THE EFFECTS OF NON-COMPETITIVE, INDIVIDUAL COMPETITIVE, AND GROUP COMPETITIVE SITUATIONS ON THE VERBAL AND FIGURAL CREATIVITY OF COLLEGE STUDENTS

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ABSTRACT

THE EFFECTS OF
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This study was concerned with the environment most conducive to creative productivity. Specifically, the major objective of this investigation was to assess the relative effects of non-competitive, individual competitive, and group competitive situations on the verbal and figural creativity of college students. An additional objective was to examine whether sex interacted with the competitive treatments to affect verbal and figural creativity.

The instrument selected to measure verbal creativity was Torrance's Product Improvement Activity. This task provides scores on verbal fluency, verbal flexibility, verbal originality, and verbal elaboration. The instrument selected to measure figural creativity was Torrance's Parallel Lines Activity. This task provides scores on figural fluency, figural flexibility, figural originality, and figural elaboration.

A sex by treatment post-test only factorial design with an equal number of observations per cell was employed. Paid volunteer subjects were randomly assigned to either the non-competitive, individual competitive, or group competitive treatment conditions. In the non-competitive condition (n=28), subjects were told not to be concerned about how their performance on the creativity task compared to that of the other subjects working on the tasks. In the individual competitive condition (n=28), subjects were first divided into four mixed-sex groups. They then were told that the individual in each group achieving the best overall performance on the creativity tasks would win a reward of ten dollars. In the group competitive condition (n=28), subjects were also divided into four mixed-sex groups. They then were told that the group achieving the best overall performance on the creativity tasks would win a reward of seventy dollars to be shared equally among the members (i.e., ten dollars for each subject).

To assess the results, two separate 2 by 3 multivariate analyses of variance (MANOVA's) were the major statistical procedures utilized. One MANOVA was performed on the scores obtained on the verbal creativity task. The other MANOVA was performed on the scores obtained on the figural creativity task. When significant treatment effects were obtained, Turkey pair-wise comparison were conducted to determine where specific treatment differences lay.

Two supplementary statistical procedures were also carried out. First, correlation matrices both within and across all treatment conditions were computed to determine the intercorrelations of the measures of verbal and figural creativity. Second, analyses of covariance were conducted to determine the effect of the different treatments on verbal originality and verbal elaboration when verbal fluency was held constant.

The statistical analyses produced the following results:

(1) Verbal creativity was differentially affected by the treatment conditions. Specifically, subjects in the individual competitive condition scored significantly higher than subjects in the non-competitive condition on verbal fluency and verbal originality and significantly higher than subjects in both the non-competitive and group competitive conditions on verbal elaboration. On none of the measures did the non-competitive treatment group differ from subjects in group competition.

(2) Figural creativity was not differentially affected by the treatment conditions. Although performance was generally higher in the individual competitive condition, none of the treatment differences were significant.

(3) Sex did not interact with the treatments to affect either verbal or figural creativity. In general, both sexes did best in the individual competitive condition.

(4) The sexes did not differ significantly on any of the measures of verbal creativity. However, males did significantly better than females on two of the figural creativity measures: figural flexibility and figural originality.

(5) Almost all of the verbal and figural creativity measures correlated significantly with each other (26 of the 28 intercorrelations were significant). However, the verbal measures and the figural measures correlated more highly among themselves than they did with each other.

(6) Intercorrelations among the creativity measures were generally highest in the individual competitive condition and lowest in the non-competitive condition.

(7) When verbal fluency was held constant, verbal originality was no longer significantly affected by the treatment conditions. However, the treatments still had a significant effect on verbal elaboration when the effects of verbal fluency were accounted for.

The most important implication of this study is that individual competition, in which individuals compete against other individuals in order to attain a reward, may be an effective procedure for instructors to use when verbal creativity is one of their instructional objectives.

Further research in this area is needed, however, before more definitive and broad generalizations can be drawn.

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A DISSERTATION

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To my parents,

who have loved and believed in me always

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CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

The Problem

Creativity has been a topic of interest throughout the history of man, although it is only within the past two decades that it has been studied in any systematic and scientific way. Indeed, in his presidential address to the American Psychological Association in 1950, Guilford noted that only 0.2% of all the titles in Psychological Abstracts were in any way related to creativity. Such a statistic readily indicated the appalling neglect of this important and unique characteristic of human behavior.

With the increasing awareness of the need to identify and develop the creative potential and abilities of our children in order to meet the challenges of the Space Age, creativity research has dramatically and steadily increased since the mid-fifties. The majority of such research has focused on identifying the nature of the creative person. Literally hundreds of investigations have sought to determine the intellectual and personological traits that characterize creative individuals. Despite the fact that many of these investigations have used different procedures and measuring instruments and have tested different types

of samples, the findings they have obtained have been remarkably congruent with one another (Dellas & Gaier, 1970). Research on this aspect of creativity, therefore, has been most rewarding, for we now have a sound, empirically based understanding of the attributes and qualities creative individuals tend to possess.

In contrast to research on the creative person, the empirical findings obtained in other areas of creativity research have not been nearly as consistent nor as plentiful. Particularly is this so with respect to research on the creative environment. In reviewing many of the studies which have examined the environmental conditions that facilitate or inhibit creative productivity, Stein (1974) points out that there are still many unresolved problems in this area. One such problem which is still open to question is whether or not competition is an effective stimulant of creative productivity. While there is a considerable body of evidence indicating that competition enhances productivity on non-creative tasks (e.g., Maller, 1929; Julian & Perry, 1967; Freischlag, 1973; Clifford, 1971), very little research has examined the relationship between competition and performance on divergent or creative thinking tasks. An exhaustive review of the literature reveals that only four studies to date have specifically compared performance on creative tasks under non-competitive and competitive conditions (Torrance, 1959; Torrance, 1965; Raina, 1968; Adams, 1968). The results

obtained have been contradictory. While Torrance (1959, 1965) and Raina (1968) found that competition facilitated creative production, Adams (1968) found competition to be detrimental.

Considering the meager and contradictory evidence on the efficacy of competition for creative achievement, further and more detailed study in this area seems warranted. Accordingly, the major purpose of this investigation is to examine the effects of competition on the creative productivity of college students, a here-to-fore unstudied population in this area. This study will specifically investigate the following questions:

(1) Does competition enhance creative productivity?

(2) Does individual competition have the same effect on creative productivity as group competition?

(3) Does the effect of individual and/or group competition on creative productivity depend upon whether or not the creative task is verbal or figural?

(4) Does the effect of individual and/or group competition on creative productivity depend upon the sex of the individual?

Importance of the Study

The world we live in today is faced with a variety of highly complex and difficult problems. Many, if not all, of these problems will only be solved when creative, original ideas are applied to them. In recognition of this fact, many eminent scholars have urged those in the business of education to direct more attention towards developing and fostering the creative abilities of students. Piaget,

perhaps one of the world's most celebrated psychologists, has asserted: "... the principal goal of education is to create men who are capable of doing new things, not simply repeating what other generations have done--men who are creative, inventive, and discovers." (1964, p. 5) Guilford (1968) has claimed that the future of mankind will be determined by present and future efforts to understand and control creative performances. According to him, "Creativity is the key to education in its fullest sense and to the solution of mankind's most serious problems" (p. 147). Torrance (1971) is yet another psychologist who believes that creativity is essential to human satisfaction and fulfillment. As he sees it:

> It is becoming increasingly clear that nothing can contribute more to the mental health and general welfare of our own nation and to the general satisfaction of its people than a general raising of the level of creativity. The stifling of creativity cuts at the very roots of satisfaction in living and eventually creates overwhelming tension and breakdown. (p. 221)

If we accept the argument that there is a need to encourage and promote creativity, it then becomes important to specify the environmental conditions which are most conducive to its expression. In short, the basic question becomes: What kind of environment stimulates creativity? By studying how individual and group competition affects creative productivity, the present investigation will examine one particular aspect of this basic question. It is believed that the data obtained in this study may have

important implications for educational practice. To the extent that individual and/or group competitive situations are found to enhance creative productivity, it may be advisable for instructors to arrange such situations in their classroom when creative thinking is one of their instructional objectives. Of course, to the extent that competitive situations are found to inhibit creative productivity, it may be advisable for instructors to de-emphasize such situations.

Conception of Creativity

Most psychologists agree that creativity is a highly complex, multifaceted phenomena. As such, it is not surprising to find that conceptions of creativity vary considerably among different investigators. In noting this situation, Golann (1963) has commented:

> Creativity has been viewed as a normally distributed trait, an aptitude trait, an intrapsychic process, and as a style of life. It has been described as that which is seen in all children, but few adults. It has been described as that which leads to innovation in science, performance in fine arts, or new thoughts. Creativity has been described as related to, or equatable with intelligence, productivity, positive mental health, and originality. It has been described as being caused by self-actualization and by sublimation and restitution of destructive impulses. (p. 548)

Clearly there are a variety of approaches to conceptualizing creativity. The present investigation adopts the approach put forth by Guilford (1959, 1967). He conceptualizes creativity in terms of mental abilities

or traits involved in creative achievement. Through factor analysis, Guilford has identified fluency, flexibility, originality, and elaboration as the major component traits related to creative thinking. Fluency is defined as the ability to generate many ideas which are meaningful and relevant to the task at hand. Fluent thinkers can efficiently retrieve and produce many ideas from their memory store in response to a problem. Flexibility is the ability to shift from one mode of thought to another, to approach a problem in diverse ways, or to apply different principles to a problem. Flexible thinkers are able to produce many different categories or types of ideas. Originality is the ability to produce unique, clever, or rare (i.e., statistically infrequent) ideas which are, at the same time, appropriate to the task at hand. Original thinkers can produce clever ideas which are rarely thought of by most other individuals. Elaboration is the ability to embellish or add detail to ideas so that they are more interesting or complex. Elaborate thinkers are able to develop or embroider their ideas by providing additional information over and above that which is necessary to communicate the basic idea.

While Guilford readily concedes that these traits are not all there is to creative thinking and that the existence of these traits will not guarantee the production of creative work, he does believe that their presence will increase the chances for creative production. These

four traits--fluency, flexibility, originality, and elaboration--are the dimensions of creativity that are of interest in this study. Since these four indices of creativity may be expressed in either verbal form (i.e., through language) or figural form (i.e., through drawings or pictures), there are actually eight different dependent variables examined in this study. Specifically, verbal fluency, verbal flexibility, verbal originality, and verbal elaboration are the dependent variables that make up the larger construct of verbal creativity. Similarly, figural fluency, figural flexibility, figural originality, and figural elaboration are the dependent variables that make up the larger construct of figural creativity. The instruments that will be used to measure these traits are described in chapter II.

Review of Related Literature

In this section we will review the literature that is pertinent to this investigation. Since the primary interest of this study is with identifying environmental conditions most conducive to creativity, we will first review several studies which have investigated the effectiveness of various procedures (other than competition) for stimulating creative thinking. Next we will focus on the variable of most concern to this study--competition. We will initially touch on some of the arguments that have been raised, for and against, the presence of

competition in our educational system. We will then review much of the research concerned with the relationship between competition and productivity on non-creative tasks. Following this we will examine in detail the few studies which have investigated the effects of competition on creative productivity. Finally, we will look at some of the literature which suggests the possibility of sex differences in responsiveness to individual and group competition.

Procedures for stimulating creativity

As indicated earlier, the majority of creativity research has concentrated on identifying the nature of the creative person. While this research has resulted in giving us a better understanding of such individuals, the labeling of individuals as creative or non-creative has had the unfortunate consequence of reinforcing the notion that creativity is a fixed trait, i.e., that a person has a certain fixed amount of creative ability and that attempts to influence or alter an individual's level of creative functioning will thereby prove to be futile. In recent years, however, many researchers have convincingly demonstrated that such a notion is unwarranted. In this section we will review just a sampling of the empirical research which shows that a variety of environmental manipulations or procedures can significantly influence the level of creative output of individuals.

One of the most consistent findings is that variations in the instructions given to individuals can alter both the quantity and quality of their creative performances. Parnes and Meadow (1959) compared the effect of brainstorming instructions with that of "evaluative" instructions on the performance of college students on Guilford's Unusual Uses test, a task which requires subjects to write, within specified time limits, as many different uses as possible for a common object (e.g., a paper clip). Under the brainstorming instructions, subjects were told to forget about quality and to concentrate solely on producing as many ideas as possible. Conversely, under the evaluative instructions, subjects were told to produce only ideas of good quality and that bad ideas would be penalized. The results revealed that a significantly greater number and quality of responses were produced under the brainstorming instruction condition than under the evaluative condition.

