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Brainstorm: A Highly Competitive Game and its Effect on Fifth Grade Science and Social Studies Achievement

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BRAINSTORM: A HIGHLY COMPETITIVE GAME
AND ITS EFFECT ON FIFTH GRADE
SCIENCE AND SOCIAL STUDIES ACHIEVEMENT

A Thesis
Presented to
the Graduate Faculty
Central Washington State College

In Partial Fulfillment
of the Requirements for the Degree
Master of Education

by
John William Meyers
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CHAPTER I

THE PROBLEM, OBJECTIVES, AND DEFINITION OF TERMS USED

In recent years a difference of opinion has existed regarding the effectiveness of games. Some educators believe games have many intrinsic values to facilitate learning and achievement. Others believe the competition involved from participating in games is detrimental to some student's emotional status. No sound research has been conducted in relation of games to achievement.

I. THE PROBLEM

Statement of the problem. Motivation is the key to learning. The interested child is the child who tries. According to Whitty (10:21-23), "interest calls forth effort, and we know that often it is intensive effort that really educates."

What is the shape of this key that motivates? This question has perplexed educators for some time. In today's technological world there are many types of instructional media that serve for motivation. What will work best in a given situation is the problem. The purpose of this study is to determine whether a highly competitive game called Brainstorm will serve as a media toward motivation and will improve achievement in science and social studies at the

fifth grade level.

Importance of the study. Education has become more watchful upon new approaches and new media for improving classroom instruction. The traditional classroom and the traditional methodology are being challenged by these new approaches and new media as it relates to achievement. No one approach to teaching, no single form of instructional media is substantiated as superior by recommendation and newness alone. Clearly it is time to initiate a series of vigorous and sophisticated investigations of these new approaches and instructional media as they relate to learning and achievement. Brainstorm is a new instructional media and no research has been conducted on it.

II. THE OBJECTIVES

The very nature of this investigation plus a very close examination of the problem and importance of the study lead this writer to state the following objectives:

1. To test the null hypothesis---fifth grade students subjected to the use of Brainstorm for the duration of one school year will not score higher on a science and social studies standardized achievement test than fifth grade students not using Brainstorm.
2. To determine the over-all value of Brainstorm as a means for improvement in attitude toward school.
3. To determine the over-all value of Brainstorm

as a new media for motivation in fifth grade.

III. DEFINITIONS OF TERMS USED

Brainstorm. The term Brainstorm throughout the report of this study shall be interpreted as an educational device and game which is a direct adaptation from the television quiz show "General Electric College Bowl." The Brainstorm machine is a device comprising of twelve individual units of micro switches and lamps, with each one of the micro switches and associate lamp being connected to a common control center. The elements are arranged in an electrical circuit whereby when one of the micro switches is depressed, the associate lamp goes on, a buzzer sounds at the control center and all the switches and lights are automatically cut off from being subsequently activated. The circuit can be reset at the control center to repeat the process with any one of the other micro switches activating the circuit.

The device was used by an instructor at the control center and two teams of five to six pupils each. Each one of the pupils participating was provided with one of the response units. The two teams are seated at the front of the classroom and the teacher asks a toss-up question, and the first pupil to respond depresses the push button of the

micro switch so as to be recognized and given a chance to answer it. If the student is correct in his answer, his team scores ten points. That team is then given a bonus question worth from ten to thirty points. The team then working together is given approximately fifteen seconds to discuss together what they believe comprises a correct answer to the bonus question. Each member of the team takes a turn in answering a bonus question. If the bonus answer is totally correct, the team receives the full amount of designated bonus points. If parts of the answer is correct partial points are awarded to the team. At the conclusion of a bonus question and answer, another toss-up question is asked and the process is repeated. After a certain time period or a designated amount of points a team is declared a winner.

A typical toss-up question used was, "Who was the main author of the Declaration of Independence?" The correct response was, "Thomas Jefferson." A typical bonus question used was, "For fifteen points name the three parts of an atom." The correct response was, "proton, neutron, and electron."

