INTERACTIONS AMONG CREATIVITY, INTELLIGENCE, ANXIETY, AND GENDER
WITH CHANGES IN AROUSAL LEVEL

DISSERTATION

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* * * * *

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INTRODUCTION

Within the scientific literature no clear consensus exists with respect to an identifiable set of parameters, definitions, and descriptions which together compose something which might be called creativity. Conservative researchers such as Cronbach (1968) contend that the existence of such a phenomenon as process has yet to be demonstrated. Wallach (1970) seems to limit his conception of creativity to the number of ideas one can produce with certain constraints. Guilford (1956) conceives of creativity as being composed of a number of different psychological processes subsumed under a general class of mental operations called divergent thinking. For still others, for example Ray (1967), creativity is associated with problem-solving skill.

The construct of creativity is yet further expanded, and thus confounded, in that different areas within psychology provide different types of orientation. The clinician speaks of the creative person in terms of how he feels about himself and how others perceive him (e.g., Snyder and Tessman, 1965). For the psychoanalyst creativity is the product of the unconscious and synthetic ego functions (e.g., Hacker, 1965). For the humanistic psychologist (e.g., Anderson, 1965) creativity is something which cannot be predicted and thus can never be fully studied from a scientific point of view.
As noted by Mooney (1958) creativity means something different to different people. Psychologists tend to focus on either creative products (e.g., Rogers, 1962; Arnold, 1962), creative processes (e.g., Wallach, 1970), or the creative individual (e.g., Roe, 1953). And these differing orientations have led to different conceptualizations of the creative process. Thus for Cronbach (1968) it doesn’t yet exist, at least experimentally; to Maslow (1963) it is the very essence of the healthy, self-fulfilled individual.

The basis for the present investigation arises most generally out of this lack of agreement in specifying the parameters of creativity. The present author believes that the lack of consensus derives in large part from the semantic characteristics of the term “creativity” to implicate and occupy two broad and relatively distinct domains of psychological inquiry: namely, the cognitive and the affective-motivational. To create something, i.e., to bring something into being where nothing was before, alerts at once psychologists interested in thinking, perceiving, and reasoning, and also those interested in feelings and motivations. This dichotomy of interests leads to a dichotomy of emphases which in turn leads to a lack of agreement about the nature of creativity.
For example, there is an unresolved issue in creativity research—one to which the present study directs itself—as to whether individual differences in creativity are due to a cognitive capacity for divergent ideational production or to differences in motivational status (e.g., See Ward, Kogan, and Pankove, 1972; Milgram and Feingold, 1977.). This is reminiscent of the somewhat archaic heredity versus environment controversy which occupied many psychologists for a time. One can, of course, never realistically hope to account fully for human behavior by considering only one and not the other. Questions should not be framed in either-or terms but instead, in terms of how much of each is involved and how they both interact.

Similarly, the present investigation begins with the proposition that creativity must be conceptualized as a concurrent cognitive-affective/motivational process. To emphasize one part to the neglect of the other only diminishes accuracy of conceptualization and of assessment.

In order to examine this proposition the author selected a particular aspect of creativity (ideational fluency) and studied its relationship to three constructs which are considered to be either cognitive (intelligence) or affective-motivational (anxiety and level of arousal) in nature. The rationale for selection of these particular variables is presented in the following chapter.
If these particular cognitive and affective/motivational variables are crucial aspects of creativity then one should be able to demonstrate the following:

1) that different levels of intelligence are associated with different levels of ideational fluency.

2) that different levels of arousal and anxiety are associated with different levels of ideational fluency.

3) that the combination of intellective and anxiety-arousal variables, in either an additive or interactive fashion, are associated with different levels of ideational fluency.

At a general level these are the basic hypotheses to be tested in the present investigation. Because the selection of the particular creativity-cognitive-affective/motivational variables relied heavily upon the contributions of previous investigations a statement of more specific hypotheses must await a review of the relevant literature which is presented in the following chapter.

Present literature related to the role of affective/motivational variables in creative performance lacks a satisfactory description of the specific mechanics of how they might interact with intelligence to produce creative responding. A review of the literature is used to generate a model which provides a hypothetical description. Predictions are generated from this model and conflicting results from previous investigations are
incorporated within it. These predictions together with other experimental hypotheses were examined by applying various statistical operations to data generated from conduct of the study. Conduct of the study and analysis of the results are presented in Chapters II and III respectively. Conclusions are detailed in Chapter IV.
CHAPTER I

REVIEW OF THE LITERATURE

Creativity and the assessment of intelligence

The present investigation is tied to a long strand of inquiry into the nature of creativity and intelligence. Historically the two constructs have been closely associated although it seems that the study of creativity was often merely coincidental to the much more intensive inquiry into the assessment of intelligence.

Galton's study of *Hereditary Genius* in 1869 used the criterion of "eminence" in a particular field for selection of subjects to be studied. "Eminence" seems to contain a composite of intelligence, motivation, and creativity. In describing Galton's conception of the poet's eminence Stein and Heinze (1960) note that "inheritance of the strong sensuous tastes (the affective/motivational component--W.S.) of the poet without the controlling faculties (the cognitive component--W.S.) may lead to complete failure (pg. 88)." Scientists were selected for "enduring reputation" of for being "otherwise well known." Literary men were selected on the basis of those Galton found "most prominent."
Louis Terman, developer of the Stanford-Binet intelligence test, is generally considered to be the father of the gifted-child movement in the United States (Gowan, 1977). Although Terman himself neglected the concept of creativity the gifted-child movement as a whole absorbed the notions of both creativity and intelligence as the major, defining characteristics of the gifted child.

Creativity is closely associated with two other major figures in the history of intelligence assessment. Charles Spearman and Louis Thurstone were at the forefront of the longstanding controversy between those emphasizing a single g-factor for intelligence as opposed to a variety of primary mental abilities. Each of these men proposed a different basis for the creative process.

In *Creative Mind*, Spearman (1931) proposed a special theory of creative performance. He suggested that all creative thinking could be accounted for on the basis of a single factor of intelligence. For Spearman, every creative act was a matter of "educing correlates" which is "displacing a relation from the ideas which were its original fundamentals to another idea and thereby generating the further idea which is correlative to the last named, and, which may be entirely novel." (Spearman, 1931, pg. 83)
Like Spearman, Louis Thurstone tied his theory of creative thinking to his theory of intelligence (Guilford, 1967). In "Creative Talent" (Thurstone, 1952) he suggested that "creative talent is not the same as intelligence although there is undoubtedly a positive correlation between the two."

Thurstone focused on the moment of insight as the basic characteristic of the creative process and also the feature which distinguished it from ordinary problem-solving. Further, "the moment of insight is often, perhaps always, in relaxed, and dispersed attention." (Thurstone, 1952, pg. 26, emphasis added) Thurstone goes on to suggest that "experimental studies be made to ascertain what kinds of mental work are done best under conditions of muscular tension with concentrated attention, and which kinds of mental work can be done best with dispersed and relaxed attention." (Thurstone, 1952, pg. 27, emphasis added)

Thus it is with Thurstone that the ideas examined experimentally in the present investigation become most explicit. Following Thurstone's suggestion, the present investigation utilized both a tension and a relaxation condition as operationalizations of "level of arousal."

It is also with Thurstone that the affective-motivational component to creativity becomes associated most closely with the intelligence assessment movement. For Thurstone, creativity closely resembles what might otherwise be called intuition. Describing intelligence Thurstone (1952, pg. 33) stated that "The
psychological act originates in the essentially affective and nonverbalized, non-focal motivation and needs of the individual." (Emphasis added.--W.S.) In this model creativity occurs when individuals become intuitively aware of this material which is essentially unconscious.

The impact of Freud and the psychoanalytic movement is clear with Thurstone's conception of creativity. As Guilford (1967) notes: Psychoanalysts have had a great deal to say about the subject of creativity....(However) it is almost entirely restricted to motivational and emotional aspects with practically nothing on intellectual aspects." (Guilford, 1967, pg. 431) In this regard Kris (1953) suggests that creative thinking is a function of the preconscious as an element in the communication between the id and ego.

