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Massed versus Spaced Practice: A Classroom Investigation

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THE problem related to the efficacy of spaced versus massed practice has concerned educators for a long time. Essentially, the problem revolves around whether learning is improved by using a practice technique that is spaced over time and provides rest periods between sessions (spaced practice), or whether learning is improved by bunching the practice sessions together and allowing no rest between sessions (massed practice).

The research on this problem involves both human and animal studies. The animal studies reported by Brogden (1951) indicate a general trend favoring spaced practice over massed practice. However, the generalizability of such studies to a human population is questionable—since not only are the subjects different, but also the learning tasks involved do not particularly resemble those in which humans are engaged.

Experiments involving humans can be roughly divided into two groups: (a) those involving nonsense syllables in the laboratory, and (b) those involving meaningful tasks in the classroom. The experiments involving nonsense syllables generally indicate that spaced practice is superior to massed practice (Warden, 1922; Hovland, 1951), and studies in the classroom tend to support that conclusion (Reed, 1924; Stroud and Ridgeway, 1932; Bumstead, 1940).

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The results of investigations are clear—spaced practice is favored over massed practice under the conditions investigated. However, how this relates to a regular classroom situation is not clear. Dismissing experiments with animals and with humans learning nonsense syllables as clearly not relating to a school classroom, we still must raise questions regarding the generalizability of those experiments carried on with humans learning meaningful material. These experiments are either old or seem to be carried on with college students. The question is still unanswered as to whether the same kind of results would be obtained if carried on in regular school classrooms.

It was the purpose of this study to investigate the relative efficacy of spaced versus massed practice using a meaningful task in normal school classrooms.

The specific hypothesis tested was: "Students memorizing using a spaced practice method will learn more than students memorizing using a massed practice method."

For the purposes of the study, spaced practice was defined as spreading four, 10-minute practice periods over four days; massed practice was defined as grouping four, 10-minute practice sessions in one block, and "learn more" was defined in terms of the number of lines of a poem reproduced from memory. The .05 level of significance was accepted.

Method

Fifty Milwaukee area teachers enrolled in a graduate course in Educational Research were asked if they would help conduct an experiment in spaced versus massed memorizing of a poem. It was explained that each teacher would have to get his administrator's approval and provide another classroom at the same level as his own within the same building. Ten teachers eventually were chosen, each teacher having a cooperating teacher within his building. The classrooms, which were to be used as the experimental unit, were paired within building and randomly assigned to a treatment. The end result was four classrooms, two per treatment, at each of grade levels 6, 7, 8, 10, and 12, a total of 20 classrooms.

The teachers were given sufficient copies of "Old Ironsides" by Oliver Wendell Holmes and specific directions for their particular treatment. "Old Ironsides" was chosen because it was short and appeared to have a high interest level for the individuals involved (Ingle, 1962).

The teachers involved in the spaced practice treatment were requested to devote 10 minutes a day for four consecutive days (Tuesday through Friday) to the task. They were to hand out the poem, read it to the students, have the students read it with them, and devote the rest of the 10 minutes to individual memorization. At the end of the 10-minute period, each student was requested to write as much as he could from memory, and the poems and work were collected. The material collected on the last day (Friday) was used to evaluate learning.

The teachers involved in the massed practice session were requested to devote four consecutive, 10-minute periods on Friday to the task. They followed the same procedures as the spaced practice group except for the fact that they did not collect the poems at the end of each 10-minute segment, but merely asked each student to turn the paper over and write from memory. Before the criterion test was given, all papers were collected.

Both groups were given a retention test on writing the poem from memory on the Monday following the final memorization period and recall test on Friday.

The criterion tests, both recall and retention, were scored by counting the number of lines correct and in proper order, disregarding spelling and punctuation.

Results

The hypothesis that students memorizing using a spaced practice method will learn more than students memorizing using a massed practice method was tested using a 2 x 5 x 2 repeated measures analysis of variance. This was done primarily so that we

could test for main effects of treatment (spaced versus massed), eliminate any effect due to difference in grade from the error term, and test interaction between method of memorizing and both recall and retention. The results of the analysis may be seen in Table 1.

