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The Effect of Time-Threat on an Arithmetic Test Situation

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THE EFFECT OF TIME-THREAT ON AN ARITHMETIC TEST SITUATION

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CHAPTER I

THE PROBLEM AND DEFINITION OF TERMS USED

There has been a difference of opinion regarding whether or not timing tests of ability is advantageous or hinders performance (4:221). Much experimentation has been done in the area of intelligence testing, but little has been done on actual classroom-type testing. The results of timing intelligence tests have been varied with little agreement among the studies.

I. THE PROBLEM

Statement of the Problem

The purpose of this study was (1) to test the effect of time-threat on the performance of eighty-two sixth grade students taking an arithmetic test, and (2) to investigate the effect of time-threat on students of different arithmetic abilities.

Importance of the Study

Timing classroom performance tests such as tests of arithmetic ability may produce a significant effect on the performance of the students taking the tests. Timing or not timing classroom tests could prove to be of utmost importance

in tests of this type. It is also important to find if students of different abilities are affected by time-threat.

Statement of Hypotheses

Four null hypotheses were investigated in the study (1) no significant difference would be found between scores on the control test and experimental test when comparing all the scores; (2) no significant difference would be found between scores on the control and experimental tests when comparing upper-third arithmetic ability students scores; (3) no significant difference would be found when comparing middle-third arithmetic ability students scores, and (4) no significant difference would be found when comparing lower-third arithmetic ability students scores.

Limitations of Study

A sample of forty-eight sixth grade students from Maple Hills Elementary School in Issaquah, Washington and two elementary teachers were used to determine if the tests used in the study were of equal difficulty. Another sample was limited to eighty-two sixth grade students and four teachers from Briarwood Elementary School in Issaquah, Washington which were used as both the control and experimental groups in the study. They were tested on two arithmetic tests of equal difficulty. They were administered each test one time only seven days apart.

II. DEFINITIONS OF TERMS USED

Mechanical Type Problem

A mechanical type problem refers to a problem that is not of a story type. Mechanical problems do not incorporate reading as a basis for finding the solution. They refer to number problems in addition, subtraction, multiplication, division; and addition, subtraction, multiplication and division of fractions, along with decimals and powers of numbers.

CHAPTER II

REVIEW OF THE LITERATURE

The literature directly applying to the topic of time-threat on classroom type tests was almost nonexistent. The review of literature was done on those studies which were closely related to the topic of this study.

I. LITERATURE ON TIMING TESTS

Intelligence Testing

One study done on intelligence testing and timing supports the fact that timing makes little difference in this type of situation. A group of fifty students took an intelligence test in Hindi, they took it with the instructions to attempt all the items but to work as quickly as possible; twenty-five students repeated the test with a twenty minute time limit. "The factor of time was found to make no particular difference in the scores" (2:48).

Ability Tests

Eysenck and Furneaux experimented with timing ability tests in England. They concluded that timing ability tests improves performance. They argue,

> that the speed with which the mind produces hypotheses is the essence of good problem solving, and that a speeded (timed) test is therefore the best measure of mental ability (6:98).

Others argue that timing or speeding tests of ability has a great effect on the outcome of the test scores and that timing produces disadvantages.

> If speed of performance is not specifically being measured, there are disadvantages to a time limit on tests of capacity, especially at early ages (5:6,112).

Power Tests

It has also been found that putting time limits on power tests (tests ordinarily without time limits) produces a greater range of scores (14:288), and in diagnostic reading tests it was found that the average student suffered the most. It was found in an experiment done on the effect of time on the Triggs Diagnostic Reading Test that,

> under power conditions the average student, that is the slow and accurate student, comes out nearer the top when given plenty of time, but suffers when there is a time limit. Change in relative standings occur with considerably greater frequency through the middle ranges of scores than they do at either extreme of the range of scores (1:181).

Desirability of Timing Tests

Most group tests are given with a time limit. Whether an ability test should be given a time limit is arguable (4:221). Studies have indicated that timing ability tests may be advantageous and other studies indicate that timing makes little difference in test score results. The purpose of this study was (1) to investigate the effect of time-threat on performance in a classroom arithmetic test

situation, and (2) to investigate the effect of time-threat on students of different arithmetic abilities.

CHAPTER III

PROCEDURE

I. GROUPS AND METHOD USED

Subjects

A sample of forty-eight sixth grade students from Maple Hills Elementary School in Issaquah, Washington were used to determine if the tests used were of equal difficulty, and the subjects of this study were eighty-two sixth grade students from Briarwood Elementary School in Issaquah, Washington. The eighty-two students were used as both the control group and the experimental group. The subjects were grouped this way to rule out individual differences that could have influenced the test results.