Thus, as noted in the Introduction, there is a dual conception of creativity originating from different orientations. For Spearman creativity is an intellectual process; for the psychoanalysts the basis of creativity is motivational and emotional in nature. For Thurstone creativity appears to be a blend of both orientations. And it is to Thurstone that the present investigation is related, philosophically speaking.
Two opposing perspectives on creativity

Like Thurstone, J. P. Guilford emphasized a multifactor basis for intelligence. With respect to creativity, however, Guilford differed from Thurstone in that he pursued his ideas with experimental investigations. Guilford is generally credited with motivating the great burst of creativity research over the last three decades. With his presidential address to the American Psychological Association in 1950, entitled "Creativity," (Guilford, 1950) and his subsequent development of the Structure of Intellect model (Guilford, 1956) creativity became a distinctly separate area of inquiry.

In connection with the present investigation two features of Guilford's work require discussion. First, using multiple factor-analysis techniques, he attempted to theoretically and empirically separate those aspects of creativity which were distinct from intelligence. Intelligence as assessed by traditional measurements was considered to be part of an operation called "convergent thinking" in which "there is usually one conclusion or answer and thinking is channeled or controlled in the direction of that answer (Guilford, 1956)." Aspects of creativity which were different from intelligence were subsumed under a type of mental operation called divergent thinking in which there is more than one "correct" answer and "there is much searching or going off in various directions (Guilford, 1956, pg. 27)." In the present study one aspect of divergent thinking, ideational fluency, is used as an operationalization of creativity.
A second feature of Guilford's work which requires discussion is that the involvement of non-intellective factors in creative performance is not considered to be particularly noteworthy. For example, it is not until after his development of the structure of the intellect model that he makes even passing reference to "work in progress" on relating non-aptitude factors to creative thinking factors, stating that the relationships between these two groups of factors is very small. (Guilford, 1958) Later, Guilford (1959) noted that there is a lack of investigation in this area, but went on to criticize those who feel that "the chief secrets of creative performance" lie in traits of motivation and temperament. Thus there is a large discrepancy between the position taken by Guilford and that taken in the present investigation with respect to the role of affective/motivational variables.

Following the lead of Guilford, researchers subsequently interested in the cognitive aspects of creativity have considered the more dynamic aspects of creativity as somewhat of a bothersome stepchild, i.e., unwanted but necessary to attend to occasionally. Similarly, those primarily interested in the affective motivational aspects of creativity stayed largely outside the cognitive/psychometric approach to the assessment of creativity.

For example, to the second group belong the following individuals. In identifying creativity with self-actualization, Rogers (1954) suggests that creativity cannot be assessed:
"by its very nature (it) is indescribable." Barron (1953) and Barron and Welsh (1952) focused on a preference for complexity versus simplicity but ignored the intellectual process. Anderson (1959) relates creativity to personality development without reference to cognition. Others in this category include Bellak (1958), Fromm (1959), MacKinnon (1962), Maddi (1965), and Vernon (1965).

To the first group, that is those interested primarily in creativity as cognition sans affect/motivation, belong Mednick (1962) and the Remote Associates Test; Getzels and Jackson (1962) and their study of creativity and intelligence; E.P. Torrance (1966 a, b, & c) and his tests of creative thinking; and Wallach and Kogan (1965 a & b) with their creativity test battery serving as the basis for the creativity-intelligence distinction.

In the first two sections of this chapter, then, two things should be abundantly clear. First, creativity has been associated on a continuing basis with both a cognitive and affective/motivational process. Second, how they might operate together to produce creative responding has not been adequately explained or studied.

It is not the purpose of the present investigation to attempt to resolve this last issue. However, to reiterate, it is the basic orientation of this study that creativity should be conceptualized as a concurrent cognitive-affective/motivational process. The
basic purpose of the present investigation is to examine this orientation by experimentally testing the relation of creativity to a selected set of cognitive-affective/motivational variables.

In the following section literature will be reviewed from which specific experimental manipulations utilized in this investigation were derived.

The effect of task context and incentives on ideational fluency

In the first section of this chapter attention was drawn to the work of Louis Thurstone. Emphasis was placed on two of his suggestions: First, that the basic characteristic of the creative process, namely the moment of insight, often, if not always, occurs in a state of relaxed attention; and second, that experimental studies be made comparing the effects of muscular tension versus relaxed attention on mental work.

With respect to creativity assessment Thurstone's suggestion has gone unnoticed. However, Wallach and Kogan (1965) hypothesize the importance of a relaxed, permissive assessment context, and use it for defining one of two essential elements in the creative process. Specifically, this element is the "presence in the (person) of a playful, permissive task attitude (pg. 351)."

"Permissiveness further connotes... a relaxed entertaining of the possible rather than tense insistence upon an answer that must be correct if one is not to lose face (Ibid, pg. 352, Emphasis added.)."
Interestingly enough, no evidence could be summoned by Wallach and Kogan to demonstrate that a relaxed, permissive testing atmosphere was most ideal for the assessment of creativity. Nor did they include a control group or a contrasting tension group in their own study. Their argument that their ability to separate creativity from intelligence was due to the relaxed setting because others had failed to do this under a more stressful setting lacks logical rigor and needs to be examined experimentally.

Following the Wallach and Kogan study there have been a few studies related to this issue. These are discussed below.

Boersma and O'Bryan (1968) investigated the relationship between creativity and intelligence under two conditions of testing. Using a between groups design with fourth-grade boys, they compared Wallach-Kogan creativity scores under test-like versus game-like conditions. Creativity under game-like conditions was associated with higher levels of creativity and a substantially smaller correlation between creativity and intelligence.

In a more extensive study Kogan and Morgan (1969) examined two major hypotheses: 1) that game-like assessment contexts elicit higher levels of creativity than do test-like contexts, and 2) that creative and intellectual performance are unrelated to each other under game-like contexts, whereas they are positively related under test-like contexts. The rationale for this second hypotheses was that, as suggested by Wallach and Kogan (1965a),
the optimal distinction between creativity and intelligence should occur under a relaxed, permissive task atmosphere.

Results evidenced no clear-cut superiority for either game-like or test-like assessment contexts. Rather, effects varied dependent on the kind of task (verbal or nonverbal ideational fluency tasks), the level of anxiety and defensiveness of the subjects, and the sex of the subject.

Findings related to the sex of the subject are of particular interest. With respect to ideational fluency, boys generated significantly more responses under test-like relative to game-like conditions. For the girls task context had no effect. This finding for boys is in direct conflict with the Boersma and O'Bryan (1968) findings in which a game-like setting enhanced creativity for boys.

Directly conflicting results such as this are typical of the few remaining studies related to this issue. For example, Hargreaves (1974) found that removal of time limits appears to depress divergent test scores in a test-like context. Overall, he found game-like conditions produce significantly higher ideational fluency scores. Channon (1974) found the opposite: "the imposition of mild stress ('test') generally increased pupils scores on these tests compared with those obtained under a relaxed or informal regime." Finally, Milgram and Milgram (1976) found that group administration exercised an adverse effect in creativity
(ideational fluency and unusual responses) in nongifted children (below average to above average intelligence), whereas for gifted children (superior to highly superior intelligence) group versus individual administration had no effect on creativity.

To summarize, several issues need more explicit emphasis. First, the effect of creativity assessment context, whether game-like or test-like, is unclear. Second, several variables seem to interact with assessment context to produce conflicting results. Intelligence level, anxiety level, and gender seem to be the most prominent moderating variables.

Third, methodological limitations of these studies prevent clearer integration of their findings. For example, in the Boersma and O'Bryan (1968) study, age-corrected intelligence scores (i.e., IQs) were compared with age-uncorrected creativity scores. Also great variations exist among three experiments in their operationalizations of "test-like" and "game-like" assessment contexts. For example, Boersma and O'Bryan took their game-like group to a university gymnasium and interspersed creativity assessment with periods of play. Kogan and Morgan (1969) established their experimenter for the game-like context as a representative of a toy company in school for the day to play some games with the children.

Fourth, despite Kogan and Morgan's (1969) stated purpose of investigating the relationship between creativity and intelligence,
they did not in fact assess intelligence experimentally, using
instead previously school-administered IQ tests, not all of which
were available for their particular subjects.