Other investigators have found that another efficient technique for enhancing creative output is to give individuals instructions that establish a "creative" set. For example, Gilchrist and Taft (1972) observed that college students increased the number and proportion of original responses on the Unusual Uses task when they were simply told to "be original" than when they were given only the standard instructions. Similarly, Manske and Davis (1968) reported that either the number of original

responses or the number of practical responses to the same task was increased depending upon whether or not subjects were told to "try to be original" or "try to be practical". An experiment by Levy (1968) also found that creative responding on a word-association task was enhanced when subjects were instructed to role play a creative person. Apparently, role playing made the subjects feel that it was appropriate and "permissable" to produce more unusual, original responses.

Another procedure that has been found to be useful for stimulating creative production is that of modeling. While it has long been recognized that the models an individual is exposed to can influence his behavior (Bandura, 1969), not until very recently has the effect of modeling on creative behavior been experimentally tested. In one of the initial investigations on this problem, Harris and Evans (1973) examined the effect of different symbolic models (i.e., written protocols in response to the Unusual Uses task) on the performance of college students on a variety of creativity tasks. One group of subjects were exposed to a model that presented a variety of divergent, original responses. Another group of subjects were exposed to a model that illustrated convergent responses. A final group of subjects were not exposed to any model at all. Analysis of the results indicated that on subsequent testing on identical, similar, and generalization creativity tasks, subjects exposed to

the divergent thinking model produced significantly more divergent and original ideas than those exposed to the convergent thinking or no model condition. In an extension of this study, Harris and Evans (1974) sought to determine whether exposure to a symbolic divergent thinking model would be more beneficial than simply instructing subjects to respond creatively. Again using college students as subjects, they found that while instructions to respond creatively enhanced performance on the Unusual Uses test over that of a control group, subjects exposed to the divergent thinking model produced the most creative, original ideas.

Belcher (1975) conducted a further study on the effects of modeling on creative production. However, in contrast to the studies of Harris and Evans, which utilized written materials as models, Belcher examined the effects of a videotaped model. In this study 92 fourth- and fifth-grade children were randomly assigned to four groups. In one group the subjects viewed a model who emitted highly original uses for tin cans. A second group of subjects viewed the same model emitting unoriginal uses for a tin can. A third group of subjects read a booklet specifically designed to train children's idea production. The final group of subjects were simply an untreated control group. Based on the fluency and originality scores from Torrance's Unusual Uses test, the

results showed that the group that observed the model emitting original uses performed significantly better than the other three groups.

Still another valuable procedure for stimulating creativity is to present rewards contingent on the production of creative effort or work. Halpin and Halpin (1973) studied the effects of reward on the creative performance of 62 undergraduate students enrolled in educational psychology courses. In this study all subjects were initially tested on Verbal Form B of the Torrance Tests of Creative Thinking. Seven days later subjects were administered Verbal Form A of the Torrance tests. However, on this second administration, half of the subjects were told that they could each earn bonus points to be added to any educational psychology test of their choice depending upon how much improvement they made over their scores obtained on the first testing. The other half of the subjects simply took the tests under standard instructions. Analysis of the data indicated that the subjects who received reward instructions scored significantly higher on verbal fluency, flexibility, and originality than did the subjects in the control group. A study by Bamber, Jose, and Boice (1975) also found that giving monetary rewards contingent upon the production of creative responses was effective in enhancing the creative performance of college students.

Further study also indicates that delayed rewards may be just as effective as immediate rewards for promoting creative production. Ward, Kogan, and Pankove (1972) gave 191 fifth-grade children two pairs of creativity tests on two occasions (both tests were administered to each child individually). On the second occasion, children in one condition each received a one cent reward immediately after each idea they produced; children in another condition were given pennies after the task was completed (Delayed Reward Condition); children in a third condition served as controls. The findings revealed that while children in the immediate and delayed reward conditions significantly increased the number of ideas (fluency) relative to controls, no differences in performance existed between the immediate and delayed rewards conditions. A more comprehensive investigation by Johnson (1974) provides confirmatory evidence. In this study 145 third-, fourth-, and fifth-graders worked on several of Torrance's figural creative thinking tests under an immediate reward, delayed reward, or no reward condition. In the immediate reward condition, subjects were told that if they "worked hard" on the tests, they would each receive prizes immediately after they had finished. In the delayed reward condition, subjects were given the same instructional set except that they were told they would have to wait one week to receive the prizes. In the no reward condition, of course, no incentives were offered. The results showed that subjects who received

immediate and delayed reward instructions scored approximately the same. However, both reward groups scored significantly higher than the subjects who did not receive any reward instructions on the measures of figural fluency, flexibility, originality, and elaboration.

From the above studies it is clear that creative production can be enhanced by a variety of environmental manipulations or procedures. Brainstorming instructions, instructions that establish a creative set, modeling, and the presentation of rewards contingent upon creative effort or production are just some of the ways that have been found to be useful for stimulating creativity. The present investigation is interested in determining if competition--in which individuals and/or groups compete against each other in order to attain a reward--is another procedure that can beneficially influence creative production. Before we examine the empirical research that is most directly related to this problem, let us first consider some of the general arguments, pro and con, that have been raised about the presence of competition in our educational system.

Competition and Education

At all levels of education, from kindergarten through graduate school, students are continually competing against one another for various rewards or honors. Not surprisingly, the students themselves are acutely aware of this situation. Recent research indicates that students perceive competition to be one of the primary characteristics of their school

environment (Johnson & Johnson, 1974).

While few would dispute the presence of competition in our educational system, many educators believe that competition is detrimental to the educational process. Alfred Adler (1964) was very much opposed to the emphasis on competition in our schools because he felt it creates an environment that fosters selflishness and disregard for others. He wrote:

> Under our present system we generally find that when children first come to school they are more prepared for competition than cooperation; and the training in competition continues throughout their school days. This is a disaster for the child; and it is hardly less of a disaster if he goes ahead and strains to beat the other children than if he falls behind and gives up the struggle. In both cases he will be interested primarily in himself. (p. 163)

Cronbach (1963) and Jersild (1975) have pointed to other negative side effects of competition. They suggest that students who are frequently unsuccessful in competitive situations often develop feelings of inadequacy and tend to withdraw from those activities in which they have failed to excel. Neill (1960) and Leonard (1968) have also argued that a major disadvantage of stressing competition is that it subverts intrinsic motivation for learning and thinking. Yet another criticism of competition is that it creates an evaluative, judgmental atmosphere that arouses excessive threat, induces undue anxiety, and, thereby, impedes learning and achievement (Rogers, 1954; Shaw, 1958). Indeed, with specific regard to creativity,

Rogers believes that the threat of evaluation that is present in competitive situations breeds defensiveness, which, in turn, is inimical to creative thinking.

Despite the many criticisms that have been leveled against competition in the schools, there still remains many educators who believe it to be beneficial to the educational process. Ebel (1972), for example, notes that exposure to competition in school is valuable because it prepares students to cope with competitive situations they will undoubtedly face once they have finished with school. Perhaps the best and most frequently cited reason for utilizing competition in the schools is that it is a highly effective means for motivating and enhancing student achievement. Ausubel (1968) most succinctly summarized this rationale when he proposed: "Competition stimulates individual effort and productivity, promotes higher standards and aspirations, and narrows the gap between capacity and performance." (p. 424) Before turning to the research which has directly tested the validity of this proposition for creative tasks, let us first review the related research concerned with the relationship between competition and productivity on non-creative tasks.

Competition and Productivity on non-creative tasks

Prior to examining the research in this area, it is important to distinguish between two forms of competition: individual competition and group competition. The former

is characterized by competition in which the competitors are individuals, only one of whom can attain the goal (e.g., best performance on a task) and receive the reward. The latter is characterized by competition in which the competitors are groups, only one of which can attain the goal and share the reward. To facilitate organization of the review, we will first examine those studies which have compared a single competitive treatment (either individual or group) with a single non-competitive treatment. We will then examine those studies which have compared the relative effectiveness of individual and group competition.

Competition vs. Non-competition. Triplett (1898) was one of the first to investigate the relationship between competition and productivity. He studied the effect of individual competition on the rate at which 40 children, ages 8 through 17, turned fishing reels. He found that 20 subjects attained higher rates in competition than when performing alone, 10 subjects achieved their best speeds when they were performing alone, and 10 subjects performed equally well under both conditions. Triplett noted that competition had the most beneficial effect on subjects with slow speeds, the least effect on subjects capable of very fast speeds, and the most harmful effect on young children who became over-excited by the competition and lost motor control.

Hurlock (1927) gave 155 fourth-, fifth-, and sixth-graders a test of simple addition problems. On the basis

of these results, the children in each grade were divided into two equal groups--the control and the rivalry group. At the beginning of the second day, the rivalry group was divided into two equal sub-groups which competed against each other on four subsequent arithmetic tests given on four successive days. The control group also took four more arithmetic tests but only with instructions to add the examples as quickly and as accurately as possible. Analysis of the results indicated that, in both grades four and six, the average score of subjects in group competition exceeded that of control subjects on every day of the experiment except that of the initial performance.

More recent experiments have also supported the beneficial effects of competition. Peretti (1971) examined the performance of college students on a color-word interference task under individual competitive and non-competitive situations. On this task subjects were presented with a list of 60 color-words. Each word was the name of a color, but the color of each was different from the name. The subjects' task was to correctly name the colors and ignore the word-names. Peretti found that performance on this task was significantly better when subjects were given competitive rather than non-competitive instructions. Also studying college students, both Freischlag (1973) and Carment and Hodkin (1973) found that performance on a simple perceptual-motor task was enhanced when subjects competed against one another than

when they were tested in a non-competitive situation.

A number of studies indicate that competition can even effectively stimulate the performance of mentally retarded children. Stoneman and Keilman (1973) gave the Maze and Dots subtests of the Factored Aptitude Series to 40 educable mentally retarded children who ranged in age from 8 to 14 years. In the Maze task the subject must draw a line through a series of points without touching them. In the Dots task the subject must put a dot in each of a series of very small traingles, without touching the sides. It was found that performance on both of these tasks was significantly better when the subjects were instructed to compete against each other than when no such instructions were given. A study by Brown, Hoppler, VanDeventer, and Sontag (1973) suggests that the reading comprehension performance of EMR children can also be improved by competitive situations. In this study, after baseline measurements indicated that the children were answering correctly only about 25% of their reading comprehension questions, the children were divided into teams and were informed that the teams would compete against each other. The goal of the competition was to see which team could correctly answer the most comprehension questions. After several days of team competition, subsequent testing revealed that the children were answering an average of 75% of the comprehension questions. They were thus doing three times better than

their performance prior to competition!

Clifford (1971) examined the performance of fifth and sixth graders on a task similar to the digit-symbol task of the Wechsler Intelligent Test under competitive and non-competitive conditions. She found that competition for a reward enhanced performance, but only when the subjects believed they were similar in ability to those whom they were competing against. It seems reasonable to suggest that when individuals feel out-matched and thereby feel they have little chance to receive the reward, competition will not effectively stimulate their performance.

Individual competition vs. group competition. The studies reviewed in this section examine productivity as a function of the type of competition in which an individual participates. The first five studies conclude that productivity is greater in individual than in group competition; the latter three report findings supporting the converse conclusion.

May and Doob (1937) contend that the American educational system encourages individual achievement and leads students to believe that their levels of aspiration can be met by becoming "the best in the class" or "at the top of the list." In reviewing the literature on competition, they conclude that "individual remuneration stimulates a greater efficiency of work than group remuneration; the work of an individual for himself is more efficient than his work for a friend or for other men." (p. 38)

Sims (1928) observed this to be true for 81 college students working on two different kinds of tasks: (1) substituting digits for letters and (2) reading with speed and understanding. Individual competitors performed far better than group competitors. In fact, the work produced under group competition was only slightly superior to the work produced when there was no competition associated with the tasks.

In one of the most extensive studies in this area, Maller (1929) had 1,538 children (grades five through eight) in ten different schools complete tests involving simple addition problems. They alternated between individual competition (where the individual achieving the best performance would get a prize) and group competition (where the class achieving the overall best performance would get a prize). The children also were given a free choice test consisting of seven sheets of work which they could do either for the group or for themselves.

The results revealed that both forms of competition produced an increase in work output above the level of unmotivated or practice work. However, the children produced a great deal more work on the tests in individual competition than in group competition. Although the children initially worked equally hard for the class as for themselves, as testing proceeded they increased the amount of work produced for themselves and decreased the amount of work produced for the class. On the free

choice test, where they could work either for themselves or for the class, the children chose the former alternative about three times as often as the latter.