Method

Two arithmetic tests were constructed employing mechanical type problems randomly selected from the adopted text of the Issaquah School District for sixth grade students. The text used was Elementary School Mathematics, Book 6, Philippines: Addison-Wesley, 1968, 348pp. Page assignments in the book were arranged in a sequential order from lower degree of difficulty to higher degree of difficulty. A sample of eighty different items were paired according to degree of difficulty. Each pair was assigned a number from

one to forty. A coin was flipped and alternately one of the paired items was placed on either the control test or the experimental test. All the numbered items on the control test were put on individual pieces of paper and placed in a container. They were mixed up and drawn out one at a time. The first item drawn out became number one on the control test, the next item drawn became number two and so on. The same thing was done with the experimental test items. This random placement was done to eliminate the possibility of getting too many of the same degree of difficulty items placed together, which may have had some effect on the results.

The type of arithmetic items used were addition, subtraction, multiplication, and division items; also addition, subtraction, multiplication, and division of fractions; along with decimals and powers of numbers.

The tests were administered to forty-eight sixth grade students from Maple Hills Elementary School in Issaquah, Washington to determine if the two tests were of equal difficulty. The students were told that the results of the tests could be used for placement in arithmetic classes in junior high school. They were given the control test first and seven days later were given the experimental test under the same conditions. Both tests were administered without time-threat by two teachers from Maple Hills in two different

classrooms. A t-test was administered to the results to determine any significant difference between the scores of two tests.

TABLE I

EQUAL DIFFICULTY OF CONTROL AND EXPERIMENTAL TESTS

Group	N	Mean	S.D.	t
Control Group	48	14.3	7.70	.16*
Experimental Group	48	14.5	6.45	

*Not significant at .05 level

The tests were then administered to eighty-two sixth grade students from Briarwood Elementary School in Issaquah, Washington. Four classrooms and four teachers were used in the study. Two of the classes took the control test first and two of the classes took the experimental test first. Seven days later the procedure was reversed. The tests were given exactly at the same time of day on both sessions.

The four instructors had written directions for the two tests and read them to the students. The instructions were:

> You are about to take an arithmetic test, the results of which may be used in placing you in arithmetic classes in junior high. Do as many of the items that you can. Do not worry about time. If you get stuck on an item, go on to the next item. Do all your figuring on scratch paper, when necessary. Any problems that can be worked on the answer sheet may be. Are there any questions?

The administrators were told that if they were asked by any of the students how much time the test would take, they were to tell the students that the test would not be timed, but to work as quickly as possible. The administrators were told to record the starting time and after forty minutes to collect the tests.

The instructions for the experimental group test were the same except the sentence, "You will have forty minutes to complete the test," was added. The administrators were also told to call out in five minute intervals the time remaining. (i.e. "You have thirty-five minutes left. You have thirty minutes left, etc.") The tests were collected after forty minutes.

All the tests were corrected by the writer of this study. The control test scores were recorded on a table in rank order from highest score to lowest. The score attained on the experimental test was paired on the table with the score that student attained on the control test. The difference between the two test scores was also tabulated on on the table, and the scores were divided into upper-third, middle-third, and lower-third based on the rank obtained on the control test.

Tests of significance were administered to (1) all control and experimental test scores, (2) upper-third control

TABLE II

TABLE OF RANK AND DIFFERENCE

Control Test Rank	Control Test Score	Experimental Test Score	Difference	
1	38	31	-7	
2	38	37	-1	
3	37	36	-1	
4	37	34	-3	
5	37	37	0	
6	36	38	+2	
7	34	33	+1	
8	34	32	-2	
9	32	31	-1	
10	31	35	+4	
11	31	32	+1	Upper-
12	31	28	-3	Third
13	30	32	+2	
14	28	26	-2	
15	28	30	+2	
16	28	21	-7	
17	28	30	+2	
18	27	22	-5	
19	27	29	+2	
20	27	33	+6	
21	26	25	-1	
22	26	24	-2	
23	26	26	0	
24	26	33	+7	
25	26	24	-2	
26	26	26	0	
27	26	30	+4	
28	25	23	-2	
29	25	32	+7	
30	23	22	-1	
31	23	21	-2	
32	22	21	-1	
33	21	22	+1	Middle-
34	21	24	+3	Third
35	20	21	+1	
36	19	20	+1	
37	18	24	+5	
38	18	17	-1	

TABLE II (Continued)