A somewhat different approach to the role of affective-
motivational variables in creative performance has been to examine
the consistency of creative performance over variations in the
motivational contest of test administration. In this context,
the central question is raised as to the nature of individual
differences in ideational production. The rationale, as
posed initially by Ward, Kogan, and Pankove (1972), is that if
one is able to change significantly the rank order of creative
individuals by manipulating motivational conditions, then the
nature of baseline differences in ideational production may be
considered to be primarily in the cognitive capacity for ideational
production.

Two studies have been done which bear directly on this
issue. Ward, Kogan, and Pankove (1972) found that incentives
(their operationalization of motivation) increased the number
of ideas relative to controls but did not affect the relative
ordering of individuals. They conclude that capacity is of greater
importance than motivational variables in accounting for
individual differences in creativity.

With respect to the present investigation, the Ward, et al.
study is limited in two ways. First, their consideration of the
role of motivation is confined to incentives and does not include motivational variables demonstrated to be significant in the literature, specifically anxiety level and level of arousal. Second, intelligence data were available on only two-thirds of their subjects and the mean IQ was below average at only 94.

Milgram and Feinfeld (1977) went one step further and examined the effects of concrete and verbal reinforcement on creative thinking of disadvantaged children. Both of these incentive conditions were found to raise the level of ideational fluency in comparison with control conditions. But they go on to suggest that, contrary to the reasoning of Ward, et al. (1972), these findings may be used to support either cognitive or motivational variables as the source of individual differences in creative thinking. They agree with Ward et al. that low correlations between baseline and incentive conditions would be evidence for the motivational position.

These two studies taken together suggest, at face value, that, although creativity scores may be influenced by motivational variables, the relative rank order of individuals on creativity does not change significantly. This conclusion, however, is hardly compelling in that other variables which might have influenced creativity were not taken into consideration: intelligence level,
level of anxiety, presence of a relaxed, permissive attitude in the subjects, and the gender of the subjects. Evidence presented above would suggest a probable interaction among them.

Thus it is possible that the relative rank ordering of individuals on creativity would change following the manipulation of appropriate affective/motivational variables.

Assessment context, then, is considered to play a crucial, albeit ambiguous, role in the motivational processes of creative production. The problem is how best to describe this motivational component. The author would suggest the phrase "level of arousal" in the form of a continuum between relaxation and tension or, at a different level, between low anxiety and high anxiety. The questions then become how much do level of arousal, gender, and intelligence contribute to creativity and further how do they interact with each other in the production of creative responses? A discussion of the relationships among these variables, which in turn leads to the development of an explanatory model, is presented in the following section.

The relationship of anxiety, intelligence, and gender with creativity

Typically a negative relationship is found between intelligence and anxiety (Spielberger, 1958; Sarason, et. al., 1960; Ruebush, 1963). Individuals with high intelligence generally
exhibit lower levels of anxiety than individuals with low intelligence.

The relationship between anxiety and creativity is less clear. Krop (1969) found that for college students high extrinsic and intrinsic motivation were all associated with higher levels of creativity. Flescher (1963) found that a moderate amount of anxiety is needed to stimulate ideational fluency for individuals in the bright normal range of intelligence. Feldhusen, Denny, and Condon (1965) found no relationship ($r = 0.04$) between ideational fluency and anxiety. White (1968) found anxiety to have a significant negative correlation ($r = -0.19$) with ideational fluency. Mediusus and Love (1965) and Reid et al. (1959) found creative children to be less anxious than their peers. Fleischer and Cohen (1965) found that low-anxiety subjects gave significantly more remote responses than high anxiety subjects. And Wallach and Kogan (1965a) found intermediate levels of manifest anxiety related to associate productivity for boys but not girls.

Thus needless to say, the relationship between anxiety and creativity is unclear. It is the premise of the present investigation, to be detailed below, that the relationship is moderated by different levels of intelligence and gender of subject.

The relationship between gender of subject and anxiety was documented by Sarason, et al. (1960) in their extensive study of anxiety in elementary school children. The consistent pattern
which emerged in many different studies in both England and America was that girls get higher scores than boys on scales of test-anxiety and general anxiety. Sarason et al. consider various explanations for this finding which need not concern us extensively here except that one should note the following: "High anxiety girls as a group are probably more psychologically heterogeneous than a group of high anxiety boys. And thus one would not expect to get as consistent differences between high anxiety and low anxiety girls as between high anxiety and low anxiety boys (pg. 257)." This relationship is, in fact, what Sarason, et al. (1960) found in their various studies.

The relationship between gender of subject and creativity is very unclear. In some instances in the literature data are analyzed separately for males and females. When this is done (e.g., Wallach and Kogan, 1965; Kogan and Morgan, 1969; Yamamoto and Chimbidis, 1966), inconclusive but exceptionally interesting findings are reported. For example, as mentioned above Wallach and Kogan (1965a) found intermediate levels of anxiety related to associative productivity for boys but not girls. And Kogan and Morgan (1969) found that test-like conditions improved creative performance of males but assessment context had no effect for females.

Cronbach (1968), however, criticizes this practice with the following comments about the Wallach and Kogan study: "They
treated data for each sex separately without first demonstrating the presence of an interaction involving sex...Moreover, it leads one to draw different conclusions about boys and girls where perhaps no difference exists." (pg. 491) Thus the interaction among gender, level of arousal, and creativity remains an unresolved issue.

Finally, then, we are left to describe the relationship between intelligence and creativity. Investigators in this area have debated for years whether the two constructs represent distinct or highly related dimensions of intellect. For example, the research of Getzels and Jackson (1962) and Wallach and Kogan (1965) seemed to indicate that intelligence and creativity were relatively independent concepts. However, Burt (1962), Thorndike (1963), Cline, Richards, and Needham (1963), and Cropley (1965) provided evidence indicating that creativity and intelligence are not completely separate dimensions of intellect.

Three positions taken with respect to this issue merit some discussion.

First, it has been suggested that tests of creativity should correlate more strongly among themselves than they do with tests of intelligence. If they do not then such tests are simply measuring intelligence in a different way. This is the position adopted by Thorndike (1963 a & b); McNemar (1964); Wallach and Kogan (1965 a & b) and Wallach (1970) in their criticism of Guilford's
factor analytic model; Getzels and Jackson's (1962) study of creativity and intelligence; and the Torrance tests of creative thinking (Torrance, 1966 a, b, & c).

Although this is seemingly a purely methodological problem, the psychological implications of an inability to distinguish between creativity and intelligence is clear: there may be nothing which one can call creativity in any psychologically meaningful way. Thus selection of instruments for creativity assessment becomes a crucial decision for a researcher.

For purposes of the present investigation the author accepts the excellent review of this issue by Wallach (1970 and 1971) which led to the conclusion that tests of ideational fluency provide maximal separation from tests of intelligence while at the same time possessing sufficient content validity and internal reliability. Ideational fluency is defined as "the ability to generate in plentiful number ideas that are appropriate to a given task constraint." (Wallach, 1970, pg. 1223)

Torrance (1962, 1963, 1966a) argues against the position taken above by suggesting that intelligence and creativity have a different relationship for different levels of intelligence. Specifically, for low levels of intelligence a high correlation should exist with creativity. However, above a certain "threshold of intelligence" creativity is more related to academic achievement than to further increments of intelligence. However, extensive studies devoted to this issue do not seem to
support it (e.g., Cicirelli, 1965; Yamamoto and Chimbidis, 1966; and Bowers, 1966).

Finally, there is the notion, mentioned occasionally in the literature, that intelligence is a necessary but insufficient condition for creativity. Guilford seems to be the most visible advocate of this position (Guilford, 1967 & 1975; Guilford and Christensen, 1973). Others include Dacy and Madaus, 1971; Goodale (1970) and Griffith (1976).

Specifically, Guilford (1975) writes: "We find that individuals who are very high on DP (divergent production) tests are almost sure to be high also in IQ, whereas those who are high in IQ are not sure to be high in DP abilities." (pg. 119) Guilford (1967, pg. 432) described a triangular relationship between creativity and intelligence such that a "high IQ is not a sufficient condition for high DP production but an above-average IQ is an almost necessary condition."