Julian and Perry (1967) divided 157 college students into four- and five-member teams to examine productivity under individual competition, group competition, and pure cooperation. These conditions were established by announcing three different sets of grading criteria for performance on a required laboratory exercise. The criteria announced were as follows: (a) the highest grades would go to individuals performing the best work, regardless of team membership (individual competition); (b) the highest grades would go to all members of the one group which produced the single best performance (group competition); and (c) the highest grades would be granted to all members of each group achieving at least 90% of the possible performance points, regardless of the performance of other groups (pure cooperation).

The required exercise involved two discussion questions to be answered in detail by each student. The findings were that the highest overall quality and quantity of performance occurred in individual competition and the poorest overall performance occurred in pure cooperation. Performance in both individual and group competition was significantly higher than in pure cooperation.

Kakkar (1968) studied the performance of 384 Indian college students on arithmetic problems under non-

competitive, individual competitive, and group competitive situations. Each student worked on the problems under each type of situation. While both competitive situations were found to increase productivity, performance was clearly best under the individual competitive condition.

In a study by Whittemore (1924), three groups of four college students were given the task of using individual types to print paragraphs from the daily press. In successive trials, the subjects were instructed: (a) to avoid competing with one another, (b) to attempt to beat other group members, or (c) to work together to surpass other groups. The results showed that all subjects produced more work when competing than when not competing. When the two types of competition were compared, it was found that subjects worked slightly faster in group competition than in individual competition while the quality of the work did not differ.

In the course of this investigation, Whittemore interrupted both competitive and non-competitive trails to ask subjects what they were thinking and whether they were conscious of competing. In analyzing the replies, Whittemore (1925) was able to provide a partial explanation for the increased productivity observed in the competitive situations. During competitive trials, the subjects' thoughts focused on some phase of their work or on the work being accomplished by their rivals. In contrast, when non-competitive trials were in progress, subjects had

a greater tendency to daydream and to think about ideas irrelevant to the task.

In yet another study comparing individual and group competition, Deutsch (1962) divided 50 volunteers from an introductory psychology course into ten groups. Each week during five weeks of experimentation, the groups were presented with a puzzle on which they were to work together. The group's task was to formulate a solution for the puzzle. The only difference between the groups was the difference in their instructions. Five groups received instructions designed to elicit group competition: "the grade or reward that each member received would be the same and would be determined by the relative position of his group in contrast with the other four similar groups." Five groups received instructions designed to elicit individual competition: "each member would be rated in comparison with the efforts of the other four members comprising his group, the grade or reward that each would receive would be different and would be determined by the relative contributions of each to the solution of the problem." Analysis of the results indicated that the productivity of group competitors on the whole was better than that of individual competitors. Group competitors not only solved the puzzle problems more rapidly, but also came up with better solutions than the individual competitors.

In an experiment by Raven and Eachus (1964), each subject was seated at one corner of a triangular board and given the task of leveling the board by turning the knob. A subject could not alter the level of his own corner directly, but by turning the knob at his corner could alter the corners at which the other two subjects were seated. Twenty triads were told that the object of the task was to see how fast the three of them could level the board in comparison to the other triads (group competition). Twenty other triads were told that the object was to see which one of them could level his own corner first (individual competition). Measures of the time required for all three corners to be leveled showed that triads in group competition operated with greater speed and efficiency than triads in individual competition.

From the studies reviewed in this section it is clear that individual and group competition may differentially affect productivity on a particular task. While some studies have found individual competition to be better than group competition, other studies have obtained opposite findings. In accounting for these contradictory results, Jones and Vroom (1964) point out that one must consider the nature of the task in order to determine whether individual or group competition will yield greater productivity. More specifically, Jones and Vroom note that those studies which found individual competition to be

more effective utilized independent tasks, i.e., tasks on which individuals worked separately. Conversely, those studies which found group competition to be more effective employed interdependent tasks, i.e., tasks requiring individuals to work together.

Competition and Productivity on creative tasks

The studies reviewed in the previous section indicate that competition can stimulate productivity on a variety of non-creative tasks, with individual competition being more effective for independent tasks and group competition being more effective for interdependent tasks. Whether or not competition is an efficacious procedure for enhancing performance on creative tasks is a problem which few researchers have tackled.

Torrance (1959) conducted the first known experimental effort to demonstrate the effects of competition on creativity. In this study first through sixth graders worked on Torrance's Product Improvement Activity, a task which requires subjects to suggest as many clever and unusual ideas as they can for improving a toy stuffed dog. While one group of children worked on the task under non-competitive conditions, another group worked under competitive conditions in which a prize was promised for the individual who achieved the best performance. Analysis of the data indicated that the competitive group produced a significantly larger number (fluency) and greater flexibility of responses than the non-competitive group.

This finding held up across all grade levels.

In response to Torrance's study, critics argued that a brief "warm-up" or practice session would eliminate the differences between the competitive and non-competitive groups. Consequently, Torrance (1965) undertook another study to test the validity of this criticism. First through sixth graders were randomly assigned either to a "practiced" condition, in which the class spent some time prior to testing thinking of ways to improve a toy fire truck, or to a competitive condition, in which the class was not given any practice but was told that the individual achieving the best performance on the task would receive a reward. The task used to assess creative thinking was identical to the one used in the first study.

The results revealed a fairly consistent tendency for all children under the competitive condition to excel those under the practiced condition. Specifically, subjects in the competitive condition scored significantly higher on fluency in the first, third, and fourth grades, significantly higher on flexibility in the second and fourth grades, and significantly higher on originality in the second, third, and sixth grades. In no grade did the children in the practiced condition exceed the children in the competitive condition on any of the measures. Thus, Torrance concluded that practice may reduce but does not completely compensate for the stimulating effects of competition.

A study by Raina (1968) provides cross-cultural evidence for the efficacy of competition on creativity. In this experiment 40 Indian students (equivalent to ninth-graders in the American educational system) worked on Torrance's Product Improvement Activity as well as his Unusual Uses test, a task which requires the subject to think of as many clever uses of a particular object as one can. Twenty of the subjects worked on the tasks under standardized conditions (the control group), while the other twenty were told that the three individuals scoring highest would each receive a monetary reward (the competitive group). The results indicated that the competitive group was significantly more fluent and flexible in their ideas than the control group. For some unexplained reason, Raina did not assess the originality scores of the two groups. Consequently, it is not known whether competition enhanced this particular component of creativity.

In contrast to the studies of Torrance and Raina, Adams (1968) obtained findings suggesting that competition is a detriment to creative production. In this study, ninth grade students worked on a battery of Guilford's divergent thinking tasks (Unusual Uses, Consequences, Object Naming). Prior to testing, one group of subjects were given the following non-competitive instructions in addition to the standard instructions: "... It is not important how well you do in comparison to others taking the tests. Your answers will not be compared with those

of other students. You may feel free to take these tests without worry as to how you do in relation to others." Another group of subjects were given the following competitive instructions in addition to the standard instructions: "...we want to discover whether you can do better than the other groups taking the tests, so your tests will be scored and compared with the scores from the other groups. Try very hard to do better than all of the other students if you want your group to come out on top."

The results showed that the group given the non-competitive instructions were significantly more flexible in their ideas than the group given the competitive instructions. Since no assessment was made of the fluency and originality of the responses, it is not known how the groups compared on these two measures. In any case, Adams' findings are clearly inconsistent with those of the previous studies. There are a number of differences, however, between Adams' study and the studies of Torrance and Raina which may partially account for the discrepant results. One difference is the way in which the competition was induced. Whereas Torrance and Raina offered a prize for the individual achieving the best performance, Adams simply instructed subjects to try to do better than others--no concrete incentive was offered. A second difference was in the type of competition that was utilized. Whereas Raina and Torrance employed individual competition, Adams emphasized group competition.

Considering these differences, it seems plausible to suggest that the subjects in Adams' study had less to personally gain from competition than the subjects in the other studies, and, as a result, they were not as motivated to do well on the tasks. Why they should be less productive than the non-competitive group, however, is still not clear. Although Adams argues it is the fear of evaluation in competitive situations that results in reduced creative performance, the subjects in the other studies also knew their performance would be evaluated. Thus, fear of evaluation cannot be used to explain the divergent results.

Overall, the meager evidence available on the effects of competition on creative productivity does not allow for definitive conclusions. A number of limitations characterize the research that has thus far been undertaken in this area. First, in two of the studies (Raina, 1968; Adams, 1968) the originality dimension of creativity was not even assessed and in no study was the elaboration dimension assessed, yet these would seem to be the two most important factors to consider. Second, no study has examined the effects of competition on the creative performance of college-age subjects. As Stein (1974) suggests, the effects of competition may vary with age. Third, no study has examined how competition affects performance on non-verbal or figural creativity tasks. Previous research indicates that while a particular procedure may enhance verbal creativity, it may have little

beneficial effect on figural creativity. Torrance (1970), for example, found that dyadic interaction effectively stimulated performance on verbal creativity tasks, while Brown (1973) reported that dyadic interaction hampered productivity on figural creativity tasks. It may well be that competition also has a differential effect on verbal and figural creativity tasks. A final limitation of research in this area is that no study has compared the relative effects of individual and group competition on creative performance. It is apparent from the studies reviewed in the previous section, however, that these different forms of competition may yield different results.

The present study proposes to eliminate the limitations that have been innumerated above. Specifically, the major objective of this investigation is to test whether non-competitive, individual competitive, and group competitive situations differentially affect the verbal and figural creativity of college students. Verbal fluency, verbal flexibility, verbal originality, and verbal elaboration are the dependent variables used to define verbal creativity. Figural fluency, figural flexibility, figural originality, and figural elaboration are the dependent variables used to define figural creativity.

Sex differences: Reaction to individual and group competition

A considerable amount of research demonstrates that competition can have a stimulating effect on the productivity of both males and females on a variety of tasks

(Hurlock, 1927; Peretti, 1971; Freischlag, 1973; Clifford, 1971; Torrance, 1965). Very little research, however, has been specifically designed to test whether a particular form of competition (i.e., individual vs. group) is more beneficial for males than females, or vica-versa. Inspection of the literature on socialization and sex-role standards suggests the possibility that the sexes may differ in their responsiveness to individual and group competition.

In his comprehensive review of research on sex-typing, Mischel (1970) notes that females in our society are socialized to be nurturant, dependent, and oriented to the needs of others. Males, on the other hand, are socialized to be independent, competitive, and self-reliant. Bardwick (1971) similarly states that the dominant motive of females is affiliation with others, while the dominant motive of males is personal achievement. To the extent that females are "other-oriented", as the literature seems to suggest, it might be expected that females would be better motivated to perform by group rather than individual competition. Conversely, to the extent that males are "self-oriented", it might be expected that males would be better motivated to perform by individual rather than group competition.

Research by Richman (1972) does, in fact, support these expectations. In this study elementary school boys and girls worked on addition problems under non-competitive, individual competitive, and group competitive conditions. In the individual competitive condition, a prize was promised to the individual achieving the best performance within the group of

which he or she was a member. In the group competitive condition, a prize was promised to the group which had the best overall performance. The results indicated that performance under the competitive conditions was better than performance under the non-competitive condition for both sexes. More interestingly, however, whereas boys did best in individual competition, girls did best in group competition.

Since Richman's data are limited to elementary school children working on a simple addition task, it would be interesting to explore whether this differential responsiveness to the individual and group competitive situations could be obtained among college students working on creative tasks. Therefore, an additional objective of this study is to investigate whether or not sex interacts with the competitive treatments to affect performance on the verbal and figural creativity tasks.

Statement of Hypotheses

To determine whether non-competitive, individual competitive, and group competitive situations differentially affect performance on the verbal creativity task, the following major hypothesis and its associated sub-hypotheses, all stated in the null form, are to be tested:

Hypothesis 1: Verbal creativity is not differentially affected by non-competitive, individual competitive, and group competitive situations.

Sub-hypotheses:

(1a) Verbal fluency is not differentially affected by non-competitive, individual competitive, and group competitive situations.

(1b) Verbal flexibility is not differentially affected by non-competitive, individual competitive, and group competitive situations.

(1c) Verbal originality is not differentially affected by non-competitive, individual competitive, and group competitive situations.

(1d) Verbal elaboration is not differentially affected by non-competitive, individual competitive, and group competitive situations.

To determine whether sex interacts with the treatment conditions (non-competition, individual competition, group competition) to affect performance on the verbal creativity task, the following major hypothesis and its associated sub-hypotheses, all stated in the null form, are to be tested:

Hypothesis 2: The effect of non-competitive, individual competitive, and group competitive situations on verbal creativity does not vary with sex.

Sub-hypotheses:

(2a) The effect of non-competitive, individual competitive, and group competitive situations on verbal fluency does not vary with sex.

(2b) The effect of non-competitive, individual competitive, and group competitive situations on verbal flexibility does not vary with sex.

(2c) The effect of non-competitive, individual competitive, and group competitive situations on verbal originality does not vary with sex.

