Quicker acquisition of information and superior recall were reported for people practicing the Transcendental Meditation technique.—EDITORS

The purpose of this preliminary study was to examine the effects of the Transcendental Meditation program on learning ability and retention (acquisition and recall). The experiment was composed of three sessions of paired-associate anticipation learning and recall, each spaced one week apart. Ten subjects who were experienced with the Transcendental Meditation technique (mean experience = 28 months, S.D. = 13.6 months), six subjects who had recently begun Transcendental Meditation (less than three months experience), and 12 nonmeditating controls participated in the first session. Twenty of these subjects took part in the second session, and 14 subjects returned for the third session. During Session I all subjects were presented with two paired-associate lists to learn to 100 percent criterion: a high-similarity (difficult) list and a low-similarity (easy) list. During Session II all the subjects were given an intermediate-similarity paired-associate list to learn to criterion. Each subject was then randomly assigned to one of three 25-minute intertrial conditions—rest, Transcendental Meditation, or serial learning. After the 25-minute interval, the subjects were reassembled and tested for retention of the paired-associate list and were then given two more trials to try to re-establish criterion knowledge. In Session III returning subjects were tested for recall of the paired-associate list learned during Session II.

Nonparametric tests showed support for a direct relationship between Transcendental Meditation, quicker acquisition, and higher recall performance. Experienced meditators acquired paired associates faster than both nonmeditators and beginning meditators and recalled a higher number of paired associates over 25-minute and one-week intervals. However, since the experienced meditators acquired material more efficiently, it was difficult to distinguish better acquisition from better recall on the recall tests. There were no significant relationships between intertrial activity (Session II) and retention. These results are interpreted as preliminary evidence of the cumulative nature of the benefits of the Transcendental Meditation program, particularly those of increased alertness and effectiveness of the individual.

INTRODUCTION

Educators have continually sought to create more optimal environments for learning and have emphasized the importance of the student’s internal (as opposed to external) environment, or, more precisely, his degree of alertness or learning readiness.

Common sense indicates that increased alertness facilitates learning. Recall is assumed to be an important measure of the degree of learning; thus, increased alertness should enhance not only acquisition but recall as well. It is not clear, however, which factors, if any, are responsible for reducing the rate of decay of encoded impressions that appears to occur as a function of time during wakefulness. A review of the literature reveals no convincing evidence of an improvement in recall as a function of external factors such as teaching methods or environmental conditions, provided the amount of learning is held constant. Therefore, educators’ emphasis on improving internal environmental factors (alertness, learning readiness) to increase acquisition and recall is clearly appropriate.

It is commonly known that increased alertness is correlated with sufficient rest. Concentration is greater when one is rested; well-rested subjects learn more easily and quickly, and retention and recall are greater after an interval of normal sleep than after an equal interval of waking activity. It may be, therefore, that a method of providing deep rest to subjects would bring about an increase in alertness, which would in turn create a more optimal internal environment for both acquisition and retention.

Recent investigations of the psychophysiology of the Transcendental Meditation (TM) technique have yielded
evidence of a resultant change in the style of functioning of the nervous system described as "restful alertness." A profound decrease in respiration rate during Transcendental Meditation has been reported (1, 9). Results of extensive measures taken by Wallace (9) include reduced oxygen consumption and heart rate. The decrease in metabolic rate during TM compared to wakefulness was greater than that found in comparing sleep to wakefulness. Increased skin resistance and an increased amount of EEG alpha rhythm coupled with short intervals of theta-wave activity indicate that a unique state of restfulness, alertness, and low anxiety occurs during TM. Two studies on reaction time (7, 8) have noted that reactions in meditators became faster after a normal period of TM (15–20 minutes). Nonmeditators did not improve in reaction time following an equal period of relaxation. Both of these studies found mean reaction time of meditators to be less than that of nonmeditators. Meditators also exhibit reduced anxiety levels (2, 3, 4, 5, 6). A process that reduces anxiety should have a positive influence on learning ability, as excessive anxiety hinders performance.

From the physiological and psychological data on TM it is therefore reasonable to deduce that there may exist some measurable differences in cognitive processes resulting from the practice of Transcendental Meditation. As these areas of psychological research had been hitherto unexplored, this prediction was investigated using a familiar measure of acquisition and recall—paired-associate learning. Based on the physiological indications that the state of awareness brought about through TM is one of increased calm and alertness, it was predicted that those who practice the Transcendental Meditation technique would learn paired associates faster than nonmeditators and that meditators would retain more paired associates than nonmeditators, both over a short (25-minute) interval and over a long (one-week) interval.