The problem the present author has with these "findings" is that Guilford's divergent production test battery contains too many devices which share more variance in common with convergent tasks than they do with the other divergent tasks. The notion of intelligence as a necessary but insufficient condition would have more merit if the creativity assessment devices were more empirically separable from intelligence. The design of the present investigation allows an examination of this notion utilizing tasks of ideational fluency.
Development of a hypothetical model

To relate these diverse studies using the conception of changes in level of arousal, a model was constructed based initially upon the Yerkes-Dodson law. Yerkes and Dodson (1908) and later Hebb (1955) and Malmo (1959) described a curvilinear relationship (an inverted U) between stress (arousal) and performance (See figure one.).

Others (e.g., Dunn, 1968) have demonstrated that as task complexity increases, a reduction in arousal should occur for optimal performance. That is, difficult tasks require a reduction in arousal; easy tasks require increased arousal for optimal performance. See Figure Two.

Now it would seem reasonable to assume that task difficulty is relative, depending upon one's intelligence. That is, for example, a task which is considered easy for a person of high intelligence may be very difficult for a person of low intelligence. Combining this assumption with findings presented in the preceding paragraph relating to task difficulty and arousal, the following relationships become apparent: for any given task, optimal performance motivation will be greater for a person of higher intelligence than for a person of lower intelligence. That is, since the given task is easier for a person of high intelligence, he requires greater arousal level for optimal performance; the less intelligent person requires less arousal
Figure 1. Performance as a function of arousal level

Figure 2. Performance as a function of arousal level for two types of task difficulty
for optimal performance because for him the task is more difficult. This relationship is presented graphically in Figure Three.

Now we must add to this model the findings reported in the preceding section of a negative correlation between intelligence and anxiety. Graphically we can represent this by denoting the anxiety levels typical of different intelligence groups keeping in mind that on a convergent thinking task the more intelligent individuals will outperform those of less intelligence. In our model this means that the typical level of arousal for an individual of high intelligence must be greater than the optimal level of arousal for an individual with less intelligence. This relationship is presented in Figure Four.

Next, we are in a position to add to this model the construct of creativity (ideational fluency). See Figure Five. Figure Four is not sufficient to accommodate the addition of creativity in that the correlation between intelligence and creativity would always be positive and high except under very limited circumstances. And as described above in the preceding sections of this chapter changes in arousal level may change creativity test production which in turn influences the correlations between creativity and intelligence. Viewing Figure Five we can readily understand why changes in the correlations between intelligence and creativity might occur: lowered levels of arousal for high intelligent subjects leads to lowered task performance whereas for low intelligent subjects performance improves as arousal levels decline. Note that this specific relation is true only for the example given and that
Figure 3. Hypothetical performance on any given convergent task as a function of arousal level for two classifications of intelligence. $X_I$ and $Y_I$ denote optimal performance arousal for the low and high intelligence groups respectively.
Figure 4. The same relationships displayed in Figure 3 are also displayed here. However, now, arousal levels (anxiety) typically found for individuals in the two intelligence classifications together with the corresponding performance levels are presented. \( \lambda_2 \) and \( \lambda_2' \) for the low and high intelligence groups respectively.
Figure 5. Hypothetical performance on a test of ideational fluency as a function of arousal level for two classifications of intelligence. $X_2$ and $Y_2$ denote typical arousal (anxiety) levels for low and high intelligence groups respectively. Arrows denote direction of change in creative performance when arousal level is reduced.
the crucial variable for predicting the direction of change is baseline level of arousal, either less than the point of optimal performance or greater than it.

Finally, we must add to this model findings related to the gender of subjects. Recall that Kogan and Morgan (1969) found that, contrary to expectation, males actually improved under test-like assessment conditions whereas for females test context had no effect. And Wallach and Kogan (1965 a & b) found that moderate amounts of anxiety were associated with the highest levels of creativity for males but not females. Also consider the Sarason et al. (1960) notion that differences between high and how anxiety females would be less consistent than differences between high and low anxiety males.

Taking all these relationships into consideration, one might suspect that "level of arousal" would be more strongly related to creativity in males as opposed to females. In terms of the model, what this may indicate is that for males the typical level of arousal is at a point less than optimal performance arousal, whereas arousal levels for females are more variable but tend to be greater than optimal performance arousal.

At this point it should be noted that Wallach and Kogan (1965 a & b) suggest the possibility of a Yerkes-Dodson function for males but not females. Their findings indicated that creativity was maximal in the presence of an intermediate
level of anxiety. There are several problems with the Wallach-Kogan proposition which are discussed in Chapter III. Suffice it to say for now that the Wallach-Kogan formulation lacks the rigor and generality of the present proposal.

**Statement of purpose and hypotheses**

General Statement of Purpose: To explore the proposition that creativity should be conceptualized as a concurrent cognitive-affective/motivational process.

Specific Statement of Purpose: To examine experimentally the effect of changes in arousal level, produced through tension or relaxation training, on interactions among creativity (ideational fluency), intelligence, anxiety, and gender.

Statement of hypotheses to be tested:

1) If creativity is at least partially a cognitive variable, different levels of ideational fluency should be associated with different levels of intelligence.

2) If creativity is also partially an affective/motivational variable, different levels of anxiety should be associated with different levels of ideational fluency. This effect should be greater for males than for females.
3) No significant differences in ideational fluency scores between males and females should exist prior to treatment.

4) Changes in level of arousal should interact with level of intelligence, anxiety level, and gender of subject based on implications of the model developed in the preceding section.

5) More specifically, the nature of individual differences in ideational fluency is sufficiently of an affective/motivational nature that the relative rank ordering of individuals should change following the manipulation of affective/motivational variables, i.e., level of arousal in the form of tension or relaxation.

The following predictions derived from the model denote the most favorable opportunities for changes in rank order of creativity. The logic of these predictions may be made more clear by examining Figure Six. Note that the actual shape of the arousal by performance function presented in Figure Six is purely speculative. And that to adequately test the model extensive empirical data would be needed in order to determine the most appropriate shape.

6) Rank orders between members of high and low anxious groups might change following decreased arousal levels for high anxious Ss and increased arousal levels for low anxious Ss. Note, however, that changes should occur in opposite directions for the high intelligence group as opposed to the low intelligence group.
Figure 6. Hypothetical performance on a test of ideational fluency as a function of arousal level with range of anxiety scores and effects of relaxation and tension depicted. $Z_1$ and $Z_2$ denote low and high anxiety respectively. Note that decreased arousal levels for low anxious subjects and increased arousal levels for high anxious subjects would probably be more difficult to achieve than the converse.
7) Rank order changes may also occur following a reduction in arousal for low anxious, high intelligent Ss as opposed to low anxious, low intelligent Ss.

8) Following a reduction in arousal, rank order changes may occur for high anxious, high intelligent Ss in comparison to high anxious, low intelligent Ss.

Additional issues to be examined experimentally include the notion that optimal separation of creativity and intelligence should occur under conditions of a relaxed, permissive attitude (Wallach and Kogan, 1965 a & b; Kogan and Morgan, 1969), and the notion that intelligence is a necessary but insufficient condition for creative performance (Guilford, 1967 & 1975).
CHAPTER II

METHOD

Pretreatment phase

Subjects:

Subjects were 342 fifth grade students from eight different schools and seventeen different classrooms. There were 178 girls and 164 boys. All students in each class participated with the following exceptions: 1) those students who were absent on one or both days of assessment; 2) those students whose parents signed and returned the nonconsent form presented in Appendix A. (Note that parental signatures were required only if parents did not want their children to participate.); and 3) in one school with one class the administration changed the consent form to require parental signatures for participation. For the thirty students in this class, permission was granted for nineteen of them.

A listing of the schools with the number of classes, participating students, returned consent forms, and absences is presented in Appendix B.

The choice to use fifth grade students was made to be consistent with previous literature in this area. For example, see Wallach and Kogan (1965 a & b); Kogan and Morgan (1969), and Ward, Kogan and Pankove (1972).
The choice to use a heterogenous population was made to extend findings of previous investigations most closely related to the present one. Specifically, Ward, Kogan, and Pankove (1972) and Milgram and Feingold (1977) used disadvantaged, below-average IQ populations. Wallach and Kogan (1965 a & b) and Kogan and Morgan (1969) used middle-class populations. Milgram and Milgram (1976) used both disadvantaged and normally advantaged populations.