(2d) The effect of non-competitive, individual competitive, and group competitive situations on verbal elaboration does not vary with sex.

To determine whether non-competitive, individual competitive, and group competitive situations differentially affect performance on the figural creativity task, the following major hypothesis and its associated sub-hypotheses,

all stated in the null form, are to be tested:

Hypothesis 3: Figural creativity is not differentially affected by non-competitive, individual competitive, and group competitive situations.

Sub-hypotheses:

(3a) Figural fluency is not differentially affected by non-competitive, individual competitive, and group competitive situations.

(3b) Figural flexibility is not differentially affected by non-competitive, individual competitive, and group competitive situations.

(3c) Figural originality is not differentially affected by non-competitive, individual competitive, and group competitive situations.

(3d) Figural elaboration is not differentially affected by non-competitive, individual competitive, and group competitive situations.

To determine whether sex interacts with the treatment conditions (non-competition, individual competition, group competition) to affect performance on the figural creativity task, the following major hypothesis and its associated sub-hypotheses, all stated in the null form, are to be tested:

Hypothesis 4: The effect of non-competitive, individual competitive, and group competitive situations on figural creativity does not vary with sex.

Sub-hypotheses:

(4a) The effect of non-competitive, individual competitive, and group competitive situations on figural fluency does not vary with sex.

(4b) The effect of non-competitive, individual competitive, and group competitive situations on figural flexibility does not vary with sex.

(4c) The effect of non-competitive, individual competitive, and group competitive situations on figural originality does not vary with sex.

(4d) The effect of non-competitive, individual competitive, and group competitive situations on figural elaboration does not vary with sex.

CHAPTER II

METHOD

This chapter presents the design, procedures, and limitations of the study. The chapter is organized according to the following sections: (1) Experimental design; (2) Subjects; (3) Instruments; (4) Experimental procedure; (5) Scoring; (6) Data Analysis; and (7) Limitations.

Experimental Design

A 2 by 3 post-test only factorial design with an equal number of observations per cell was utilized in this study. The independent variables were sex (male and female) and treatment condition (non-competition, individual competition, group competition). Four dimensions of verbal creativity-- verbal fluency, verbal flexibility, verbal originality, and verbal elaboration-- and four dimensions of figural creativity-- figural fluency, figural flexibility, figural originality, and figural elaboration-- served as dependent variables. The experimental design is depicted in Table 1. This design is the same for both the verbal and figural creativity measures.

TABLE 1. Experimental design of the study (note: FL= fluency, FX= flexibility, O= originality, E= elaboration)

			TREATMENT		
			Noncomp.	Ind. Comp.	Grp. Comp.
			FL FX O E	FL FX O E	FL FX O E
SEX	Male	S_1 S_2 ⋮ S_{14}	n=14	n=14	n=14
	Female	S_1 S_2 ⋮ S_{14}	n=14	n=14	n=14

Subjects

Subjects in this study were students enrolled at Michigan State University during spring term of 1976. They were recruited by eight undergraduate students who were hired by the investigator. The recruiters were told that (1) they should each attempt to recruit an equal number of males and females and (2) they would each receive three dollars for every subject they recruited who showed up for and participated in the study. In addition, each recruiter was told to give the following information about the study to prospective subjects: (1) the date and time of the study and the location where it was scheduled to take place; (2) that it was concerned with creative thinking; (3) that it would only take about

30 minutes of their time; and (4) that they would each be paid two dollars for participating. As a result of this procedure for securing subjects, within two weeks the recruiters were successful in obtaining the agreement of 98 students, 49 male and 49 female, to serve as subjects.

After a list of the names of the prospective subjects was compiled, they were grouped according to sex and college level (freshman, sophomore, junior, senior and graduate). From these groups they were randomly assigned, through use of a random numbers table, to the three treatment conditions. Since each treatment was scheduled to take place in a different room in Erickson Hall, three days before the experiment a postcard was sent to each subject indicating the room number he or she was to report to.

On the day of the experiment, a total of 86 subjects actually showed up. Specifically, 29 subjects (15 male, 14 female) showed up for the non-competitive condition, 29 subjects (15 male, 14 female) showed up for the individual competitive condition, and 28 subjects (14 male, 14 female) showed up for the group competitive condition. Since it was desirable to have an equal number of subjects in each cell of the design of the study, data from two male subjects, one from the non-competitive and the other from the individual competitive condition, were randomly discarded and were not considered in subsequent data analysis. A total of 84 subjects, 28 in each treatment condition, therefore

constituted the sample of this study.

Demographic data collected on all 84 subjects indicates that the treatment groups were roughly equivalent in terms of age and college class level. The average ages of the subjects in the non-competitive, individual competitive, and group competitive conditions were 20.1, 20.0, and 19.9, respectively. With respect to college class level, the non-competitive condition was composed of 8 freshman, 6 sophomores, 8 juniors, 5 seniors, and 1 graduate student. The individual competitive condition was composed of 8 freshman, 7 sophomores, 7 juniors, 5 seniors, and 1 graduate student. The group competitive condition was composed of 8 freshman, 6 sophomores, 7 juniors, 6 seniors, and 1 graduate student. Overall, then, the sample was composed of 24 freshman, 19 sophomores, 22 juniors, 16 seniors, and 3 graduate students.

Instruments

Two tests from the Torrance Tests of Creative Thinking (Form A) were the creativity tasks employed in this study. The Product Improvement Activity (PIA) was used to assess verbal creativity, while the Parallel Lines Activity (PLA) was used to assess figural creativity. These tasks were selected for three reasons:

(1) Both of them allow for scoring on the dimensions of creativity that are of interest in this study-- fluency, flexibility, originality, elaboration.

(2) Research demonstrates high levels of inter- and intra-scorer reliability on these tasks (usually over .90), even when inexperienced scorers are used (Halpin & Halpin, 1974; Torrance, 1966). To reliably score these tasks, all that seems to be necessary is careful study of the scoring manual.

(3) Although several critics (e.g., Crockenberg, 1972) have noted that the validity of the Torrance tests are still open to question, several studies have found that such tests do possess some degree of validity for use with adults. For example, Torrance (1968) found that graduate students who scored high on these tasks also made the most original and creative applications of the knowledge presented in a course. Torrance and Hansen (1965) also observed that creative business education teachers (as identified by these tasks) asked more provocative questions, more self-improving questions, and more divergent ones than did their less creative peers. In still another study, Sommers (1961) reported that students carefully identified by college industrial arts instructors as creative scored significantly higher on several of Torrance's tests (including the ones used in this study) than did the less creative students. While these studies suggest that the tasks employed in this study are of some value for measuring creativity, the reader should be cautioned that performance on these tasks is not

a completely valid index of creativity. The results of the study, therefore, should be interpreted with this caution in mind.

In summary, these tasks have been selected because they provide measures that are of interest in this study, they can be scored reliably, and they have demonstrated some validity for use with adult populations. The following is a description of both of these tasks:

Product Improvement Activity. This task requires the subject to formulate suggestions for improving an object with respect to its function as a toy. The object selected for use is a stuffed toy elephant. This was chosen from among the various stimuli experimented with by Torrance because it most successfully minimizes differences in the quality and nature of responses based on sex differences. For group administration, a sketch of a toy elephant accompanies the sheets with instructions and blanks for the responses. The instructions given are:

> In the middle of this page is a sketch of a stuffed toy elephant of the kind you can buy in most dime stores for about one or two dollars. It is about six inches tall and weighs about a half pound. In the spaces on this page and the next one, list the cleverest, most interesting, and unusual ways you can think of for changing this toy so that children will have more fun playing with it. Do not worry about how much the change would cost. Think only about what would make it more fun to play with as a toy.

Torrance reports that this task has been one of his most dependable verbal tests. It is a complex test with a high

degree of face validity. It permits subjects to consider ideas which they would not dare express in a more serious task.

The nature of the task allows for scoring on the traits of fluency, flexibility, originality, and elaboration. The fluency score is determined by counting the number of relevant, separate responses or ideas given by the subject. An idea is relevant if it tells how the toy elephant could be improved as a plaything, i.e., something that would be fun. The flexibility score is determined by the number of different principles or approaches used in responding to the task. An inclusive list of twenty-one general principles is given in the scoring manual. Originality is determined from a table of responses giving scoring weights of 0, 1, or 2. Approximately 350 responses are listed, based on a tabulation of the responses of 594 subjects from grades one through twelve. Rare responses showing creative strength but not included in the list are scored "2". Elaboration is determined by scoring the extent to which the idea is spelled out or developed by counting the details beyond those which are necessary to communicate the basic idea. The scoring manual presents several illustrations of elaborated responses.

Parallel Lines Activity. This task requires the subject to make multiple associations to a single stimulus and to express his ideas pictorially. Although the task normally consists of three pages containing thirty sets of parallel

lines, pilot testing indicated the advisability of adding an additional page with 12 more sets of parallel lines. Consequently, in this study the task consisted of four pages containing 42 sets of parallel lines. The instructions given are:

> In ten minutes see how many objects or pictures you can make from the pairs of straight lines below and on the next pages. The pairs of straight lines should be the main part of whatever you make. With pencil or crayon add lines to complete your picture. You can place marks between the lines, on the lines, and outside the lines--wherever you want to make your picture. Try to think of things that no one else will think of. Make as many different pictures or objects as you can and put as many ideas as you can in each one. Make them tell as complete and as interesting a story as you can. Add names or titles in the spaces provided.

The rationale of this task, as explained by Torrance, is based upon incomplete figures (i.e., parallel lines) creating tensions in the individual with the usual response being to complete the figures in the simplest and easiest way possible. Thus, the subject has to be able to handle his tensions and delay the gratification of this impulse in order to produce an original and elaborate set of figures.

Like the PIA, this task allows for scoring on the traits of fluency, flexibility, originality, and elaboration. Fluency is determined by counting the number of relevant responses, although any repetitious responses are subtracted from this total. A relevant response is defined as

one which contains or makes use in some way of the parallel lines. Flexibility is determined by counting the number of different categories into which the subject's responses can be classified. The scoring manual lists 68 categories which were derived from the responses of 500 subjects from kindergarten through college. Originality is determined from a table of responses giving scoring weights of 0, 1, 2, or 3. Approximately 250 responses are listed, based on a tabulation of the responses of 500 subjects from kindergarten through college. Imaginative responses showing creative strength but not included in the list are scored "3". Elaboration is determined by counting the number of ideas communicated by each drawing which are an addition to the minimum basic idea. Examples of elaborated drawings are presented in the manual.

Experimental Procedure

As previously indicated, subjects were randomly assigned to the non-competitive, individual competitive, and group competitive treatment conditions. Such random assignment, of course, permits one to assume that the three treatment groups were equivalent on all possible variables. A pretest was therefore not necessary.

The experiment was conducted on April 29, 1976 in three identical size classrooms in Erickson Hall on the Michigan State University campus. Three male doctoral candidates in educational psychology served as the experimenters. A description of the procedure that was

adhered to within each treatment condition now follows:

Non-competitive condition- Subjects assigned to this condition were seated at separate desks as they entered the classroom. After the subjects had arrived (a total of 29 out of a possible 32 actually showed up[1]), they each filled out a demographic sheet indicating their name, age, and college level (see Appendix A). Next, the experimenter read the following instructions to all the subjects:

> In this study I am interested in assessing the creative thinking abilities of college students. You will all be given two separate tasks on which to work. One task is a measure of verbal creativity, while the other task is a measure of figural creativity. It is important that you be as creative as you can on both tasks so that my results will be reliable. Do not worry, however, about how others are doing on the tasks. It is not my purpose to compare your score with those of others, so you don't have to be concerned about how you do in relation to others. You will all have ten minutes to work on each task. I will tell you when the first ten minutes are up. At that time you will stop work and I will hand out the second task you are to work on. Before you begin work on each task, be sure to read the instructions for each task carefully. Are there any questions?..... Do not ask any questions after we begin. Just use your own best judgment if you have a question. Also, do not talk to anyone while you work on the tasks.

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[1] As noted earlier, data from one of these Ss was randomly discarded following the experiment and was not considered in data analysis.

After these instructions were read, the PIA was handed out face down to each subject by the experimenter. Once every subject had the PIA, the experimenter then told the subjects to turn it over and to read the instructions to the task silently while he read them aloud. This was done in order to insure that all subjects finished reading the instructions at the same time and would therefore have an equal start on the task. After the subjects had worked for ten minutes on the PIA, they were told to stop and the PLA was then handed out by the experimenter. The same procedure used in administering the PIA was used for the PLA.

Upon completing work on both tasks, all the subjects were thanked for participating and they were each paid two dollars as they left the classroom.