Each classroom using Brainstorm was divided into six teams of five or six members. Teams were setup by the teacher according to achievement so as to have even sides.

The teams competed once a week in a cycling schedule where each team eventually played all other teams. Team standings were posted on a bulletin board and at the end of the year a champion team was declared.

Section. Section was interpreted as an individual teacher using conventional techniques and working independently with a self-contained class of approximately thirty-five students.

Control group. Throughout the report of this study the term "control group" shall be interpreted to mean two sections as defined above.

Experimental group. Throughout the report of this study the term "experimental group" shall be interpreted to mean two sections as defined above except the students in this group will be subjected to the use of Brainstorm.

Attitude toward school. The term "attitude toward school" was interpreted as a student's like toward school in relation to enjoyment and motivation to study.

CHAPTER II

REVIEW OF LITERATURE

During the 1950's the national literature on education became involved in a concern for quality in education. The Soviet orbital successes a short time later caused an anxiety in education which emphasized new types of media. Educators became increasingly aware of new modes of instruction, teaching machines, and audio-visual equipment through the literature of the time.

I. LITERATURE ON MOTIVATION, ACHIEVEMENT, AND GAMES

Many forms of educational media have been introduced into the classroom in the last decade. Most all of these media are related to motivating the student to learn. Wasserman's findings (9:162-172) pointed out highly motivated subjects did show increased performance. Also the preliminary findings in a study by Moore and Smith (7:160-162) indicated a direct relation between motivation and achievement.

Games tend to create excitement and motivate the participants. Games related to academic subjects to some extent should create a motivation for students to learn. Kasperson (6:409-422) says, "games have unquestionably impressive effectiveness in stimulating student interest

and involvement and this is their greatest strength."

Coleman (4:1-2) reported, "there are apparently certain aspects of games that especially facilitate learning, such as their ability to focus attention, their requirement for action rather than merely passive observation, their abstraction of simple elements from the complex confusion of reality, and the intrinsic rewards they hold for mastery." By the combination of these properties that games provide, they show remarkable consequences for learning.

There are also many other advantages in games as educational media. Kasperson (6:409-422) lists these.

1. Because of the excitement surrounding the playing of a game the attention span of the student is appreciably lengthened.
2. Games are versatile in that they can involve simultaneously both fast and slow learners and increase social interaction among diverse groups in a class.
3. Games generate feedback which provides immediate reinforcement.
4. Games are probably a highly effective medium with bright underachievers who resist more expository instructional techniques.

In a game there is usually a winner and a loser. Some educators believe losing or being defeated is a bad experience for a child. Coleman (4:1-2) points out that

children must learn to accept defeat. If they cannot, they are at a very low level of socialization.

II. LITERATURE ON COMPETITION

There is some controversy over the use of games and the competition involved. Combs (5:356-358) reported what he believed were myths about competition and his "facts" denying these myths.

- Myth 1. We live in a competitive society.
- Fact 1. We live in the most cooperative interdependent society the world has ever known.

- Myth 2. Competition is a powerful motivating force.
- Fact 2. Only those compete who feel they have a chance of winning. The rest ignore the competition.

- Myth 3. Competition is a useful device for controlling and improving quality.
- Fact 3. Competition is inefficient and outmoded as a means for quality production.

Another controversy over competition through the use of games is the amount of learning which actually takes place. "Ironically, the very things that make a game engrossing and exciting may also be a weakness in that they diminish rather than incite learning," states Boocock and Coleman (1:217-218). There may be emphasis on winning rather than learning.

As stated before, the purpose of this study is to determine if a highly competitive game can noticeably

improve achievement.

CHAPTER III

METHODS OF RESEARCH

I. RESEARCH SETTING

Fifth grade students in self-contained classrooms attending Lydia Jane Hawk Elementary School and Mountain View Elementary School, both of the North Thurston School District, Lacey, Washington, were the subjects for this study. These two schools serve a community of largely middle class families. Each school enrolls approximately six hundred students. Lydia Jane Hawk and Mountain View are graded kindergarten through fifth grade.