The present investigation incorporated a broad range of socioeconomic status and intelligence levels. One school (#1 in Appendix B) was located in an upper class suburb. Schools 2, 3, and 4 (see Appendix B) were located in a middle to upper-middle class suburb. Schools 5 and 6 were from a parochial school system and located within lower-middle to middle-class areas of the city. Schools 7 and 8 were located in lower class areas of the city, i.e., the inner city.

**Materials:**

a. Creativity Assessment. Creativity was operationalized in the form of ideational fluency, defined as the ability to generate in plentiful number ideas that are appropriate to a given task constraint (Wallach, 1970). The rationale for selection of ideational fluency was presented in the preceding chapter.
Three verbal assessment devices from the Wallach-Kogan Creativity Battery (Wallach and Kogan, 1965a) were used. These are presented in Appendix C together with the answer sheets used in this investigation. The first device is named "Instances" and asks that the subject name as many different examples of a particular class of events or objects as he can. The second device is called "Alternate Uses" and asks that the subject list as many different uses for a particular object as he can. The third device is entitled "Similarities" and requires that the subject name all the ways he can think of that two objects are alike.

For the pretreatment phase of the experiment being discussed at present, the first half of each device was used. This consists of the first two items of the "Instances" test, the first four items of the "Alternate Uses" test, and the first five items of the "Similarities" test. This division of the Wallach-Kogan tasks into halves was used by Ward, Kogan, and Pankove (1972) and Milgram and Feingold (1977). This procedure is also justified from the high item-sum correlations reported by Wallach and Kogan (1965a). That is, "all items are making substantial contributions to the total score (pg. 12)." An inspection of the item-sum correlations provided by Wallach and Kogan (1965a) substantiates this conclusion.

b. Anxiety Assessment. Anxiety was assessed with the "Test Anxiety Scale for Children" (Sarason et al., 1960) presented
in Appendix D. This device consists of a series of thirty "yes-no" questions asked orally and answered in writing. As noted in the preceding chapter, this device has been widely researched. In addition, within the area of investigation under consideration, this device or portions of it is often used as an anxiety measure (e.g., see Wallach and Kogan, 1965 a and b; Kogan and Morgan, 1969).

The Test Anxiety Scale was chosen as the appropriate measure in contrast to the General Anxiety Scale for Children (Sarason, et. al., 1960) for two reasons: 1) The Test Anxiety Scale is used much more often in the literature to assess anxiety in children, and 2) an assessment of test anxiety would appear logically to be more closely related to the contrasting experimental conditions described in the preceding chapter, i.e., test-like versus game-like conditions.

c. Intelligence Assessment. The "Short Form Test of Academic Aptitude, Level 3" (Sullivan, Clark, and Tieg, 1970) was used for the assessment of intelligence. This test is composed of a series of mental ability tests designed for group administration in Grades 1.5 through 12.

There are five levels of this test for use with different grade ranges. The level used for this investigation, level 3, is used for grades 5.0 through 6.9. Testing for this investigation occurred during the last two months of the grade five school year.
The four subtests of the Short Form Test of Academic Aptitude (SFTAA) were designed to measure vocabulary development, logical reasoning, eduction of quantitative relations, and meaningful memory.

The SFTAA was chosen because of its long history of use in school settings and the ready availability, via the Examiner's Manual, of standard scores, percentiles, mental ages, and IQs as well as language and nonlanguage scores.

An answer form to the SFTAA was developed by the present author for this study. The answer form is presented in Appendix E.

Procedures:

The permission and cooperation of the four school system administrators, principals of the eight schools, and teachers of the seventeen classes were enlisted. In general, a prospectus of the investigation was submitted to the four different administrators who, following their approval, in turn, referred the prospectus to the various principals. The principals, following their approval, discussed the project with the fifth grade teachers. There were no rejections from any of the administrators, principals, or teachers to whom a request was made.
Following the acknowledgment of teacher cooperation, the author met with teachers in the various schools to deliver the consent forms and discuss the mechanics of the project, i.e., time and room scheduling. Teachers were asked not to discuss the project with their students but to refer students to the author. Similarly teachers were asked to refer any parental questions to either the author or his academic advisor both of whose phone numbers were made available. Teachers were told that experimental results of interest for their respective classed would be made available to them both without the identification of the individual students.

a. Day One--Administration of the Short Form Test of Academic Aptitude, Level 3: Assessment contexts varied from school to school. A total of nine test sessions were required for SFTAA administration to the 242 students. The number of students for each session ranged from 17 to seventy-two. Settings included classrooms, cafeterias, and gymnasiums. Students were seated at either desks or tables. This information for each school is presented in Appendix F.

Once the students were settled at their desks or tables, teachers left the room. The author then introduced himself as being from the Ohio State University and as one who was helping to conduct a research project related to how fifth grade students think and feel about certain things. He also told the students that he would be spending one
hour per day for two days with them in order to find out how they think and feel.

Students were assured that since this was a research project their teachers and parents would not be made aware of their individual results. Students were asked to hold any questions they might have until the end of day two.

Following this introduction, the SPTAA test booklets and answer sheets were passed out. The directions, time limits, and procedures described in the examiner's manual were carefully followed. Total actual testing time for the SPTAA is thirty-eight minutes. With the introduction and distributing and collecting of test materials, the total time for the session on Day One varied between 50 and 55 minutes.

b. Day Two—Administration of the Test Anxiety Scale for Children and the Wallach-Kogan Creativity Test Battery:
A total of twelve separate sessions was required for the administration of these two instruments. A description of the contents of these sessions is presented in Appendix G. For each session the Test Anxiety Scale for Children (TASC) was administered first, followed by the Wallach-Kogan Creativity Battery (WKCB).

Standard procedures and instructions (See Appendix D.) for administration of the TASC were followed. Introduction and questions were read orally to students. Each question was read twice or more often if requested.
Several deviations were made from the procedures used by Wallach and Kogan (1965 a). Each of the deviations is commonly found in studies utilizing the WKCB. These deviations include, for the present investigation, the use of group rather than individual administration, the use of written rather than oral responses, and the use of timed rather than untimed boundaries. Other studies in which these deviations have occurred in one form or another include Boersma and O'Bryan (1968), Hargreaves (1974), Channon (1974), and Kogan and Morgan (1969). Indeed, it is difficult to locate any investigation in which all of the conditions described by Wallach and Kogan were explicitly met.

For example, Wallach and Kogan (1965 a & b) had their "test" administrator become very familiar to students before creativity assessment began. In addition, the time allotted granted for each test item in the present investigation was very generous: five minutes for the two "Instances" test questions and two and one-half minutes for the remaining questions in the "Alternate Uses" and "Similarities" tasks. Thus there was a total of twenty-seven and one-half minutes allotted for the eleven questions in the battery. Combining this with the twenty-three minutes allotted for the second half of the WKCB used in the post-treatment phase, a total of fifty and one-half minutes in actual test time was used for the three verbal instruments in the WKCB. If one recalls that Wallach and Kogan (1965 a & b) also included in their original battery two non-verbal devices, then one might not expect that more than fifty minutes would have been devoted to the verbal portion.
It should be emphasized that Wallach and Kogan do not provide any information or comment with respect to this time variable.

Preliminary verbal instructions for the three tasks used by Wallach and Kogan (1965 a) were also used in the present investigation (See Appendix C.).

c. Scoring of Assessment Devices: SFTIA scores were converted into standard scores by using conversion tables provided in the Examiner’s Manual. The standard scores have a mean of 50 and a standard deviation of 10. In the present sample the mean was 54.07 with a standard deviation of 8.16.

The TASC was scored by totaling the number of positive responses to the thirty items. Sarason, et. al. (1960) do not report standard scores or norms on this scale. Within the literature each study utilizes data from its own sample for computation of descriptive statistics.

The WKCB was scored for ideational fluency by summing the number of responses to each item and then summing across the three tests for a total score. This procedure is consistent with the original Wallach and Kogan (1965) procedures and also with other studies using this measure. As with the TASC no standard norms exist within the literature for WKCB scores.