Control Test Rank	Control Test Score	Experimental Test Score	Difference	
39	18	18	0	
40	18	20	+2	
41	18	18	0	
42	17	16	-1	
43	17	24	+7	
44	17	15	-2	
45	17	19	+2	
46	16	19	+2	Middle-
47	16	17	+1	Third
48	16	11	-5	
49	16	14	-2	
50	15	11	-4	
51	15	13	-2	
52	14	16	+2	
53	14	17	+3	
54	14	12	-2	
55	14	21	+7	
56	14	15	+1	
57	14	26	+12	
58	14	13	-1	
59	13	15	+2	
60	13	15	+2	
61	13	7	-6	
62	11	12	+1	
63	11	10	-1	
64	11	15	+4	
65	11	13	+2	
66	10	14	+4	
67	10	11	+1	Lower-
68	10	11	+1	Third
69	8	3	-5	
70	8	7	-1	
71	8	10	+2	
72	8	14	+6	
73	7	12	+5	
74	7	12	+5	
75	7	10	+3	
76	7	2	-5	
77	7	6	-1	
78	6	8	+2	
79	5	1	-4	
80	5	5	0	
81	4	7	+3	
82	1	1	0	

and experimental test scores; (3) middle-third control and experimental scores, and (4) lower-third control and experimental scores.

CHAPTER IV

I. RESULTS

Null Hypothesis 1

A t-test was administered to the scores of the control and experimental group tests for the eighty-two students. The mean of the control group test scores was 19.5 with a standard deviation of 10.25. The mean for the experimental group test scores was 20.05 with a standard deviation of 9.55. The t was .36 which was not significant at the .05 level.

TABLE III

TABLE OF SIGNIFICANCE FOR ALL SCORES

Group	N	Mean	S.D.	t
Control Group	82	19.50	10.25	.36*
Experimental Group	82	20.05	9.55	

*Not significant at .05 level

Null Hypothesis 2

The scores on the control group tests and the paired score on the experimental group tests were divided into upper-third scores. The upper-third scores consisted of the top twenty-seven scores on the control test and the paired scores on the experimental test. The mean of the upper-third control group test scores was 30.24 with a standard

deviation of 4.25. The mean of the upper-third experimental group test scores was 30.44 and the standard deviation was 4.78. The t was .16, which was not significant at the .05 level.

TABLE IV

TABLE OF SIGNIFICANCE FOR UPPER-THIRD SCORES

Group	N	Mean	S.D.	t
Upper-Third Control Group	27	30.24	4.25	.16*
Upper-Third Experimental Group	27	30.44	4.78	

*Not significant at .05 level

Null Hypothesis 3

The scores on the control group tests and the paired scores on the experimental group tests were divided into middle-third scores, which were the next twenty-seven scores on the control test and its paired score on the experimental test. The mean of the middle-third control test was 18.72 with a standard deviation of 3.06. The mean of the middle-third experimental test was 18.90 with a standard deviation of 4.82. The t was .17, which was not significant at the .05 level.

TABLE V

TABLE OF SIGNIFICANCE FOR MIDDLE-THIRD SCORES

Group	N	Mean	S.D.	t
Middle-Third Control Group	27	18.72	3.06	.17*
Middle-Third Experimental Group	27	18.90	4.82	

*Not significant at .05 level

Null Hypothesis 4

The scores on the control group tests and the paired scores on the experimental group tests were divided into lower-third scores, which were the lowest twenty-eight scores on the control test and its paired scores on the experimental group test. The mean of the lower-third control group test scores was 8.64 with a standard deviation of 3.12. The mean of the lower-third experimental group test scores was 11.36 with a standard deviation of 5.98. The t was 2.13, which was significant at the .05 level.

TABLE VI

TABLE OF SIGNIFICANCE FOR LOWER-THIRD SCORES

Group	N	Mean	S.D.	t
Lower-Third Control Group	28	8.64	3.12	2.13*
Lower-Third Experimental Group	28	11.36	5.98	

*Significant at .05 level

CHAPTER V

I. SUMMARY AND CONCLUSIONS

Summary

The study found no significant difference between all the scores on the control group test and the experimental group test. However, students taking the experimental test did have a higher mean score. The mean score for the experimental group was 20.05 and the mean score for the control group test was 19.5.

The control and experimental group scores were divided into upper-third scores according to rank on the control group test. A t-test of significance indicated no significant difference between the two groups of scores. The mean for the control test was 30.24 and the mean for the experimental test was 30.44.

The control and the experimental group scores were divided in the middle-third scores according to rank on the control group test. There was no significant difference between the two groups of scores. The mean for the control test was 18.90; the experimental mean was 18.72.

The control and experimental group scores were divided into lower-third scores according to rank on the control test. There was a significant difference at the .05 level between the two groups of scores. The mean of the lower-third control

test was 8.64 and the mean for the experimental test was 11.36, indicating a significant difference. Students of lower arithmetic ability did better under the time-threat situation.