METHOD

All subjects were members of the undergraduate student population of the University of California at Berkeley. Nonmeditators (NM) were recruited through the campus placement center. Experienced meditators (TM) were randomly selected from a mailing list of the Students International Meditation Society and contacted by telephone. Beginning meditators (BTM) were recruited at introductory lectures held at the Berkeley Center of the Students International Meditation Society. All subjects were requested to attend three sessions, each one week apart and approximately one hour in length.

Ten experienced meditators (mean = 28 months experience, S.D. = 13.6 months), six beginning meditators (less than three months experience), and 12 nonmeditators participated in the first session. Eight experienced meditators, four beginning meditators, and eight nonmeditators took part in the second session; and six experienced meditators, three beginning meditators, and five nonmeditators returned for the third session. Nonmeditating subjects were told that the experiment was a standard learning experiment; TM and BTM subjects were told that the purpose of the experiment was to measure learning changes due to TM. None of the subjects were aware that they were to be tested in the same room with people from other groups.

Groups of five to ten subjects, which included members of each experimental group, were presented with paired-associate lists played on a Wollensak tape recorder. Each item on the lists consisted of a three-letter nonsense trigram (s-term) followed by a meaningful word (r-term) that subjects were to associate with the three-letter trigram (s-term). Lists consisted of ten pairs.

The anticipation method was used for learning trials; i.e., the presentation of each nonsense trigram (s-term) was followed by a four-second silence during which the subject could guess at its associated word. The trigram was then repeated, followed immediately by its associated word (r-term). Each learning trial was alternated with a test trial in which each trigram was read at seven-second intervals; subjects were directed to recall the associated words, if possible, and record them on answer sheets.

Nonparametric tests were used to measure interaction between acquisition, retention, and intertrial activity (see Session II below), to inspect for trends in correlation of amount of meditation experience and acquisition rate, and to make pairwise and combined comparisons of acquisition and retention among the three groups.

SESSION I—The twofold purpose of this session was to reveal any differences in learning ability among groups by first presenting a very high-similarity (difficult) paired-associate list (list 1) and to determine the number of repetitions necessary for most subjects to reach a criterion of two consecutive correct responses to all items on a low-similarity (easy) paired-associate list (list 2). The following directions were given to all groups:

The experiment will be carried out with the aid of this tape recording machine. You will hear three letters of the alphabet, then there will be a short silence, and then the three letters will be repeated, immediately followed by a familiar word. You will hear ten such groups of letters and words. Try to remember which letters are paired with each of the familiar words, because after hearing each learning list of trigrams and words once, you will hear a list of only the three-letter trigrams read slowly. At this time try to write the appropriate word for each trigram as you hear it. If you can't make a guess then place an "X" on the line on your paper where you would have written that word. Don't worry if you don't learn all of the pairs right away, but try to pick them up as you go along, since there will be several repetitions of the entire learning list—test list sequence.
Please note that although the order of presentation will change each time the list is presented, the pairs will remain the same over all the opportunities to learn them. After you have heard the first test list, you can try to guess the right word for each trigram while the learning list is being given by writing your answer during the silence after each trigram is given; you may then correct yourself on that item when you hear the pair read together. However, you may at no time write any of the trigrams to help learn them.

The experimenter then diagrammed the presentation (learning list) and answer (test list) procedures on the blackboard, answered subjects' procedural questions, and began the tape.

SESSION II (ONE WEEK AFTER SESSION I)—Based on the subjects' performance on the Session I lists, it was decided to use an intermediate-similarity (intermediately difficult) list (list 3) to measure recall differences. The subjects were given the following instructions prior to the testing:

You will be presented with a list of pairs to learn in the same way as last week. However, this time you may have your list checked for errors at any time by the experimenter or the assistants. Once you have demonstrated knowledge of the list by completing two consecutive correct test lists, put your pencil down.

If after the twelfth trial some subjects had not reached criterion, all subjects studied written lists of all the pairs for five minutes before continuing learning and test trials. When all subjects had reached criterion, they were randomly assigned to one of three intertrial conditions (in three separate rooms):

1. Rest. Subjects were told to close their eyes and relax until further directions were given.
2. Transcendental Meditation. Subjects were told to close their eyes and begin to meditate as they normally did at home until further directions were given.
3. Serial learning. Subjects were presented with two serial learning lists.