The experiment included approximately one hundred and forty fifth grade students. The experimental treatment was conducted during the entirety of the 1969-1970 school year.

II. PROCEDURES FOR THE EXPERIMENT

The procedures used in this experiment will be discussed in terms of three factors: (1) the design of the experiment; (2) the teaching procedures; (3) the testing procedures.

Design of the experiment. Generally, the experiment followed the classical design for experimental research.

There was one experimental group of two sections and one control group of two sections. The experimental group ~~was~~ students from two self-contained fifth grade classrooms at the Lydia Jane Hawk School. The control group ~~was~~ students from two self-contained fifth grade classrooms at the Mountain View School. Each group numbered seventy students.

The two groups were selected on the basis of similar standardized achievement test scores and the district superintendent's recommendation of fifth grade teachers of similar qualifications with good science and social studies teaching approaches.

Teaching procedures. Two conditions occurred in this experiment. The two sections of the experimental group were subjected to using the highly competitive game Brainstorm once a week for a period of eight months. The other condition, the two sections of the control group, omitted the use of Brainstorm. Other than the use of Brainstorm, all four sections were taught by similar methods and strategies. The basic approach used in teaching the four sections is generally considered to be "traditional," one teacher using conventional methods in a self-contained classroom of thirty-five students.

The study, covering a course in fifth grade social studies and science, was of one year's duration. The basic texts used in the course were Concepts In Science 5 by Brandwein (2) and In These United States by Preston and Tottle (8).

Four teachers, three males and one female, carried the primary responsibility for conducting the courses in this study. Each instructor had his bachelor's degree from similar institutions and all but one had taken graduate work, thus affording similar educational backgrounds.

In terms of experience, variations did occur. The teachers of the control group had thirty and ten years of experience. The teachers of the experimental group had two and three years experience. Both experimental teachers had used Brainstorm in their previous teaching experience.

Testing procedures. The "American School Achievement Test For Social Studies And Science, Grades 4-6," was given at the beginning of the school year as a pre-test and the same test was given at the conclusion of the school year as a post-test. These standardized science and social studies test scores served to determine whether there was significant differences in achievement between the control

and experimental groups.

To determine objective number two (See Page 2) attitudes of the experimental and control classes were measured objectively by the use of an "Equal - Appearing Interval Scale," (See Appendix) administered both as a pre-test and a post-test. To determine objective number three (See Page 2) a "Summated Rating Scale for Brainstorm" (See Appendix) was submitted to parents, principal, teachers, and students of the experimental group at the close of the school year. From these attitudinal scores a somewhat objective measurement of the value of Brainstorm was gained.

The data from the following testing will be presented and analyzed in the next chapter.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

I. ACHIEVEMENT TEST RESULTS

The raw scores from the achievement pre and post-tests were computed so that a statistical comparison was made between the scores of the experimental and control groups.

The "t" test for a difference between two independent means from Bruning and Kintz (3:10-11) was used to show and compare any significant difference in the scores of the test groups.

The ten per cent level was established as the statistical measure of significant difference in learning.

The study was conducted under as controlled and yet as "natural" conditions as could be found in an operating school.

TABLE I

A COMPARISON OF MEANS IN ACHIEVEMENT
INVOLVING THE USE OF BRAINSTORM

<u>Pre-test Results</u>				
Test	E group GP score	C group GP score	"t" test score	Signifi- cance
California Achievement	5.65	5.44	1.337	none
Social Studies Achievement	5.17	5.18	.058	none
Science Achievement	5.90	5.82	.369	none
<u>Post-test Results</u>				
Social Studies Achievement	7.09	6.00	5.926	beyond the .001 level of confi- dence
Science Achievement	7.23	6.64	1.934	beyond the .10 level of confi- dence

NOTE: E means experimental
C means control
GP means grade placement

In the pre-tests there is no significant difference of achievement demonstrated by the test groups at the .10 level of confidence.