Conclusions

Time-threat seems to make little difference in performance on mechanical arithmetic test items. However, lower arithmetic ability students improved significantly when subjected to time-threat. These findings coincide with a study by Ruebush on the effect of anxiety on testing. He found that the effect of anxiety on performance, whether facilitating or interferring, may vary systematically depending upon intelligence, type of task, and instructions for the test (12:205-212).

Time-threat may act as stress upon the students in a testing situation. Some studies reviewed report that performance is impaired as a result of psychological stress (9:293-317). However, other studies indicate that stress makes little difference in performance (7:21-26, 8:71, 13: 133-45). The latter findings support the findings of this study indicating that there was little difference under the experimental situation.

Another study by Murphy supports the findings of the lower-middle group scores. Murphy's investigation on the

effects of threat on performance of identifying design patterns on four decks of cards found that performance differences obtained were greater under threat than under nonthreat. There were fewer errors in the threat condition (10:134-141). These findings parallel the findings of this study for the lower-third arithmetic scores. However, Murphy's study dealt with perceptual skill rather than arithmetic ability, so the results may be inconclusive.

Sarason and his associates (1952:561-565) found that results on performance tests are effected by anxiety levels of the subjects. He found differences in performance of subjects of high and low anxiety when subjected to different degrees of anxiety provoking situations. This study made no attempt to determine the anxiety levels of the subjects being studied, but these individual differences may have had some effect on the outcome of the study.

Research in the specific area of time-threat on classroom type tests is lacking. Research in other areas of threat, anxiety, and timing of tests have uncovered many differences of opinion. More studies on time-threat classroom type tests is indicated and a replication of this particular study using a larger sample and different age group students seems justifiable.

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APPENDIX

CONTROL GROUP TEST

Name_____ Math Test

1.) (36÷9)x9=n

n=

2.) 5x3 1/3=

3.) 20x4/5=

4.) 3 1/2÷3 1/10=

5.) Reduce 12/32=

6.) 8x1/4=

7.) 1 1/4x2 1/2=

8.) 23,142÷551=

9.) 8^3=

10.) 37-n= 29

n=

11.) 5/6-3/8=

12.) Reduce 18/20=

13.) 1 1/4÷1/2=

14.) 7/12-n= 1/4

n=

15.) $\frac{5/6}{5/8}$=

16.) 387÷46=

17.) $50.40÷24=

18.) n+8= 15

n=

19.) 372+78+65=

20.) 32,716÷7=

21.) nx5/8= 0/8

n=

22.) 6÷1/2=

23.) nx4/5= 1

n=

24.) $\frac{4/5}{2/5}$=

25.) 3/2+5/6=

26.) n-1/4= 5/8

n=

27.) 3/4÷7/5=

28.) 50,783÷72

29.) 3/8+n= 9/8

n=

30.) $\frac{3/7}{1/5}$=

31.) 1/3x4 3/4=

32.) Reduce 16/48=

33.) $\frac{12\ 1/2}{100}$=

34.) 2,335÷467=

35.) 3/5x3/2=

36.)
$1.98+
.99+
.49+
.16=

37.) 1/2x1/4=

38.) 15/18=nx56

n=

39.) 3 1/2x4 1/3=

40.) 2 1/3÷1/2=

EXPERIMENTAL GROUP TEST

Name_____ Math Test

1.) 1/4÷1 1/5=

2.) 3168÷792=

3.) 586+79+8=

4.) 259÷37=

5.) 2 2/5÷1 1/10=

6.) 12,803÷413=

7.) 53,969÷58=

8.) (56÷8)x8=n

n=

9.) 7^3=

10.) n+9=13

n=

11.) 2/5xn=0/5

n=

12.) $\frac{32/100}{8/10}$=

13.) $\frac{5/8}{9/16}$=

14.) 1/6+1/7=

15.) $69.50÷25=

16.) 6/7xn=1

n=

17.) 1/2x1/3=

18.) 1/8+n=5/8

n=

19.) n-1/4=5/8

n=

20.) 8/35=2/7xn

n=

21.) 1 1/8x1 1/2=

22.) Reduce 18/30=

23.) 3/5÷1/8=

24.) 1/2x5 1/4=

25.) $\frac{4/5}{5/6}$=

26.) 5x3/10=

27.) Reduce 10/24=

28.) 24x1/6=

29.) Reduce 10/32=

30.) 2 1/2÷ 1/4=

31.) $\frac{1/4}{2/3}$=

32.) 8÷1/3=

33.) 68,327÷8=

34.) 1/2-n= 1/6

n=

35.) 3/4+5/6=

36.) $3.24+
$ .69+
$1.49+
$ .08=

37.) 6x2 2/5=

38.) 2/3x5/2=

39.) 5 1/5x1 1/3=

40.) 54-n= 47

n=