Individual competitive condition- After the subjects assigned to this condition had arrived (a total of 29 out of a possible 33 actually showed up[2]), they were divided into four mixed-sex groups. Two of the groups were composed of four males and three females, another group was composed of four females and three males, and the last group was composed of four females and four males. Next, each group was seated together at separate desks in a location of the room apart from the other groups. The desks were

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[2] Again, data from one subject was randomly discarded prior to data analysis.

arranged in a circle for each group. After all the subjects were seated, they each filled out the demographic sheet indicating their name, age, and college level. The experimenter then read the following instructions to all subjects:

> In this study I am interested in assessing the creative thinking abilities of college students. You will all be given two separate tasks on which to work. One task is a measure of verbal creativity, while the other task is a measure of figural creativity. Since it is important that you be as creative as you can on both tasks so that my results will be reliable, the individual in each group achieving the best combined performance on these tasks will be rewarded with ten dollars. Therefore, try to do better than the other members of your group so that you can win the reward. You will all have ten minutes to work on each task. I will tell you when the first ten minutes are up. At that time you will stop work and I will hand out the second task you are to work on. Before you begin work on each task, be sure to read the instructions for each task carefully. Are there any questions?..... Do not ask any questions after we begin. Just use your own best judgment if you have a question. Also, do not talk to anyone while you work on the tasks.

After these instructions were read, the PIA was handed out face down to each subject by the experimenter. Once every subject had the PIA, the experimenter then told the subjects to turn it over and to read the instructions to the task silently while he read them aloud. Following ten minutes of work on the PIA, the subjects were told to stop and the PLA was then handed out by the experimenter. The same procedure used in administering the PIA was used for the PLA.

Upon completing work on both tasks, all the subjects were thanked for participating and were informed that the winner in each group would be contacted and given the ten dollar prize within one week. Each subject was then paid two dollars as he or she left the classroom.

Group competitive condition- After the subjects assigned to this condition had arrived (a total of 28 out of a possible 33 actually showed up), they were divided into four mixed-sex groups. While two of the groups were composed of four males and three females, the other two groups were composed of four females and three males. Next, each group was seated together at separate desks in a location of the room apart from the other groups. The desks were arranged in a circle for each group. After all the subjects were seated, they each filled out the demographic sheet indicating their name, age, and college level. The experimenter then read the following instructions to all the subjects:

> In this study I am interested in assessing the creative thinking abilities of college students. You will all be given two separate tasks on which to work. One task is a measure of verbal creativity, while the other task is a measure of figural creativity. Since it is important that you be as creative as you can on both tasks so that my results will be reliable, the group achieving the best overall performance on these tasks will be rewarded with seventy dollars (to be shared equally among the members). Therefore, try to do your best so that your group's chances of bettering the other groups and receiving the reward will be increased. You will all have ten

> minutes to work on each task. I will tell you when the first ten minutes are up. At that time you will stop work and I will hand out the second task you are to work on. Before you begin work on each task, be sure to read the instructions for each task carefully. Are there any questions? ..... Do not ask any questions after we begin. Just use your own best judgment if you have a question. Also, do not talk to anyone while you work on the tasks.

After these instructions were read, the PIA was handed out face down to each subject by the experimenter. Once every subject had the PIA, the experimenter then told the subjects to turn it over and to read the instructions to the task silently while he read them aloud. Following ten minutes of work on the PIA, the subjects were told to stop and the PLA was then handed out by the experimenter. The same procedure used in administering the PIA was used for the PLA.

Upon completing work on both tasks, all the subjects were thanked for participating and were informed that the winning group would be contacted and given the seventy dollar prize (ten dollars for each group member) within one week. Each subject was then given two dollars as he or she left the classroom.

In all conditions subjects worked on the tasks independently. Also, to insure that the subjects in all conditions were given exactly ten minutes to work on each task, the experimenters used stop-watches to keep track of time.

Paranthetically, it is worthwhile to note that the administration of the experiment went very smoothly. No problems at all arose in any treatment condition. Indeed, no questions were asked in any condition, thus suggesting that the subjects clearly understood what they were expected to do during each phase of the experiment.

Scoring

Soon after all testing was completed, each test paper was given a number which was used as a code for the name, sex, and treatment condition of each subject. All the tests were then randomly shuffled together. This was done in order to avoid experimenter bias in the scoring of the tests, i.e., to insure that the scorer did not know the sex or treatment condition to which each subject belonged.

Although the scoring guide provided by Torrance helps make scoring as objective as possible, there is typically some degree of subjectivity in scoring since not all possible responses are covered by the manual. Therefore, to check on the reliability of the scores, two raters (the principal investigator and another graduate student) independently scored the responses of each subject. Subsequent Pearson product moment correlations between the scores of the two raters for each dependent variable yielded the following inter-rater reliability coefficients:

Verbal fluency:	.99	Figural fluency:	.99
Verbal flexibility:	.97	Figural flexibility:	.98
Verbal originality:	.95	Figural originality:	.97
Verbal elaboration:	.94	Figural elaboration:	.97

Such high reliability coefficients are consistent with previous research which also found inter-rater reliabilities on the Torrance tests in the .90's for each measure of creativity (Halpin & Halpin, 1974; Torrance, 1966).

Since the summed scores of the two raters were used in data analysis, the actual scorer reliability coefficients for each dependent variable, computed by the Spearman-Brown Prophecy formula (Ebel, 1972), were as follows:

Verbal fluency:	.99	Figural fluency:	.99
Verbal flexibility:	.98	Figural flexibility:	.99
Verbal originality:	.97	Figural originality:	.98
Verbal elaboration:	.97	Figural elaboration:	.98

Data Analysis

To analyze the effects of sex and treatment conditions and their interaction on the scores obtained on the verbal and figural creativity tasks, two separate 2 by 3 fixed effects multivariate analyses of variance (MANOVA's) were the major statistical procedures employed. One MANOVA was performed on the four measures of verbal creativity. The other MANOVA was performed on the four measures of figural creativity. By using the MANOVA statistical approach, multivariate F-ratios were computed which enabled the investigator to test for main effects and interaction effects

on the dependent variables when such variables were considered together or simultaneously. The MANOVA approach also provided univariate F-ratios for each separate dependent variable. When significant univariate F-ratios for a treatment effect were obtained, Tukey pair-wise comparisons were performed to determine where the specific treatment differences lay, i.e., to determine which treatments were significantly different from each other on the particular dependent variable.

To derive additional information from the data obtained in this study, two supplementary statistical procedures were also carried out. First, to determine the intercorrelations of the eight dependent variables, correlation matrices both within and across all treatment conditions were computed. Second, to determine the effect of the different treatments on verbal originality and verbal elaboration when verbal fluency is held constant, analyses of covariance (ANCOVA's) were conducted. (The reason for doing these particular ANCOVA's is more readily explained after the results pertinent to the hypotheses of interest are presented in Chapter III).

All the statistical analyses in this study were calculated in the computer center at Michigan State University. For all analyses an alpha level of .05 was adopted to test the statistical significance of the results. The results are reported in Chapter III.

Limitations

The generalizability of the results of this study is limited by the particular methods that were employed. Specifically, the methodological limitations of this investigation were:

(1) Subjects were paid volunteer students solicited from Michigan State University. Therefore, the findings obtained are generalizable only to comparable populations.

(2) The verbal creativity task utilized was Torrance's Product Improvement Activity. The figural creativity task utilized was Torrance's Parallel Lines Activity. Therefore, the findings obtained are generalizable only to creativity tasks that are similar in nature to these tasks.

(3) Individual competition was induced through promise of a reward for the individual achieving the best performance within a group. Group competition was induced through promise of a reward for the group achieving the best performance among other groups. Therefore, the findings obtained are generalizable only to situations in which individual and group competition are induced by promise of a reward for best performance.

(4) In this study, fluency, flexibility, originality, and elaboration are considered to be important components of creative thinking. These four traits,

as expressed in both verbal and figural form, were the dependent variables measured. The conclusions drawn from this study, therefore, are only generalizable to these particular indices of creativity.

CHAPTER III

RESULTS

This chapter presents the results of the statistical analyses of the data. First, the results of the analyses relevant to each major hypothesis, and their accompanying sub-hypotheses, are reported. Next, the results of the analyses that provide additional or supplementary information are presented. Finally, the chapter concludes with a summary of the findings obtained.

All of the statistical analyses reported in this chapter were calculated on the Control Data Corporation 6500 Computer System in the computer center at Michigan State University.

Hypothesis One

Hypothesis one stated that verbal creativity is not differentially affected by non-competitive, individual competitive, and group competitive situations. A multivariate test of this hypothesis was performed and is displayed in Table 2. The multivariate F-ratio of 2.1644 with D.F. of 8 and 150 has a significant p value of less

than .0105. Hypothesis one is therefore rejected. The treatments did differentially influence overall performance on the verbal creativity task. Inspection of the univariate F-ratios also presented in Table 2 indicates that the significant multivariate F was primarily caused by the fact that the treatments differed significantly on the measures of verbal fluency (p less than .0205), verbal originality (p less than .0015), and verbal elaboration (p less than .0023). The sub-hypotheses, which stated that each of the above measures is not differentially affected by the treatment conditions, are therefore rejected also. However, since the treatment effect on verbal flexibility only approached significance (p less than .0575), the corresponding sub-hypothesis for verbal flexibility is not rejected.

The means and standard deviations for each of the four measures of verbal creativity that were observed for each treatment condition are presented in Table 3. It can be seen that for all measures the scores in the individual competitive condition were higher on the average than the scores obtained in the non-competitive or group competitive conditions. To determine which mean differences among the treatments were statistically significant, Tukey pair-wise comparisons were performed on each of the

Table 2. Multivariate and Univariate Tests for Treatment Effects on measures of Verbal Creativity

Multivariate			
F-Ratio = 2.1644	*p* less than .0105	D.F. = 8, 150	
Univariate			
Variable	MS (Error)	MS (Hypothesis)	*F*-Ratio	*p* value
VF	103.9826	425.5119	4.0921	.0205
VX	16.0979	47.7262	2.9647	.0575
VO	106.7271	755.3929	7.0778	.0015
VE	29.5924	195.1905	6.5959	.0023
D.F. for Hypothesis = 2				
D.F. for Error = 78				

Note: VF=Verbal Fluency, VX=Verbal Flexibility, VO=Verbal Originality, VE=Verbal Elaboration.

Table 3. Observed means and standard deviations of verbal creativity measures within each treatment condition

Treatment (n=28)		Variable			
		VF	VX	VO	VE
Non-Comp	$\bar{X}$	12.9	7.1	7.9	4.7
	SD	3.2	1.8	4.0	2.4
Ind Comp	$\bar{X}$	16.8	8.4	13.1	6.9
	SD	6.3	2.5	6.6	3.3
Grp Comp	$\bar{X}$	15.0	7.6	10.0	4.6
	SD	5.1	1.6	4.5	2.3

Note: The means in this and subsequent tables were computed by dividing the averages of the summed scores by 2. Similarly, the standard deviations were computed by dividing the standard deviations of the summed scores by 2.

measures for which significant univariate F-ratios were obtained. Through such post-hoc analysis, it was revealed that subjects in the individual competitive condition scored significantly higher than subjects in the non-competitive condition on verbal fluency (p less than .025) and on verbal originality (p less than .005) and significantly higher than subjects in both the non-competitive and the group competitive conditions on verbal elaboration (p less than .01 for each). On none of the measures did the scores of the subjects in the group competitive condition differ significantly from the scores of the subjects in the non-competitive condition.

Table 3 also indicates that the standard deviations of the scores for all of the measures of verbal creativity are highest for the individual competitive condition. Visual inspection of the raw scores (see appendix B) suggests that the greater variability of the scores in the individual competitive condition was attributable to the fact that more subjects in this condition obtained extremely high scores on each of the measures than did subjects in the other two conditions.

Hypothesis Two

Hypothesis two was concerned with the question of a sex by treatment interaction effect on verbal creativity.

Formally, it stated that the effects of non-competitive, individual competitive, and group competitive situations on verbal creativity do not vary with sex. The results of the multivariate test of this hypothesis are reported in Table 4. The multivariate F ratio of .5161 with D.F. of 8 and 150 has a non-significant p value of less than .843. Hypothesis two is therefore not rejected. From examination of the univariate F-ratio also presented in Table 4, it is additionally evident that nothing in the data supports an interaction effect. Thus, the sub-hypotheses, which stated that the effects of the treatment conditions on each separate measure of verbal creativity do not vary with sex, are also not rejected.