The main effect due to practice method was significant at the .01 level. The mean for the classes using the spaced method was 14.72, and the mean for the classes using the massed method was 9.71. From this we may conclude that the hypothesis was supported—there was more learning using the spaced method. Since there are no significant interactions, this result holds across the other factors.

The main effect due to grade was significant at the .01 level. The result for grades 6, 7, 8, 10, and 12 were 10.66, 7.01, 10.22, 15.73, and 18.00 respectively. Since this main effect was not an integral part of the hypothesis under question, no further analysis was carried out. It is interesting to note that there was no steady progression in scores, as might have been expected, until the tenth grade was reached. We have no explanation to offer for the rather low seventh-grade score.

The main effect due to the test was significant at the .05 level. The mean score for the recall test was 12.82, while the mean score for the retention test was 11.60. This was to be expected, although the difference was quite small, indicating little loss as a result of 72 hours. Perhaps a more interesting finding is that there were no interactions. This indicates that on the test of retention neither practice method had a superior effect.

From these results it seems clear that the kind of spaced practice that schools use, that is, approximately 24 hours between similar tasks, produces greater learning than when the task is given in one continuous block. This result may be most easily explained by the different motivational factors that may be operative in each situation. The spaced practice technique, used as it was used, becomes a new task each day, varying the classroom procedures—this tends to have a positive effect on motivation. Also, the spaced practice method is calculated to keep fatigue at a minimum, thus reducing rather powerful inhibiting factors. On the other hand, the massed practice technique may start with the same positive motivation, that is, a different task, but as the practice continues, fatigue and boredom may build up which inhibit the learning. Even though an attempt was made in this investigation to break the massed practice activity with some slight variation, the effective result may have been one of the same task stretching on endlessly. The fact that there was no difference in retention between the two methods tends to support the notion that each method allows other factors to operate selectively, and that, over time, there may be no difference in the methods.

At least one possible criticism of the techniques involved must be recognized. It may be argued that the techniques involved in this study represented simply two different levels of spaced practice (24 hours and a few minutes) in which case it may be said that long spaced practice is better than short spaced practice. By strict definition this is probably true; however, we felt that these

Source of Variation	Degree of Freedom	Sum of Squares	Mean Squares	F Ratio	Significance
Between Classrooms					
Practice Method (P)	1	250.95	250.95	16.28	.01
Grade Level (G)	4	651.61	162.90	10.57	.01
P × G	4	59.91	14.98	.97	N.S.
Classes w/in (PG)	10	154.06	15.41	—	—
Within Classes					
Test (T)	1	15.02	15.02	5.48	.05
T × P	1	2.80	2.80	1.02	N.S.
T × G	4	.67	.17	.06	N.S.
T × P × G	4	6.88	1.72	.63	N.S.
T × C (PG)	10	27.45	2.74	—	—

Table 1. Analysis of Variance Results Using Mean Number of Lines Correctly Memorized per Classroom

procedures were necessary so that the conditions would more adequately represent those found in most school classrooms, and so that the spaced practice group did not have more time than the massed practice group on the task involved. In addition it was felt that keeping students involved in memorizing for 40 straight minutes, less time for initial reading, would be impossible.

Summary

Twenty public school classrooms, four each in grades 6, 7, 8, 10, and 12, were paired within building and randomly assigned to a spaced practice group (10 minutes a day for four consecutive days) or a massed practice group (four, 10-minute periods as a block) to test the hypothesis that students memorizing using a spaced practice method would learn more than students memorizing using a massed practice method. The findings were:

1. The spaced practice group learned a significantly greater number of correct lines of the poem than did the massed practice group.

2. There was a significant difference between grades; however, there was no increasing increment until the tenth grade.

3. There was, as expected, a significant difference between a test of immediate recall and one of retention (72 hours later). The difference, however, was not great.

4. There was no interaction between method of memorizing and retention, indicating that over time both methods seemed equally effective.

It was suggested that the differences between the two methods are due to the fact that each allows a different level of motivation to operate and involves a different level of fatigue.

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A Call for Papers

FREDERICK A. RODGERS

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