In the post-tests there are significant differences demonstrated by the test groups beyond the .10 level of confidence. On the basis of this data the null hypothesis is rejected at the .10 level of confidence in science achievement and the null hypothesis is rejected at the .001 level of confidence in social studies achievement.

II. ATTITUDE TOWARD SCHOOL TEST RESULTS

The raw scores from the Attitude Equal Appearing Interval Scale (See Appendix) were computed so that a statistical comparison was made between the scores of the experimental and control groups.

The "t" test for a difference between two independent means from Bruning and Kintz (2:10-11) was used to show and compare any significant difference in the scores of the test groups.

The ten per cent level was established as the statistical measure of significant difference in attitude toward school.

TABLE II

A COMPARISON OF MEANS IN ATTITUDE TOWARD SCHOOL
INVOLVING THE USE OF BRAINSTORM

<u>Attitude Pre-test Results</u>			
Experimental group interval score	Control group interval score	"t" test score	Signifi- cance
.791	.792	.003	none
<u>Attitude Post-test Results</u>			
.857	.757	3.729	beyond the .001 level of confi- dence

In the pre-test there is no significant difference in attitude toward school demonstrated by the test groups.

In the post-test there was significant difference demonstrated by the test groups beyond the .001 level of confidence. This data indicates Brainstorm is a means for improvement in attitude toward school.

III. MOTIVATIONAL RATING RESULTS

The experimental group scores from the "Summated Rating Scale for Brainstorm" (See Appendix) were averaged. The control group did not rate the motivational aspects of Brainstorm since they were not familiar with it.

A mean score of five or higher was established as meaningful in rating Brainstorm a beneficial media to motivation.

TABLE III

A SUMMATED RATING OF BRAINSTORM
AS A MEDIA TO MOTIVATION

<u>Experimental Group</u>	Mean score
Student Brainstorm rating	6.83
Teacher Brainstorm rating	7.00
Parent Brainstorm rating	6.68
Principal Brainstorm rating	7.00

The means from the rating of Brainstorm as a beneficial media to motivation were meaningful beyond the mean score of five in all ratings. This data indicates that students, teachers, parents, and principal of the experimental group believe Brainstorm is a beneficial media to motivation.

The presentation and analysis of the data used will be discussed in the summary and conclusions presented in the following chapter.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

I. SUMMARY

The purpose of this study was to determine whether the highly competitive game Brainstorm would improve achievement in science and social studies. No research has been done before now on this exact topic. Some research has been conducted on the effect of games relating to achievement. Data from this research was usually positive toward higher achievement, but some research has indicated drawbacks in learning by the use of games. No current research involves one game, but relates to games in general. This study was concerned with one unique game used for the duration of one entire school year and made use of a control versus experimental situation.

Rationale for the study are threefold. The study attempted to gain: (1) more accurate identification and specific application of an educational game related to achievement; (2) close control over the learning and testing environment; (3) a precise criterion measure which would evaluate materials presented during the experiment, rather than generalized learnings. Present research on games has failed to meet these criteria.

II. CONCLUSIONS

The hypothesis of this study was that there would be no difference in achievements of students in social studies and science using Brainstorm as compared to those not using Brainstorm. Other objectives of the study were to determine whether the game Brainstorm had any value on improvement of attitude toward school and as a new media of motivation for students in the elementary school. A group of two sections using Brainstorm was compared experimentally with a similar group of two sections not using Brainstorm for an outcome of achievement and attitude toward school. The two sections that used Brainstorm also rated the game in relation to motivation.

At the conclusion of the school year for the purpose of measuring achievement a "t" test of significance for a difference between two independent means was run on the two groups and the results as discussed in Chapter IV lead this writer to the following conclusions:

The difference in social studies achievement was in favor of the experimental group by a "t" score of 5.926. The difference is significant beyond the .001 level of confidence. The null hypothesis was rejected.