Table 5 provides visual corroboration for the lack of an interaction effect. It can be seen that for both sexes the mean performance on all the measures was highest in the individual competitive condition and lowest in the non-competitive condition (the only exception being that the mean verbal elaboration score for males was negligibly lower in the group competitive condition than in the non-competitive condition). A further observation of interest is that, with the exception of verbal flexibility, the mean differences on all of the measures between the individual competitive and non-competitive and between the

Table 4. Multivariate and Univariate Test for Sex Treatment Interaction Effects on measures of Verbal Creativity

Multivariate		
F-Ratio = .5161	p less than .843	D.F. = 8, 150

Univariate				
Variable	MS (Error)	MS (Hypothesis)	F-Ratio	p value
VF	103.9826	21.4643	.2064	.8140
VX	16.0979	2.5119	.1560	.8558
VO	106.7271	118.6548	1.1118	.3342
VE	29.5924	13.9048	.4699	.6269

D.F. for Hypothesis = 2

D.F. for Error = 78

Table 5. Observed sex by treatment means for measures of Verbal Creativity

Treatment (n=14)		Variable			
		VF	VX	VO	VE
Non-Comp	M	13.1	7.3	8.4	4.8
	F	12.6	6.9	7.4	4.5
Ind Comp	M	16.5	8.8	11.6	6.4
	F	17.0	7.9	14.5	7.4
Grp Comp	M	15.6	8.0	10.0	4.6
	F	14.3	7.1	9.9	4.5

Note: M= Male, F= Female

individual competitive and the group competitive conditions was slightly greater for females than for males. Indeed, the individual competitive condition seemed to be especially beneficial for females with respect to the verbal originality measure. The mean verbal originality score among females in the individual competitive condition was nearly two times greater than the mean score among females in the non-competitive condition.

Hypothesis Three

Hypothesis three stated that figural creativity is not differentially affected by non-competitive, individual competitive, and group competitive situations. The results of the multivariate test of this hypothesis appears in Table 6. The multivariate F-ratio of 1.6417 with D.F. of 8 and 150 has a non-significant p-value of less than .1176. Hypothesis three is therefore not rejected. From inspection of the univariate F-ratios in Table 6, it appears that one of the figural creativity measures, figural elaboration, is significantly affected by the treatments (p less than .0173). However, according to the MANOVA statistical model (Finn, 1974), whenever the multivariate F-ratio is found to be non-significant, any "significant" univariate F's are interpreted as being due to chance and are not considered true effects.

Table 6. Multivariate and Univariate Tests for Treatment Effects on measures of Figural Creativity

Multivariate			
F-Ratio = 1.6417	p less than .1176		D.F. = 8, 150

Univariate				
Variable	MS (Error)	MS (Hypothesis)	F-Ratio	p value
FF	135.3388	73.3690	.5421	.5837
FX	65.6941	69.4405	1.0570	.3525
FO	404.2445	586.3333	1.4504	.2408
FE	408.7866	1749.7262	4.2803	.0173

D.F. for Hypothesis = 2

D.F. for Error = 78

Note: FF = Figural fluency, FX = Figural flexibility, FO = Figural originality, FE = Figural elaboration

Table 7. Observed means and standard deviations of figural creativity measures within each treatment condition

Treatment (n=28)		Variable			
		FF	FX	FO	FE
Non-Comp	$\bar{X}$	11.9	9.8	17.5	15.8
	SD	4.9	3.9	8.6	8.5
Ind Comp	$\bar{X}$	13.4	10.8	22.1	23.5
	SD	5.6	4.0	10.0	11.8
Grp Comp	$\bar{X}$	12.0	9.2	19.8	18.1
	SD	7.1	4.4	13.5	9.2

Consequently, all of the sub-hypotheses, which stated that each separate measure of figural creativity is not differentially affected by the treatment conditions, are also not rejected.

The means and standard deviations for each of the four measures of figural creativity that were observed for each treatment condition are presented in Table 7. Inspection of the means reveals a trend which is parallel to the results obtained on the verbal creativity measures. More specifically, it can be seen that for all the measures of figural creativity, mean performance was highest in the individual competitive condition in comparison to the non-competitive or group competitive conditions. It should be re-emphasized, however, that none of the treatment differences reached statistical significance.

Hypothesis Four

Hypothesis four was concerned with the question of a sex by treatment interaction effect on figural creativity. Formally, it stated that the effects of non-competitive, individual competitive, and group competitive situations on figural creativity do not vary with sex. The results of the multivariate test of this hypothesis are presented in Table 8. The multivariate F-ratio of 1.11 with D.F. of 8 and 150 has a non-significant p value of less than .359.

Hypothesis four is therefore not rejected. From examination of the univariate F-ratios also given in Table 8, it is additionally evident that nothing in the data supports an interaction effect. Therefore, the sub-hypotheses, which stated that the effects of the treatment conditions on each separate measure of figural creativity do not vary with sex, are also not rejected.

Table 9 gives the sex by treatment means for each measure of figural creativity. Although no significant interactions were obtained, close inspection of Table 9 suggests some interesting patterns. Whereas the mean performance of females on each of the measures was highest in the individual competitive condition, males did not exhibit as consistent a pattern. In fact, on two of the measures, figural fluency and figural originality, males achieved their highest mean performance in the group competitive condition. Another noteworthy pattern is that whereas the mean performance of males on each of the measures was lowest in the non-competitive condition, females, on the average, tended to do least well in the group competitive condition.

Table 8. Multivariate and Univariate Tests for Sex by Treatment Interaction Effects on measures of Figural Creativity

Multivariate			
F-Ratio = 1.1111	p less than .3590		D.F. = 8, 150

Univariate				
Variable	MS (Error)	MS (Hypothesis)	F-Ratio	p value
FF	135.3388	176.4643	1.3039	.2774
FX	65.6941	51.7976	.7885	.4582
FO	404.2445	1137.3333	2.8135	.0661
FE	408.7866	146.8929	.3593	.6993

D.F. for Hypothesis = 2

D.F. for Error = 78

Table 9. Observed sex by treatment means for measures of Figural Creativity

Treatment (n=14)		Variable			
		FF	FX	FO	FE
Non-Comp	M	12.4	10.5	20.1	17.0
	F	11.4	9.0	14.8	14.6
Ind Comp	M	13.7	11.1	23.3	22.5
	F	13.0	10.5	20.8	24.5
Grp Comp	M	14.5	10.8	27.0	18.7
	F	9.4	7.6	12.6	17.4

Summary of Hypothesis Testing

To summarize the results of hypothesis testing, the status of each major hypothesis and its associated sub-hypotheses are reported below:

Hypothesis 1: Verbal creativity is not differentially affected by non-competitive, individual competitive, and group competitive situations. Status: Rejected.

Sub-hypotheses:

(1a) Verbal fluency is not differentially affected by non-competitive, individual competitive, and group competitive situations. Status: Rejected.

(1b) Verbal flexibility is not differentially affected by non-competitive, individual competitive, and group competitive situations. Status: Failed to reject.

(1c) Verbal originality is not differentially affected by non-competitive, individual competitive, and group competitive situations. Status: Rejected.

(1d) Verbal elaboration is not differentially affected by non-competitive, individual competitive, and group competitive situations. Status: Rejected.

Hypothesis 2: The effect of non-competitive, individual competitive, and group competitive situations on verbal creativity does not vary with sex. Status: Failed to reject.

Sub-hypotheses:

(2a) The effect of non-competitive, individual competitive, and group competitive situations on verbal fluency does not vary with sex. Status: Failed to reject.

(2b) The effect of non-competitive, individual competitive and group competitive situations on verbal flexibility does not vary with sex. Status: Failed to reject.

(2c) The effect of non-competitive, individual competitive, and group competitive situations on verbal originality does not vary with sex. Status: Failed to reject.

(2d) The effect of non-competitive, individual competitive, and group competitive situations on verbal elaboration does not vary with sex. Status: Failed to reject.

Hypothesis 3: Figural creativity is not differentially affected by non-competitive, individual competitive, and group competitive situations. Status: Failed to reject.

Sub-hypotheses:

(3a) Figural fluency is not differentially affected by non-competitive, individual competitive, and group competitive situations. Status: Failed to reject.

(3b) Figural flexibility is not differentially affected by non-competitive, individual competitive, and group competitive situations. Status: Failed to reject.

(3c) Figural originality is not differentially affected by non-competitive, individual competitive, and group competitive situations. Status: Failed to reject.

(3d) Figural elaboration is not differentially affected by non-competitive, individual competitive, and group competitive situations. Status: Failed to reject.

Hypothesis 4: The effect of non-competitive, individual competitive, and group competitive situations on figural creativity does not vary with sex. Status: Failed to reject.

Sub-hypotheses:

(4a) The effect of non-competitive, individual competitive, and group competitive situations on figural fluency does not vary with sex. Status: Failed to reject.

(4b) The effect of non-competitive, individual competitive, and group competitive situations on figural flexibility does not vary with sex. Status: Failed to reject.

(4c) The effect of non-competitive, individual competitive, and group competitive situations on figural originality does not vary with sex. Status: Failed to reject.

(4d) The effect of non-competitive, individual competitive, and group competitive situations on figural elaboration does not vary with sex. Status: Failed to reject.

Additional Analyses

After carrying out the statistical analyses that were necessary to test the formal hypotheses of this study, the investigator believed that additional data analysis would be valuable in that it could provide supplementary information that was of interest. Consequently, further statistical analyses were performed with the objectives of answering the following questions: (1) After collapsing the data across treatments, were any significant sex differences obtained with respect to performance on the verbal and figural creativity tasks? (2) To what extent did the measures of verbal and figural creativity correlate with each other both within and across all treatment conditions? and (3) Was there still a treatment effect on the measures of verbal originality and verbal elaboration when verbal fluency was held constant? The results that were obtained with respect to these questions are reported below in turn.

Effect of Sex on Verbal Creativity

The MANOVA that was used to test for a treatment effect and a sex by treatment interaction effect on the verbal creativity scores also, of course, provided F-ratios for the

testing of a sex main effect. The results of this multivariate test are presented in Table 10. As can be seen, both the multivariate F (F= 1.25, p less than .295) and all the univariate F's are non-significant. Therefore, no significant sex effect was obtained, i.e., collapsing across treatments, males and females did not differ significantly in their performance on the verbal creativity task. Table 11, which gives the means of the males and females on each of the verbal creativity measures, visually confirms this finding.

Effect of Sex on Figural Creativity

Like the MANOVA on the verbal creativity scores, the MANOVA that was used to test for a treatment main effect and a sex by treatment interaction effect on the figural creativity scores also provided F ratios for the testing of a sex main effect. The results of this multivariate test are reported in Table 12. The multivariate F-ratio of 4.9096 with D.F. of 4 and 75 has a highly significant p value of less than .0015. This indicates that, collapsing across treatments, the sexes differed significantly in terms of their overall performance on the figural creativity task. Inspection of the univariate F-ratios shows that the significant multivariate F was primarily caused by the fact that the sexes differed significantly on the measures of figural flexibility (p less than .0442) and figural originality (p less than .0011).

Table 10. Multivariate and Univariate Tests for a Sex Effect on measures of Verbal Creativity

Multivariate				
F-Ratio = 1.2557		p less than .2950		D.F. = 4, 75
Univariate				
Variable	MS (Error)	MS (Hypothesis)	F-Ratio	p value
VF	103.9826	18.1071	.1741	.6777
VX	16.0979	41.4405	2.5743	.1127
VO	106.7271	29.7619	.2789	.5990
VE	29.5924	4.2976	.1452	.7042
	D.F. for Hypothesis = 1			
	D.F. for Error = 78			

Table 11. Observed means of males and females for measures of Verbal Creativity

Sex (n=42)	Variable			
	VF	VX	VO	VE
Males	15.1	8.0	10.0	5.3
Females	14.6	7.3	10.6	5.5

Table 13, which presents the means for males and females on each figural creativity measure, reveals that the males did better than the females on the figural task.

Table 12. Multivariate and Univariate Tests for a Sex Effect on measures of Figural Creativity

Multivariate				
F-Ratio = 4.9096		*p* less than .0015		D.F. = 4, 75
Univariate				
Variable	MS (Error)	MS (Hypotheses)	*F*-Ratio	*p* value
FF	135.3388	438.8571	3.2427	.0757
FX	65.6941	275.0476	4.1868	.0442
FO	404.2445	4710.0119	11.6514	.0011
FE	408.7866	30.9643	.0757	.7839
D.F. for Hypothesis = 1				
D.F. for Error = 78				

Table 13. Observed means of males and females for measures of Figural Creativity

Sex (n-42)	Variable			
	FF	FX	FO	FE
Males	13.5	10.8	23.5	19.4
Females	11.3	9.0	16.1	18.8

On all the measures males outperformed females, although only in the case of figural flexibility and figural originality were these differences considered significant.