(It should be noted that obviously none of the NM group could be assigned to the second intertrial condition, as they had not received instruction in TM.) Twenty-five minutes later the subjects were reassembled and given a test trial from paired-associate list 3 to obtain a measure of recall. They were then given two more learning and test trials in order to try to re-establish criterion knowledge of the list.

SESSION III (ONE WEEK AFTER SESSION II)—All subjects were given a test trial of the paired-associate list from the preceding week (list 3) in order to obtain a measure of long-term retention and recall.

RESULTS

SESSION I—The TM group learned significantly more pairs than the NM group during the first seven test trials of list 1 (high-similarity, difficult) and also during the first seven test trials of list 2 (low-similarity, easy) \( (p < .05 \) in both cases, Wilcoxon sum rank test). No significant difference was found between nonmeditators and beginning meditators for either list; however, the Mann-Kendel test of correlation measured a mild positive correlation \( .42, N = 10, p < .10 \) between amount of TM experience (length of time since learning the technique) and ability to learn the paired-associates in list 1. No correlation was found for the second list. (See table 1.)

SESSION II—The TM group learned more pairs than the NM group during the first seven test trials of list 3 (intermediate-similarity, intermediately difficult) \( (p < .10, \text{ Wilcoxon sum rank test}) \). After the 25-minute intertrial interval the TM group also recalled significantly more pairs than the NM group \( (p < .05, \text{ Wilcoxon test}) \). No significant difference was found between the NM and BTM groups for the number of correct responses. Kendall's

<table>
<thead>
<tr>
<th>TABLE 1</th>
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<tbody>
<tr>
<td>MEAN NUMBER OF CORRECT RESPONSES ON PAIRED-ASSOCIATE ACQUISITION (LEARNING) TRIALS</td>
</tr>
<tr>
<td><strong>NUMBER OF CORRECT RESPONSES IN FIRST 7 TRIALS</strong></td>
</tr>
<tr>
<td><strong>GROUP</strong></td>
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<td></td>
</tr>
<tr>
<td>Experienced meditators (TM)</td>
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<tr>
<td>Beginning meditators (BTM)</td>
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<td>Nonmeditators (NM)</td>
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</tbody>
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tau, for the Kruskal-Wallis test, did not reveal a significant interaction between intertrial activity and short-term (25-minute) recall, possibly because of the small size of the subgroups. (See fig. 1 and tables 1 and 2.)

SESSION III—When subjects were retested for long-term recall of list 3 (intermediate difficulty), the TM group remembered significantly more pairs than the nonmeditators (\( p < .05 \), Wilcoxon test). The Kruskal-Wallis trend test disclosed a significant trend in numbers of pairs recalled, increasing from NM to BTM to TM subjects (\( p < .01 \)). (See fig. 2 and tables 1 and 2.)

**TABLE 2**

**MEAN NUMBER OF PAIRED ASSOCIATES RECALLED FROM LIST 3 (INTERMEDIATE SIMILARITY)**

<table>
<thead>
<tr>
<th>GROUP</th>
<th>25-MINUTE INTERVAL (Session II)</th>
<th>1-WEEK INTERVAL (Session III)</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>Experienced meditators (TM)</td>
<td>8</td>
<td>6.50</td>
</tr>
<tr>
<td>Beginning meditators (BTM)</td>
<td>4</td>
<td>3.25</td>
</tr>
<tr>
<td>Nonmeditators (NM)</td>
<td>8</td>
<td>3.88</td>
</tr>
</tbody>
</table>

**DISCUSSION**

These results provide preliminary support for the hypotheses of this study. The first hypothesis, that TM subjects would acquire paired associates faster than nonmeditators, was supported by the significant differences in acquisition rate between experienced meditators and nonmeditators on all three lists. The fact that there were no significant differences in acquisition rate between nonmeditators and beginning meditators suggests that meditators prior to beginning the TM technique are not different from nonmeditators and that the TM program is indeed responsible for the significant differences in acquisition rate between the nonmeditators and the experienced meditators. A longitudinal study would strengthen this preliminary conclusion.

Both tests related to the second hypothesis—that the TM program would enhance retention of material—gave results in the direction of confirmation. Experienced meditators (TM group) showed significantly superior short-term and long-term retention and recall. However, since they also acquired material more efficiently, it is difficult to distinguish better acquisition from better recall on the recall tests.
Future research designed to extend these preliminary findings should employ groups matched for age, sex, and, most importantly, intelligence to control for differences in learning ability between groups due to the self-selection of those who choose to learn the TM technique.

If the results of this pilot study are confirmed in further studies, the implications for improvement of education through the Transcendental Meditation program are obvious and considerable.

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