The difference in science achievement was in favor

of the experimental group by a "t" score of 1.934. The difference is significant beyond the .10 level of confidence. The null hypothesis was rejected.

The difference in attitude toward school was in favor of the experimental group by a "t" score of 3.729. The difference is significant beyond the .001 level of confidence. The null hypothesis was rejected.

In all the statistical comparisons discussed above the conclusion reached by this writer was that there was a significant difference beyond the established .10 level of confidence. The null hypothesis was rejected by this writer in all statistical comparisons.

A summated rating scale for Brainstorm was administered to the parents, principal, teachers, and students of the experimental group. The results as discussed in Chapter IV lead this writer to the following conclusions:

Ratings of 6.83 by the students, 6.68 by the parents, and 7.00 by the teachers and principal are meaningful beyond the mean score of five. The writer concludes that it is agreed strongly to very strongly that Brainstorm is beneficial as a motivational teaching device and could benefit other fifth grade students.

Generalizations arising from this analysis definitely point out that Brainstorm has value to the field of education in achievement, attitude toward school, and as a motivational force.

III. RECOMMENDATIONS

One study on any new teaching technique cannot be labeled adequate. Control over the learning and testing environment was kept as close as possible in this situation, but still there were limitations. This study being the first directly related to Brainstorm has left other avenues and possibilities open for further studies.

The writer lists some of the more important issues concerning Brainstorm together with some suggestions for further investigations:

- (1) While learning and achievement may be measured in experiments of one or two hours, it is possible that under classroom conditions a period of one year's instruction is insufficient to gain a comprehensive measure of learning and achievement fair to both conditions.
- (2) In this experiment only science and social studies were measured. However if four to six courses were measured, possibly a more reliable

comparison could be made.

- (3) In this study methods and strategies were not controlled. Further studies could maintain some control over what is to be taught and how it is to be taught. However, a degree of freedom should be given to the separate conditions for organizing and pacing the materials.
- (4) This study somewhat ignored the teacher variable. One teacher instructing a section of both the experimental and control groups would eliminate this variable, but would cause impracticalities.
- (5) A series of studies need to be conducted on a number of grade levels. At the secondary level studies need to be conducted in varied subject fields. This series of studies could relate optimum benefits of Brainstorm at certain levels and in certain subject fields.
- (6) Further studies should be designed to measure more than achievement, attitude toward school, and motivational aspects. The ability of students to think critically, to study independently, on concepts of learning, and certain behavioral objectives are some factors that

should be measured.

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APPENDIX

EQUAL - APPEARING INTERVAL SCALE

Instructions: Place an (X) on the dot next to the
one sentence you most agree with.

- 1.00 . I like school and want to study all the time.
- .90 . I like school and I like to study a lot.
- .80 . I like school and I like to study
sometimes.
- .70 . I like school.
- .60 . I like school sometimes.
- .50 . I do not like school
most of the time.
- .40 . I do not like
school.
- .30 I do not like school and
I do not like to study. .
- .20 I hate school and I
never want to study. .

NOTE: The higher the scale value the more positive
the attitude toward school.

SUMMATED RATING SCALE FOR BRAINSTORM

Instructions: Given below is a statement concerning the game Brainstorm. Below the statement are seven blanks proceeded by opinions about the statement. Place a check mark in the blank that best describes your opinion of the statement.

Statement: Brainstorm is beneficial as a motivational teaching device and could benefit other fifth grade students.

- _____ agree very strongly
- _____ agree strongly
- _____ agree
- _____ disagree
- _____ disagree strongly
- _____ disagree very strongly
- _____ have no opinion about Brainstorm

NOTE: Seven points will be given for checking the blank agree very strongly, six points for agree strongly, five points for agree, three points for disagree, two points for disagree strongly, one point for disagree very strongly, and four points for have no opinion about Brainstorm.