Intercorrelations of verbal and figural creativity measures

To determine the extent of the inter-relationships among the measures of verbal and figural creativity across all treatment conditions, Pearson product moment correlations between each measure and every other measure were calculated. The correlation matrix that resulted is presented in Table 14.

Examination of the matrix reveals several noteworthy findings. First, virtually all of the intercorrelations were statistically significant--the only exceptions being verbal elaboration with figural fluency (p less than .11) and verbal elaboration with figural flexibility (p less than .13). Indeed, while the average intercorrelation among all the measures is .41, several intercorrelations were extremely high, reaching above an intercorrelation of .70. A second finding worthy of note is that while the average intercorrelation among the verbal creativity measures was a moderately high .51, the average intercorrelation among the figural creativity measures was also moderately high, being .62. Interestingly, however, the average intercorrelation between the verbal and figural creativity measures was only .29. These findings show that the verbal measures correlated more highly among themselves

than they did with the figural measures. Similarly, the figural measures were more related to each other than they were with the verbal measures.

To determine if the degree of the inter-relationships among the verbal and figural creativity measures was different under the different treatment conditions, correlation matrices between the scores within each treatment condition were also computed. Table 15 presents the correlation matrix for the non-competitive condition, Table 16 presents the correlation matrix for the individual competitive condition, and Table 17 presents the correlation matrix for the group competitive condition. Close inspection of these matrices reveals that 9 of the 28 intercorrelations in the non-competitive condition were statistically signigicantly, 19 of the 28 intercorrelations in the individual competitive condition were statistically significant, and 16 of the 28 intercorrelations in the group competitive condition were statistically significant. These findings indicate that the measures of verbal and figural creativity were most related to each other in the individual competitive condition and least related to each other in the non-competitive condition. The implications of these results are presented in Chapter IV.

Table 14. Intercorrelations of Verbal and Figural Creativity Measures across all Treatment Conditions (N = 84)

Measure	VX	VO	VE	FF	FX	FO	FE
VF	.76[a]	.71[a]	.36[a]	.33[a]	.34[a]	.35[a]	.37[a]
VX		.53[a]	.22[c]	.22[c]	.24[c]	.26[b]	.32[b]
VO			.50[a]	.38[a]	.34[a]	.39[a]	.38[a]
VE				.14	.13	.24[c]	.26[b]
FF					.93[a]	.84[a]	.32[b]
FX						.80[a]	.35[a]
FO							.48[a]

[a]Significant at .001 level; [b]Significant at .01 level; [c]Signifcant at .05 level

Table 15. Intercorrelations of Verbal and Figural Creativity Measures within Non-Competitive Condition (N = 28)

Measure	VX	VO	VE	FF	FX	FO	FE
VF	.68[a]	.49[b]	.15	.31	.25	.22	.24
VX		.44[b]	.11	.23	.10	.24	.33[c]
VO			.55[a]	.15	.01	.01	.13
VE				-.17	-.23	-.18	-.01
FF					.90[a]	.78[a]	.08
FX						.78[a]	.07
FO							.44[b]

[a]Significant at .001 level; [b]Significant at .01 level; [c]Significant at .05 level

Table 16. Intercorrelations of Verbal and Figural Creativity Measures within Individual Competitive Condition (N = 28)

Measure	VX	VO	VE	FF	FX	FO	FE
VF	.81[a]	.76[a]	.36[c]	.36[c]	.46[b]	.38[c]	.30
VX		.57[a]	.15	.29	.39[c]	.31	.27
VO			.42[c]	.34[c]	.36[c]	.43[c]	.39[c]
VE				.01	.06	.25	.26
FF					.94[a]	.81[a]	.45[b]
FX						.78[a]	.49[b]
FO							.57[a]

[a] Significant at .001 level; [b] Significant at .01 level;
[c] Significant at .05 level

Table 17. Intercorrelations of Verbal and Figural Creativity Measures within Group Competitive Condition (N = 28)

Measure	VX	VO	VE	FF	FX	FO	FE
VF	.69[a]	.64[a]	.29	.31	.25	.32[c]	.35[c]
VX		.31	.17	.10	.10	.17	.15
VO			.34[c]	.57[a]	.54[a]	.52[b]	.26
VE				.42[c]	.41[c]	.43[c]	.17
FF					.95[a]	.89[a]	.30
FX						.87[a]	.38[c]
FO							.41[c]

[a]Significant at .001 level; [b]Significant at .01 level;
[c]Significant at .05 level

Covariate Analysis: Verbal originality and Verbal elaboration

From Table 14 it is evident that verbal fluency has a significant high correlation with verbal originality (.71, p less than .001) and a significant moderate correlation with verbal elaboration (.36, p less than .001). These positive correlations indicate, of course, that as verbal fluency increases, these other two variables also tend to increase. In light of this fact, an interesting question that arose was whether or not the significant treatment effect that was obtained on verbal originality and verbal elaboration would still be maintained if the effect of verbal fluency on these measures was accounted for, i.e., held constant. To answer this question, analyses of covariance (ANCOVA's) on the verbal originality scores and on the verbal elaboration scores with verbal fluency as the covariate were carried out. The results of these ANCOVA's are presented in Tables 18 and 19.

As can be seen from Table 18, when verbal fluency was held constant, no longer was there a significant treatment effect on verbal originality, although it did approach significance (p less than .0587). While this finding does not nullify the previously reported finding that the individual competitive condition was significantly better than the non-competitive condition for enhancing verbal originality, it does suggest that the significant increase of verbal originality in the individual competitive condition was largely a secondary result of the increase of verbal

fluency in that condition.

The results of the ANCOVA on verbal elaboration, however, do not lead to the same conclusion. Table 19 shows that the effect of the treatment on verbal elaboration was still significant (p less than .0136) even when verbal fluency was held constant. This indicates that the significant increase in verbal elaboration in the individual competitive condition relative to the non-competitive and group competitive conditions was not a secondary result of the increase in verbal fluency.

Table 18. Analysis of Covariance: Verbal Originality

Sources of Variation	df	MS	F
Treatment	2	169.81	2.94*
Sex	1	70.39	1.22
Treatment by Sex	2	74.50	1.29
Within	77	57,71	

*p less than .0587, not significant at .05 level.

Table 19. Analysis of Covariance: Verbal Elaboration

Sources of Variation	df	MS	F
Treatment	2	124.58	4.55*
Sex	1	7.51	.27
Treatment by Sex	2	9.89	.36
Within	77	27.37	

*p less than .0136, significant at .05 level.

Summary of Findings

To summarize, the major findings of this study were:

(1) Verbal creativity (as measured by verbal fluency, verbal flexibility, verbal originality, and verbal elaboration) was differentially affected by non-competitive, individual competitive, and group competitive situations. Specifically, subjects in the individual competitive condition did significantly better than subjects in the non-competitive condition on verbal fluency and verbal originality and significantly better than subjects in both the non-competitive and group competitive conditions on verbal elaboration. On none of the measures did the subjects in the non-competitive condition differ significantly from subjects in the group competitive condition.

(2) Figural creativity (as measured by figural fluency, figural flexibility, figural originality, and figural elaboration) was not differentially affected by non-competitive, individual competitive, and group competitive situations. Although average performance on all measures of figural creativity was generally highest in the individual competitive condition and lowest in the non-competitive condition, none of these treatment differences were significant.

(3) The effects of non-competitive, individual competitive, and group competitive situations on verbal creativity did not vary with sex, i.e., no sex by treatment

interaction occurred. The observed cell means on each measure of verbal creativity indicated that for both sexes, average performance was highest in the individual competitive condition and lowest in the non-competitive condition.

(4) The effects of non-competitive, individual competitive, and group competitive situations on figural creativity did not vary with sex, i.e., no sex by treatment interaction occurred. The observed cell means on each measure of figural creativity suggested some interesting patterns, however. Among females, average performance was highest in the individual competitive condition and generally lowest in the group competitive condition. Among males, on the other hand, average performance was highest in either the individual competitive or group competitive conditions and lowest in the non-competitive condition.

(5) Collapsing across treatments, males and females did not differ significantly on the measures of verbal creativity. Significant sex differences were obtained on figural creativity, however. Specifically, males did significantly better than females on figural flexibility and figural originality.

(6) Almost all of the measures of verbal and figural creativity were significantly related to one another. However, verbal creativity measures correlated more highly among themselves than they did with the figural

measures. Similarly, the figural measures correlated more highly among themselves than they did with the verbal measures.

(7) The degree of relationship among the verbal and figural creativity measures varied under different treatment conditions. Highest intercorrelations were obtained in the individual competitive condition and lowest intercorrelations were obtained in the non-competitive condition.

(8) With verbal fluency held constant, no longer was there a significant treatment effect on verbal originality. This was not the case for verbal elaboration, however. Even when verbal fluency was held constant, verbal elaboration was still significantly affected by the treatments.

CHAPTER IV

DISCUSSION

This chapter presents a discussion of the major findings of the study. In addition, some suggestions for future research are offered.

Discussion of Findings

To facilitate organization of the discussion, the major findings of this study are discussed under the following headings: (1) Treatment effect on verbal creativity; (2) Treatment effect on figural creativity; (3) Sex by Treatment interaction effects; (4) Sex differences in verbal and figural creativity; and (5) Relationships among verbal and figural creativity measures.

Treatment effect on verbal creativity

Previous research indicated that individual competition, in which a reward was offered for best performance, can enhance the performance of elementary school students (Torrance, 1959, 1965) and junior high school students (Raina, 1968) on a verbal creativity task. The present investigation extends this finding to college students. In comparison to the subjects in the non-competitive situation, subjects in the individual competitive situation scored significantly higher on the measures of verbal

fluency, verbal elaboration, and verbal originality. In more descriptive terms, subjects in individual competition generated a significantly greater number of ideas that were both meaningful and relevant to the task at hand. They also, to a significantly greater extent, embellished or added detail to their ideas so that they were more interesting or complex. Perhaps most importantly, subjects in individual competition produced significantly more ideas that were of high quality; ideas that were clever, original, or uncommon, yet still appropriate to the task. Although the covariate analysis suggested that this latter finding was largely a secondary result of the positive effects individual competition had on verbal fluency, this still does not negate the fact that verbal originality, when measured according to Torrance's scoring procedures, was significantly enhanced by individual competition. The results of the covariate analysis do suggest, however, that if the number of ideas in response to the task was held constant across all subjects (e.g., if all subjects were told to produce five ideas apiece), individual competition may not have significantly benefited verbal originality production. Further research is needed to verify this possibility.

In contrast to the stimulating effects of individual competition, it was found that group competition did not effectively promote performance on the verbal creativity task. Indeed, not only were the scores of subjects in the group competitive situation not significantly different

from the scores of subjects in the non-competitive situation, but also, subjects in group competition produced significantly less verbal elaboration responses than the subjects in individual competition. A possible explanation for the failure of group competition to stimulate creative performance may be derived from considering the nature of the group competitive situation itself. Recall that in the group competitive condition the subjects were informed that they would receive the reward of seventy dollars (to be shared equally among them) if the overall performance of their group was better than that of the other groups. This means, of course, that each individual was largely dependent upon his teammates in order to receive the reward. For even if an individual did exceptionally well on the tasks, he still may not win the reward unless his teammates also did well. In essence, individuals in group competition had less "personal control" over the possibility of winning the reward than did individuals in individual competition. To the extent that the subjects in the group competitive situation were cognizant of this fact, it may have lessened their motivation to do well, and, as a consequence, their performance was no better than the performance of subjects in the non-competitive situation, in which no incentives were offered.

Regardless of whether or not this explanation is correct, it is clear that group competition was not as effective as individual competition. This finding gives support to a very important conclusion: the extent to

competition enhances performance on a verbal creativity task may well depend upon the type of competition that is utilized. This conclusion, it may be remembered, is in accord with much of the research on non-creative tasks (e.g., Maller, 1929; Julian & Perry, 1967), in which individual competition and group competition were found to have differential effects.

Treatment effect on figural creativity

In addition to assessing the effect of non-competitive, individual competitive, and group competitive situations on verbal creativity, this study also sought to determine what effect these three conditions would have on figural creativity. Previous research (Brown, 1973) had suggested that although a particular procedure may be useful for stimulating verbal creativity, it may not be beneficial to figural creativity. The results of this study are substantially in agreement with this particular notion. Although subjects in the individual competitive condition tended to do slightly better on the average than subjects in the non-competitive and group competitive conditions on all of the measures of figural creativity, none of these average differences were found to be statistically significant. One must assume, therefore, that the differences were simply due to chance.