For the intelligence, anxiety, and creativity measures, the means, medians, standard deviations, and ranges obtained in this investigation are presented in Table 1.
TABLE 1. Means, medians, standard deviations, and ranges for the Short Form Test of Academic Aptitude (SFTAA), the Test Anxiety Scale for Children (TASC), and the first half of the Wallach-Kogan Creativity Battery (WKCR-1) scores as obtained in the pretreatment phase of this study. N = 342

<table>
<thead>
<tr>
<th></th>
<th>Means</th>
<th>Medians</th>
<th>Standard Deviations</th>
<th>Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFTAA**</td>
<td>54.07</td>
<td>54.59</td>
<td>8.16</td>
<td>29 - 73</td>
</tr>
<tr>
<td>TASC</td>
<td>11.76</td>
<td>12.25</td>
<td>5.97</td>
<td>0 - 30</td>
</tr>
<tr>
<td>WKCR-1</td>
<td>83.02</td>
<td>83.38</td>
<td>31.10</td>
<td>22 - 227</td>
</tr>
</tbody>
</table>

** Standard scores

Treatment phase

Selection of Subjects:

Criteria for selection of subjects to be used in the treatment phase was based, in terms of design, upon the desire to populate with equal n's the cells of a 2 x 3 x 2 x 2 factorial design. These factors were, in order, two levels of intelligence (high and low), three levels of treatment (relaxation, tension, and control), two levels of anxiety (high and low) and the two levels of gender (male and female).

Criteria for defining the two intelligence categories were, for low intelligence, standard scores less than or equal to fifty-two, and for high intelligence, standard scores greater than or equal to fifty-five. This is a modified mean-split procedure taking into consideration the norms provided by the test-makers and the actual distribution of scores in this study. (See Table 1.)
Criteria for defining the two anxiety categories was placement in the upper third of the frequency distribution of TASC scores for high anxiety and placement in the lower third of the frequency distribution of TASC scores for low anxiety. Thus scores of fourteen and above defined the high anxiety category while scores less than or equal to eight defined the low anxiety category.

The application of these criteria to the data yielded four quadrants for both males and females. These were high anxiety-high intelligence (HA-HI), low anxiety-high intelligence (IA-HI), high anxiety-low intelligence (HA-LI), and low anxiety-low intelligence (IA-LI). The number of potential subjects for each quadrant is presented in Table 2.

Table 2. Number of potential subjects for the various experimental conditions from which random selection was made and random assignments to the various conditions were made.

<table>
<thead>
<tr>
<th>Quadrant</th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Anxiety-High Intelligence</td>
<td>44</td>
<td>27</td>
</tr>
<tr>
<td>High Anxiety-Low Intelligence</td>
<td>32</td>
<td>17</td>
</tr>
<tr>
<td>Low Anxiety-High Intelligence</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Low Anxiety-Low Intelligence</td>
<td>20</td>
<td>34</td>
</tr>
</tbody>
</table>
Numbers were assigned to students in each of these categories. A random digits table developed by Dayton (1970) with an IBM 7094 electronic computer was then used, first to select the students who would be experimental subjects for the treatment phase, and second, to assign students to the three experimental conditions—relaxation training, tension training, or control.

Tables 3 and 4 present mean standard intelligence scores and mean anxiety scores respectively for males, females, and the totals for the subjects selected for participation in the treatment phase of the experiment.

Table 3. Mean standard intelligence scores for males, females, and total sample selected for treatment phase of the experiment. \((n = 10)\)

<table>
<thead>
<tr>
<th></th>
<th>High Intelligence</th>
<th>Low Intelligence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Females Males Total</td>
<td>Females Males Total</td>
</tr>
<tr>
<td>High Anxiety</td>
<td>60.4 60.9 60.7</td>
<td>67.9 64.2 66.1</td>
</tr>
<tr>
<td>Low Anxiety</td>
<td>61.7 63.7 62.7</td>
<td>65.1 68.6 66.9</td>
</tr>
</tbody>
</table>

Table 4. Mean Test Anxiety Scale for Children scores for males, females, and total sample selected for treatment phase of the study.

<table>
<thead>
<tr>
<th></th>
<th>High Intelligence</th>
<th>Low Intelligence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Females Males Total</td>
<td>Females Males Total</td>
</tr>
<tr>
<td>High Anxiety</td>
<td>17.7 17.1 17.4</td>
<td>18.5 17.4 18.0</td>
</tr>
<tr>
<td>Low Anxiety</td>
<td>4.9 4.4 4.7</td>
<td>5.4 5.1 5.2</td>
</tr>
</tbody>
</table>
As can readily be seen from inspection of these tables, the criteria used to establish the various categories was sufficient to generate high face validity. As a point of reference, for example, the mean IQ for the high intelligent group was 117.1 while the mean IQ for the low intelligence groups was 93.32.

Materials:

"Level of arousal" as discussed in Chapter Two was operationalized in the form of relaxation or tension training. Both of these treatment strategies were adaptations developed by the present author of Arlene Koeppen's (1974) relaxation training for children. The relaxation techniques consist of the sequential tensing and then relaxing of various small muscle groups. Attention is drawn and emphasis placed upon the sensations of relaxation. The relaxation script which provided the basis for the relaxation training sessions in the present investigation is presented in Appendix H.

Increased arousal level or tension was operationalized in the form of "trying hard" by tensing various small muscle groups. Attention is then drawn and emphasis placed on the sensations of tension or "trying hard." The relaxation script was modified for this purpose by 1) eliminating references to relaxation and substituting the phrase "trying hard"; 2) by eliminating specific instructions to relax, and 3) by eliminating instructions to pay
attention to the sensations of relaxation and substituting instructions to attend to sensations of "trying hard." The tension script which provided the basis for the tension training sessions in the present investigation is presented in Appendix I.

The decision to use these two treatment strategies was made in order to define the two ends of the dimension "level of arousal" more effectively than in attempts made in previous investigations. Attempts to define this dimension in the past consisted primarily of test-like versus game-like assessment contexts.

Open-ended questions which were presented to subjects following the relaxation or tension training sessions together with answer sheets for these questions are presented in Appendix J. Some of these questions were derived from Griffith (1976); others were developed by the present author. The decision to present open-ended questions following each training session was made in order to strengthen, in terms of face and content validity, the psychological experience of responding to open-ended, divergent thinking kinds of questions while in the state of arousal determined by the experimental condition.

**Procedures:**

At least a two week interval occurred between the pre-treatment and the treatment phases for each school. Once subjects were selected for the treatment phase arrangements were made with teachers and principals to schedule the relaxation and tension
training sessions. Teachers were not made aware of which students had been assigned to the respective experimental conditions. All procedures were administered by the present author.

Each treatment session lasted for twenty minutes, ten minutes of which was devoted to relaxation or tension training and the second ten minutes devoted to five open-ended questions. One and one-half minutes were allotted for response time to each question.

These treatment sessions took place over four consecutive school days. Within each school both a relaxation and a tension training session were held on each of these days. A total of fifty separate relaxation training sessions and 45 separate tension training sessions were conducted. The number of students per session ranged from one to eight. Sessions took place in various settings. These included vacant classrooms, conference rooms, teachers' lounges, and special projects' rooms. In all cases students were seated in hard-back chairs in front of a desk or table. The number of students per group per treatment condition per school is given in Appendix H.

Both relaxation and tension training sessions proceeded as follows. On the first day preliminary information and instructions as contained in appendixes H and I was read to students. Following this the exercises for hands and arms, arms and shoulders, shoulders and neck, and the conclusion were administered.
Single repetitions of each portion were made to ensure learning. On the second day, following a cursory review of the preliminaries, a quick reminder was made of the specific training procedures administered on the first day. Next, the relaxation or tension training for face and nose, stomach, legs and feet, and the conclusion were administered, repeating each new portion once to ensure learning. On days three and four the entire series of training procedures for all the small muscle groups included were administered once only. These portions of the training sessions lasted ten minutes on each day.

