino will risk his last penny on a cock fight / (⁵) or a horse race. / (⁶) Americans are apt to think the Filipinos are lazy. / (⁷) This is partly true. / (⁸) For centuries they have learn-

The numbers and the oblique lines were not on the learning sheets, and are inserted here merely to aid in explaining the methods of grading employed later. The students were given two and one-half minutes in which to study the selection, and then reproduced as much of it as they could in their own language immediately and again a week later. The first is taken as a measure of what was learned; the second, as a measure of what was retained. The learning was with knowledge that the reproductions would be called for.

The selection was then divided into 36 "facts" or ideas, as shown by the numbers and oblique lines in the sample above, and the ratio of the number of facts which each retained to the number which he had learned was found. This is called the percentage of retention. The group was then arranged in the order of the number of units learned, and divided into quartiles. The results for the different quartiles follow. The figures in the second and third columns give the average number of facts learned and retained respectively. The fourth column gives the average ratios of retention to learning by quartiles.

RATIOS OF RETENTION TO LEARNING IN THE FIRST SELECTION

Rank of quarters	Av. learn- ing score	Av. reten- tion score	Av. p'ct. retained	Standard deviation
1	25.5	22.2	88%	3.6
2	19.1	15.3	80	6.0
3	14.9	12.7	85	5.3
4	9.1	7.9	88	5.5
Avs.	17.1	14.5	85	5.1

In general the four quartiles retained about the same percentage of what they had learned, viz., from 80 to

88%. Inasmuch as the quartile which learned the most learned about two and one-half times as much as the quartile which learned the least, the advantage is clearly and decidedly with the more rapid learners. If it be thought that the differences in the retention ratios of the quartiles is significant, the idea is soon dispelled, for repeating the experiment five times, each time with a new group, showed very small average deviations for each quartile from the average of all 24 ratios. The average of all the ratios is 82; the average deviations of the four quartiles from this average is +2.3 for the first quartile, -0.3 for the second, 0 for the third, and -0.8 for the fourth.

With the same group of subjects a much more difficult selection, "The Policies of Labor Unions," was next tried. It dealt with the theory of labor unionism, and was taken from Readings in Economics by C. J. Bullock. It contained about 900 words. The first ten lines of the selection used are:

Collective Bargaining. 1. *Its purpose.* If the whole body of workers of a given kind can be brought into the union, so that the union can meet the employers as the representative of the whole, the position of the worker will be greatly strengthened. The fear that if he refuses to accept certain terms, another man will be employed in his place is removed. His ignorance of the market conditions will be partly remedied both thru the combination of the knowledge of all the workers of the union, and in some cases, by the broader outlook which the union officials, partly or wholly exempted from daily application to manual work, may be able to obtain. The whole matter of bargaining can be put into the hands of the most—

Two changes were made in method. First, on account of the greater length of the selection, the subjects answered questions about it instead of reproducing it. Secondly, each subject determined his own length of learning time, knowing that the length of the time he took was an element in determining his score. The learning scores and retention scores of different subjects were made comparable by calculating the amount learned and

the amount retained per minute of time invested in learning by each subject. A summary of the results follows: The figures in the second column give the average learning scores of the quartiles. If all the questions had been answered correctly, the score would have been 100%. The figures in the third column give the average retention scores after one week; those in the fourth column, the average learning times in minutes. The figures in the fifth and sixth columns give the average learning and retention scores per minute of time spent in learning (M. L. T.), and those in the seventh column give the average percentages of retention.

RATIOS OF RETENTION TO LEARNING IN THE SECOND
SELECTION

Quar- ters.	Av. learning score	Av. retention score	Av. time	Av. L. S. per M. L. T.	Av. R. S. per M. L. T.	Av. p'ct retained	Stand. dev.
1	74%	68%	9.5	7.8%	7.1%	91%	11.5
2	57	47	10.5	5.4	4.5	83	11.7
3	40	37	12.2	3.3	3.1	94	25.3
4	21	20	12.9	1.6	1.5	94	28.4
Avs.	48	43	11.3	4.5	4.0	90	19.2

The quartile which learned the most took the least time for study. So far as quartile averages go, the higher the learning ability the less time needed for study, in spite of the greater gains from study. With the increase in the difficulty of the material the range between the best and the poorest learners increases. Whereas in the first selection the fastest quartile learned two and one-half times as much as the slowest, in the second selection the fastest quartile learned nearly five times as much as the slowest. The second selection was intentionally somewhat difficult for the class. An idea of how difficult it was may be gained from the fact that the average mark of the whole class in learning was 48%, 100% being a perfect answering of all questions. We are most interested in the percentages of retention, however. The first, third, and fourth quartiles retain about the same percents, 91, 94, and 94; the second quartile retains 83%. The standard deviations are large in the two slowest quartiles because when a person learns very little, an ability to answer one question more or less greatly changes the ratio of retention to learning.

The correlations between learning and retention, based on the absolute numbers of units, i.e., numbers of "facts" in the first selection, and percentile marks in the second selection, are very high. For the first selection the correlation is $.87 \pm .02$, and for the second selection, $.94 \pm .01$. Lyon's correlations are much lower, "seldom going above .4 and averaging only .25"¹ when prose was used as the material, and recall without any re-learning was the method employed. His method of measuring quickness of learning was not as exact as the method here employed. He used the amount of time needed to secure a perfect recital, and when a subject failed to give a perfect recital, he was obliged to resume learning, and this time was of course added to the learning time.

Summarizing our results we may say that differences in the rate of learning between the best and the poorest in a group increase with increase in the difficulty of the subject matter. By difficulty is meant thought difficulty. In this investigation at least it is true that when persons are allowed to determine the length of their learning time, or time spent in study, those who learn the most take the least time. Concerning the relation of retention to learning, there is a decided tendency in this investigation for fast and slow learners to retain about the same proportion of what they learned, and this is true whether they reproduce what they learned in their own language, or answer questions on it, and whether the subject matter is easy or difficult. Lastly, the material is very well suited for laboratory experiments in educational psychology.

Some corollaries for teaching practice are, that teachers should ascertain the relative learning abilities of their students early and assist them to become conscious of their rates of learning, and to adapt the length of their study periods to their abilities, or else teachers must expect less of the slower learners. Secondly, in class reviewing fast learners can review their larger learning in about the same time as slower learners review their smaller learning, and with equal effectiveness.

¹Lyon, D. O. Relation of Quickness of Learning to Retentiveness, p. 49.