It is curious to this investigator that performance on the figural creativity task was less responsive to the treatment conditions than was performance on the verbal

creativity task. There does not appear to be any obvious explanation as to why this result occurred. A plausible explanation, though speculative, however, is suggested by the work of Clifford and her associates (Clifford, 1972; Clifford, Cleary, and Walster, 1972). Based on a number of studies, these investigators have come to the conclusion that although competition can be an effective stimulator of performance on a variety of tasks, it has less impact on tasks which are "intrinsically interesting". They theorize that when an individual perceives a task as intrinsically interesting or challenging, he is highly motivated to work and perform on this task; therefore, the imposition of extrinsic motivational techniques, such as competition, are less influential simply because they are unnecessary to establish and promote motivation to perform. Kruglanski and his associates (1975) have provided some empirical support for this theory. These investigators found that college students were significantly more willing to work on a task without monetary compensation when they perceived it to be an interesting one than when they considered the task to be dull.

With regard to the results of this investigation, is it possible that the figural creativity task was perceived as more intrinsically interesting than the verbal creativity task? If so, to the extent that the aforementioned theory is correct, this could be the reason performance on the figural creativity task was not significantly enhanced

by the competitive treatments. However, since the investigator did not gather systematic evidence with respect to the intrinsic interest of each task, this explanation must remain an interesting speculation that can be verified only through future empirical research. In any event, an important conclusion to be noted is that just as the effectiveness of competition for stimulating creativity may depend upon the nature of the competitive situation (i.e., individual vs. group), it also may depend upon the nature of the creative task (i.e., verbal vs figural).

Sex by Treatment interaction effects

Another major concern of this study was to test whether or not the sexes were differentially affected by the treatment conditions. Inspection of the sex-typing literature (Mischel, 1970) and research by Richman (1972) had suggested the possibility that whereas the performance of males on the creative tasks might be most enhanced by individual competition, the performance of females might be greater in group competition. Analysis of the results of this study provided no support for such an interaction effect. Most generally, overall performance for both sexes tended to be highest in the individual competitive situation. Indeed, in contrast to what might be expected, individual competition seemed to be especially beneficial to the females. Not only did females achieve their highest mean performance on every single measure of verbal and

figural creativity in individual competiton, but also, the differences in the creativity scores between the individual competitive condition and the other two conditions were generally greater among females than among males.

That females tended to do best when they competed individually against other males and females seems to contradict the "fear of success" theory postulated by Horner (1972). According to this theory, it is held that females in our culture are taught that competition, particularly with a male, is unfeminine and may result in social rejection. As a result of such training, Horner argues that many women develop a "motive to avoid success" which serves to inhibit their performance in individual competitive situations. Indeed, Horner also asserts that those women who are most capable of achieving success (e.g., college women) are the ones who tend to be most afraid of it. Although Horner has marshalled some evidence to support her theory (Horner, 1968), more recent research (Zuckerman and Wheeler, 1975) has failed to find any firm evidence of a "fear of success" motive among women. Certainly the results of the present investigation offer no support for Horner's theory. Perhaps the pervasive growth of the women's liberation movement in recent years has served to reduce "fear of success" among women.

Sex differences in verbal and figural creativity

Although it was not a primary focus of this investigation, data with regard to sex differences in verbal

and figural creativity was also obtained. After collapsing the data across treatment conditions, analysis of the results indicated no sex differences on the measures of verbal creativity. It was found, however, that males did significantly better than females on the measures of figural flexibility and figural originality. These findings, though interesting, are probably quite limited in terms of generalizability. Examination of the empirical literature concerned with sex differences in creativity reveals that although a number of studies have obtained results largely consistent with those of this study (e.g., Bieri, Bradburn, & Galinsky, 1958; Mendelsohn & Griswold, 1966), just as many studies have reported partially or totally contradictory results (e.g., Torrance & Aliotti, 1969; Frederickson & Evans, 1974). Indeed, an exhaustive review of the research in this area by Maccoby and Jacklin (1974) points up the highly inconsistent and contradictory nature of this type of research. In light of this fact, the sex differences observed in this study should be interpreted with extreme caution. It is probably best to assume that the differences obtained are largely a function of the particular sample studied or the particular tasks employed. Broader generalizations do not seem warranted.

Relationships among verbal and figural creativity measures

A further consideration of this study was the extent to which the measures of verbal and figural creativity related to one another. When Pearson product moment

correlations were computed among all the measures across all the treatment conditions, the results showed that almost all the intercorrelations were statistically significant. This indicates that each variable was measuring, at least to some degree, some factor in common with every other variable. Of course, this finding should be expected if we are to believe that each measure is an index of the larger construct of creativity. In this regard, it was also revealed that whereas the verbal measures tended to correlate highly among themselves (average intercorrelation of .51), and the figural measures tended to correlate highly among themselves (average intercorrelation of .62), the intercorrelations between the verbal and figural measures were comparatively low (average intercorrelation of .29). Two important implications are suggested by this finding. First, it supports the value of examining creativity along two separate dimensions, one verbal and the other figural. A second and related implication is that one should not assume that verbally creative individuals are also figurally creative. Similarly, figurally creative individuals should not be assumed to be verbally creative. This would seem to be an especially important fact for teachers to keep in mind.

Additional information with respect to the inter-relationships among the verbal and figural creativity measures was provided when intercorrelations were computed within each separate treatment condition. In general, it was found that the intercorrelations among the measures were

highest in the individual competitve condition and lowest in thc non-compctitive condition. This finding suggests that thc dcgrcc of the relationships that are obtained among creativity measures may well depend upon the conditions under which the tests are administered. It is noteworthy that several other investigators have observed this to be true, although the results they have obtained have been contradictory. For example, although Leith (1972) found, similar to this study, that intercorrelations among creativity measures were highest in an evaluative rather than a relaxed atmosphere, Vernon (1971) and Boersma and O'Bryan (1968) reported higher relationships among creativity measures when the tests were given under relaxed rather than evaluative conditions. While such contradictory results are not readily explained, the major point to be emphasized is that different testing conditions can differentially influence the extent of the inter-relationships among measures of creativity. In light of this fact, it seems quite possible that one of the reasons research has been so inconsistent with respect to the reliability and validity of creativity tests, including the Torrance tests, is that different investigators have administered the tests under different conditions.

Suggestions for Future Research

At a most general level, the results of this study support the idea that the level of creative productivity of an individual can be influenced by the conditions under which he works. Specifically, the results of this study indicate that individual competition, in which individuals compete against other individuals in order to win a concrete reward, can effectively enhance creative output on a verbal task. An obvious educational implication of this finding, of course, is that teachers may find it profitable to arrange individual competitive situations in the classroom when verbal creativity is one of their instructional objectives. However, before any definitive and broad implications can be drawn, additional investigations that overcome the limitations of the present study are needed.

For example, both in this study and in the studies by Torrance (1959, 1965) and Raina (1968) money or concrete prizes were used as the reward in the competitive situations. It would be interesting to examine whether different types of rewards, such as grades or public recognition, would lead to outcomes different from those obtained in this study. Indeed, it is reasonable to assume that a greater amount of anxiety would be generated in a situation in which individuals competed against each other for grades rather than for money. And since there is research to suggest that anxiety and stress may impede creative thinking (Tortorella, 1967; Krop, Alegre, & Williams, 1969), it is quite possible that

individual competition for grades would have a different effect on creative performance than individual competition for money.

Another useful study would be to test the effects of competition on performance on a more substantial task than the one used in this study. For example, would competition facilitate the production of creative research papers or creative paintings? Clearly working on Torrance's creative thinking tests is a much simpler task than the task of producing a research paper or painting. Such differences in the complexity of the task are certainly a factor worthy of consideration in future research.

Since this study utilized only independent creative tasks (i.e., individuals worked separately on the tasks), a further investigation that might be fruitful would be to examine the relative effects of non-competition, individual competition and group competition on performance on an interdependent creative task (i.e., a task on which individuals work together). As reported in Chapter I, a number of studies found that group competition was more beneficial than individual competition for increasing productivity on non-creative interdependent tasks. Similar effects might be predicted on creative interdependent tasks.

Still another study that might be worthwhile to conduct would be to assess how individual and/or group competition compares to other procedures for stimulating creative production. For instance, would individual

competition be a significantly better technique for promoting creativity than brainstorming or modeling? Only through comparative research can such questions be answered.

In conclusion, as with other areas of creativity research, our understanding of the relationship between competition and creativity is still in its early phases. There is still much yet to be done. While the results of this study support the efficacy of individual competition as a means for enhancing verbal creativity, further research is needed before more definitive and wide-ranging conclusions can be offered.

APPENDICES

APPENDIX A

DEMOGRAPHIC DATA SHEET

NAME: _____

SEX: Male _____ Female _____

AGE: _____

LEVEL OF COLLEGE:

Freshman _____

Sophomore _____

Junior _____

Senior _____

Grad _____

APPENDIX B

RAW SUMMED SCORES

Raw Summed Scores for Ss in the Non-competitive Conditions

Sex (n=14)	Variables							
	VF	VX	VO	VE	FF	FX	FO	FE
	20	16	16	14	24	24	48	25
	26	12	10	7	24	20	52	28
	31	16	33	14	8	8	14	46
	20	12	6	6	18	18	34	40
	38	18	35	13	36	34	52	37
	24	14	13	4	52	40	69	33
Males	30	20	25	9	32	18	68	77
	20	10	11	17	22	20	36	34
	27	18	14	8	12	12	11	22
	32	16	18	4	31	28	38	35
	36	19	16	14	24	18	40	34
	14	8	15	7	14	12	17	22
	20	13	8	9	28	24	48	8
	29	12	14	8	23	19	35	36
	18	12	16	9	16	12	30	33
	26	14	12	8	30	20	28	12
	28	16	18	16	16	16	30	24
	21	12	12	1	34	30	44	19
	32	18	33	17	32	14	20	8
	26	9	16	12	26	24	36	25
	24	8	6	6	12	12	2	10
	28	17	18	16	24	20	20	40
Females	36	16	12	4	30	24	44	20
	22	10	18	16	16	12	26	50
	20	13	22	10	30	24	42	30
	34	19	8	3	30	26	61	80
	14	12	2	4	14	12	26	36
	24	18	14	5	10	6	6	22

Raw Summed Scores for Ss in Individual Competitive Condition

Sex	Variables							
(n=14)	VF	VX	VO	VE	FF	FX	FO	FE
	23	15	23	15	16	16	38	62
	38	18	31	23	37	30	87	54
	50	29	39	26	36	32	65	62
	30	14	26	15	21	18	36	33
	34	21	16	13	20	20	37	52
	50	25	37	8	16	16	36	41
Males	20	16	8	8	18	18	38	65
	12	8	2	7	32	20	58	45
	27	16	14	17	16	8	36	16
	59	26	45	9	52	41	76	93
	40	19	24	16	16	12	24	37
	24	12	10	5	32	26	40	3
	35	16	31	12	28	25	44	34
	21	12	18	5	43	28	37	34
	37	18	11	11	34	30	48	44
	45	19	45	6	22	19	44	38
	60	19	35	23	25	23	37	26
	31	15	29	21	6	6	8	22
	18	14	13	7	15	12	21	31
	14	12	2	3	18	18	24	44
	41	23	37	9	42	30	64	38
Females	34	18	44	18	33	26	52	50
	34	19	37	11	28	18	38	41
	39	14	46	23	44	30	100	106
	46	20	34	19	36	28	46	106
	22	8	28	18	18	18	28	50
	28	12	27	17	14	12	25	52
	26	12	18	22	29	23	46	38

Raw Summed Scores for Ss in Group Competitive Condition

Sex (n-14)	Variables							
	VF	VX	VO	VE	FF	FX	FO	FE
	24	12	6	5	24	20	40	38
	42	21	32	10	38	30	62	46
	22	16	8	9	14	14	34	22
	13	13	8	2	16	14	36	47
	26	16	26	8	22	21	48	23
	29	13	14	15	36	28	66	69
Males	20	14	12	7	16	14	30	22
	28	18	14	8	12	8	25	9
	39	19	29	10	58	38	128	66
	38	14	25	1	15	13	28	28
	35	12	41	17	70	42	106	12
	56	22	34	10	40	28	62	78
	36	20	12	18	16	14	44	28
	30	14	20	10	30	20	54	38
	26	14	28	10	15	15	23	25
	44	20	23	14	20	18	24	33
	29	10	21	10	14	13	32	46
	38	18	28	4	10	8	18	20
	25	14	20	8	30	28	24	40
	40	15	25	17	18	14	42	42
Females	32	16	20	12	14	12	18	48
	36	15	6	1	12	6	0	8
	16	12	14	5	10	10	14	38
	40	14	29	10	24	16	42	72
	22	16	17	6	22	18	24	34
	19	12	16	8	17	13	22	31
	18	13	14	13	29	16	22	16
	16	10	15	9	27	25	47	35

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