The next ten minutes of each session were devoted to answering five open-ended questions, each with a time limit of one and one-half minutes. Questions were asked orally by this author; students answered in writing. Following the statement of each question the author would remind the students to either relax or try hard while answering. Approximately half-way into the time limit the author would again remind the students with a phrase such as "Remember what it feels like to relax (or try hard)?"

It should be noted that the author did not follow word-for-word the scripts as they are presented in the appendixes. Such a procedure would have created a stilted and artificial atmosphere. Instead, the script was used as a handy prop and guide, but the exact phrasing of the words was spontaneous. To this issue two points should be made: 1) the author is an experienced psychology intern who has administered numerous relaxation treatments to
psychotherapy patients; and 2) within any given treatment session the students who were participating belonged to different experimental categories. For example, in tension training session #1, in school #4, there were two low intelligent-high anxious subjects; three low intelligent-low anxious subjects; one high intelligent-high anxious subject; and three high intelligent-low anxious subjects. Thus the opportunity for experimenter bias to operate by treating different groups of subjects differently is remote.

It should also be noted that out of 320 opportunities for absences to occur in this phase of the experiment (eighty relaxation or tension training subjects times four days equals three hundred-twenty) only sixteen absences occurred, one for the IA-HI category; four for the HA-HI category, five for the HA-LI category, and six for the IA-LI category. This is a ninety-five percent attendance rate, which is considered to be very high in terms of school attendance.

**Post-treatment phase**

On the fifth consecutive school day treatment subjects again received either relaxation or tension training as on days three and four.

Following this, however, the second half of the Wallach Kogan Creativity Battery (WKCB-2) was administered. This consisted of items 3 & 4 from the "Instances" task; items 5-8 of the "Alternate Uses" task; and items 6 - 10 of the
"Similarities" task.

Procedures identical to those described for the pretreatment phase were followed with the following exceptions. After each question was asked, subjects were reminded to either "try hard" or "relax" depending upon their experimental category. This was done again half-way into the time limits. The time limits themselves consisted of two and one-half minutes for the two "Instances" items and two minutes for the remaining nine items. Thus actual test time for the reassessment of ideational fluency was twenty-three minutes.

Reassessment of ideational fluency for control subjects occurred approximately one week following completion of the treatment phase. Control subjects were not aware that they had been selected until the day of reassessment. Procedures were identical to those described for the pretreatment phase.
CHAPTER III
RESULTS

Analysis of Pre-treatment Data

Correlational analyses, t-tests, and analysis of variance procedures were all applied to pre-treatment data. The purpose of these analyses was fourfold: 1) to explore in detail the propositions discussed in Chapter I that different levels of intelligence and different levels of anxiety should be associated with different levels of ideational fluency; 2) to examine gender differences with respect to the anxiety dimension as discussed in Chapter I; 3) to examine the proposition that intelligence is a necessary but insufficient condition for creativity; and 4) to examine the proposition that the lowest correlation between intelligence and creativity should occur under conditions associated with low stress.

The first information to be extracted from the pre-treatment data was the intercorrelations among ideational fluency, intelligence (standard scores), and anxiety. Using procedures described in Bruning and Kintz (1968), Pearson product-moment correlations were computed and tested for significance. These results are presented in Table 5.

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TABLE 5. Pearson product-moment correlations among ideational fluency (WKCB-1), intelligence (SPTAA), and anxiety (TASC) scores. (N = 342)

<table>
<thead>
<tr>
<th></th>
<th>Ideational Fluency</th>
<th>Intelligence</th>
<th>Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideational Fluency</td>
<td>.21***</td>
<td>-.13*</td>
<td></td>
</tr>
<tr>
<td>Intelligence</td>
<td></td>
<td>-.16**</td>
<td></td>
</tr>
</tbody>
</table>

* p = .0087
** p = .0016
*** p = .00005

As can be seen in Table 5, each of the correlations was low but significant. These results tend to support the notion that these variables are interrelated albeit at a relatively low level.

To further analyze the data, partial correlations were computed. It was important to know what the relationship between ideational fluency and intelligence would be if anxiety were partialled out of both variables, and similarly what would be the relationship between ideational fluency and anxiety if the effects of intelligence were partialled out. When these were computed, there was not much difference from the original correlations. One might have argued that a likely contributor to the relationship between ideational fluency and anxiety (r = -.13) would be intelligence level. However, when intelligence was partialled out a significant correlation of -.10 was obtained. Thus, at this pre-treatment level the relationship between ideational fluency
and anxiety is not strongly influenced by intelligence.

When the effects of anxiety were partialled from the
$r = .21$ relationship between ideational fluency and intelligence,
a correlation of $r = .19$ was obtained. At this pre-treatment level,
the relationship between ideational fluency and intelligence is
relatively uninfluenced by anxiety.

In preparation for analysis of the post-treatment data,
what these results indicate is that if intelligence and anxiety
have any effect on ideational fluency it will probably be in
an additive, independent fashion with little interaction between
these two variables.

Another approach to assessing the relationship among these
variables is to examine whether there exists any differences
in ideational fluency for high versus low intelligence,
high versus low anxiety, and females versus males. That is,
another way to assess the separate effects of intelligence, anxiety,
and gender on ideational fluency is to see if different levels
of these variables are associated with different levels of ideational fluency.

For this purpose different levels of intelligence and
anxiety were formed as follows. Standard intelligence scores of
58 and higher or 52 and lower were the criteria for high and
low intelligence categories. What this division entailed was
essentially an upper-third ($n = 102$) and a lower-third ($n = 130$)
categorization ($N = 342$).
Similarly, anxiety categories were formed by taking subjects whose TASC scores were either in the upper third \( (n = 135) \) or lower third \( (n = 104) \) of the frequency distribution.

A comparison of the mean ideational fluency scores for these different categorizations is presented in Table 6.

**TABLE 6.** Comparisons of mean ideational fluency (WKCB-1) scores for high and low intelligence groups, high and low anxiety groups; and females and males.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean Ideational Fluency Scores</th>
<th>t-scores</th>
<th>Significance Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Intelligence</strong></td>
<td>102</td>
<td>91.94</td>
<td>3.30</td>
<td>&lt; .0005</td>
</tr>
<tr>
<td><strong>Low Intelligence</strong></td>
<td>130</td>
<td>78.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>High Anxiety</strong></td>
<td>135</td>
<td>83.39</td>
<td>2.26</td>
<td>&lt; .025</td>
</tr>
<tr>
<td><strong>Low Anxiety</strong></td>
<td>104</td>
<td>92.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>178</td>
<td>84.90</td>
<td></td>
<td>n.s.</td>
</tr>
<tr>
<td>Males</td>
<td>164</td>
<td>86.40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These results show quite clearly that indeed it does make a significant difference for ideational fluency if the person is either high or low on intelligence. Individuals with high intelligence produce significantly more ideas than do individuals with low intelligence.
Similarly, level of anxiety makes a difference. Those with low anxiety produced significantly more ideas on the WKCB-1 than did individuals with high anxiety.

As expected, gender differences were not significant.

The next issue to be examined relates to the level of ideational fluency for those students who reported moderate amounts of anxiety. As mentioned in Chapter I, Wallach and Kogan (1965 a & b) suggested a Yerkes-Dodson function in this context for boys only. That is, boys with moderate amounts of anxiety apparently had higher levels of ideational fluency than those with low or high anxiety. The present author uses the word "apparently" because it is not clear that the relationship proposed actually exists in the Wallach-Kogan data. Instead of selecting different anxiety levels and reporting the respective levels of ideational fluency, Wallach and Kogan report only the anxiety levels of their 2 X 2 categorization of intelligence and creativity.

Following the recommendations of Cronbach (1968), an examination of this issue was made first for the total sample. Mean ideational fluency scores for individuals reporting moderate levels of anxiety was 81.78, a mean which is actually lower than that of either high or low anxiety groups (See Table 7.). If anything, there is a U-shaped function with moderate anxiety being associated with the lowest level of ideational fluency.
Actually, however, a more accurate description is that low anxiety is associated with significantly higher levels of ideational fluency than either high or moderate anxiety. Thus from this perspective the Wallach-Kogan suggestion of a Yerkes-Dodson function is not supported. Wallach and Kogan (1965 b, pp. 365-366) write that "if anxiety is either too low or too high then creativity is reduced." In fact, when this suggestion is more rigorously analyzed, those with the lowest levels of anxiety have the highest levels of creativity (ideational fluency).

When this analysis was performed for males separately, the same results were obtained (See Table 7 below.). That is, subjects with the lowest anxiety scores produced significantly more ideas on WKCB-1 than subjects scoring high on the anxiety scale. Further, male subjects reporting moderate levels of anxiety had the lowest WKCB-1 scores.

However, for females, although the results were in the same direction, differences on ideational fluency for the three anxiety categories were negligible. Thus for the females, different levels of test anxiety scores were not associated with different levels of ideational production (See Table 7 below.).
TABLE 7. Within gender comparisons of mean ideational fluency (WKCB-1) scores for high, low, and moderate anxiety scores.

<table>
<thead>
<tr>
<th>Anxiety Level</th>
<th>Mean Ideational Fluency Scores</th>
<th>t-scores</th>
<th>Significance Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Anxiety</td>
<td>81.04</td>
<td>2.66</td>
<td>.005</td>
</tr>
<tr>
<td>(n = 48)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Anxiety</td>
<td>95.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 63)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate Anxiety</td>
<td>80.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 53)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Anxiety</td>
<td>84.68</td>
<td>.29</td>
<td>n.s.</td>
</tr>
<tr>
<td>(n = 82)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Anxiety</td>
<td>86.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 40)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate Anxiety</td>
<td>82.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 51)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These results are consistent with the discussion of sex differences on anxiety described in the preceding chapter. And it calls attention to the need to scrutinize carefully findings which ignore the gender variable.

Accordingly, t-tests comparing WKCB-2 idea production for both males and females were performed. Results are presented in Table 8.
TABLE 8. Within gender comparisons of differences between ideational fluency (WACKS-1) scores for two intelligence groups.

<table>
<thead>
<tr>
<th></th>
<th>Mean Ideational Fluency Scores</th>
<th>t-scores</th>
<th>Significance Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Intelligence (n = 51)</td>
<td>92.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Intelligence (n = 78)</td>
<td>78.86</td>
<td>2.54</td>
<td>&lt; .01 (one-tailed)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Intelligence (n = 51)</td>
<td>91.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Intelligence (n = 52)</td>
<td>79.08</td>
<td>2.08</td>
<td>&lt; .025 (one-tailed)</td>
</tr>
</tbody>
</table>

As can be seen these results are similar to those presented in Table 6. Differences in ideational productions occur between students with high versus low intelligence scale scores irrespective of anxiety scores and gender.

Because of the apparently differential effect of anxiety on ideational fluency for males and females, it became important to consider the intercorrelations among these three variables for each gender. These correlations are presented in Table 9.
TABLE 9. Within gender Pearson product-moment correlations among ideational fluency (WKCR-1), intelligence (SFTAA), and anxiety (TAS) scores.

<table>
<thead>
<tr>
<th></th>
<th>Ideational Fluency</th>
<th>Intelligence</th>
<th>Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>n=164</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ideational Fluency</td>
<td>.20*</td>
<td>-.23**</td>
<td></td>
</tr>
<tr>
<td>Intelligence</td>
<td></td>
<td></td>
<td>-.38***</td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>n=178</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ideational Fluency</td>
<td>.22*</td>
<td>-.03</td>
<td></td>
</tr>
<tr>
<td>Intelligence</td>
<td></td>
<td></td>
<td>-.05</td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Upon inspecting the intercorrelations in Table 9, it is clear that anxiety scale scores are a much more important dimension for males than for females in terms of understanding the interrelationships among the three variables. Tests comparing the differences between correlations of males and females on the anxiety dimension were made using the Fisher $z$-transformation as described in Bruning and Kintz (1968).

For the correlation between intelligence and anxiety the difference between males and females was significant ($z = 3.187; p < .0001$). For the correlation between ideational fluency and anxiety the difference between males and females was also significant ($z = 1.905; p = .0287$).
These results indicate that the role of anxiety in divergent production may be more powerful for males than for females. To examine further the role of anxiety in ideational fluency for males, anxiety was partialled out of the correlation between ideational fluency and intelligence ($r = .20$). The resultant correlation was $r = .13$ which is still significant ($p = .05$). But the reduction in size of correlation suggests that at least some portion of the correlation between intelligence and ideational fluency is augmented by the relationship each has with anxiety.

Next, the issue of optimal conditions for distinguishing between intelligence and creativity was examined. As discussed in Chapter I, Wallach and Kogan (1965 a), Kogan and Morgan (1969), and Boersma and O'Bryan (1966) have all suggested that the correlations between intelligence and creativity should be less under game-like as opposed to test-like conditions. That is, an optimal distinction can be made between intelligence and ideational fluency when subjects are assessed in a relaxed, permissive setting. It seems a logical extension of this line of reasoning that one would expect a high correlation between intelligence and ideational fluency for high anxious subjects and a low correlation for low anxious subjects.

Instead, in the present investigation, just the opposite occurred. The correlation between intelligence and ideational fluency scores for high anxious students ($n = 135$) was .15,
whereas the same correlation for low anxious students (n = 104) was .344. The difference between these two correlations was significant (z = 2.92; p = .0016).

Interestingly enough, the same pattern existed for males and females. For males the correlations between intelligence and ideational fluency were .35 and .05 for low and high anxiety categories respectively. For females, the corresponding correlations were .32 and .12.

These findings then have important implications for the issue of distinguishing between creativity and intelligence. These are discussed in the following chapter.

Next in the analysis of pre-treatment data, we are in a position to examine the notion discussed in Chapter I that intelligence is a necessary but insufficient condition for creativity (e.g., Guilford, 1967 & 1975). Results from the analyses performed thus far indicate that there may be some basis for this proposition. For example, ideational fluency was significantly higher for high intelligence as opposed to low intelligence; and there was a significant, positive correlation between intelligence and creativity. However, the most direct evidence bearing on this issue should come from an inspection of the ideational fluency scores of students who are low on intelligence. If there are no students or very few who are high on ideational fluency then the proposition would be supported.
For this analysis the criterion for high ideational fluency was defined as scores being in the upper third of the frequency distribution (i.e., scores greater than 91). A count was then made of the number of students who were low on intelligence scores (lower third) yet in the upper third of the ideational fluency score distribution.

The results were as follows: twenty-three percent (26 out of 112 students) who were in the bottom third of the intelligence score distribution placed in the upper third of the ideational fluency score distribution. The mean IQ of this group was only 92.6, yet their ideational fluency scores had a mean of 123.9, which was almost one and one-third standard deviations above the mean of 83.02 for the entire sample of 342 students. These results, then, do not provide support to the proposition that intelligence is a necessary but insufficient condition of creativity, at least when creativity is defined as ideational fluency.

These results were also found when males and females were considered separately, although the effect was stronger for females. Thirty-two percent of girls and fifteen percent of boys who were in the lower third of their respective intelligence score distributions scored in the upper third of their ideational fluency score distributions.

Finally, it is possible to examine the effects of intelligence, anxiety, and gender on ideational fluency by performing a $2 \times 2 \times 2$ analysis of variance ($n = 15$/cell) on the pre-treatment ideational
fluency scores of the subjects selected for the treatment phase. Using procedures described by Winer (1962) such an analysis was performed. Results are presented in Table 10

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Intelligence</td>
<td>5200.83</td>
<td>1</td>
<td>5200.83</td>
<td>4.176</td>
<td>.05</td>
</tr>
<tr>
<td>B - Anxiety</td>
<td>3181.97</td>
<td>1</td>
<td>3181.97</td>
<td>2.554</td>
<td>n.s</td>
</tr>
<tr>
<td>C - Gender</td>
<td>172.8</td>
<td>1</td>
<td>172.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>.04</td>
<td></td>
<td>.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>448.54</td>
<td></td>
<td>448.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC</td>
<td>529.20</td>
<td></td>
<td>529.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABC</td>
<td>1009.13</td>
<td></td>
<td>1009.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>104624.67</td>
<td></td>
<td>1245.5317</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As can be seen, differences between ideational fluency scores for the two intelligence categories were similar whereas similar differences for the two anxiety categories only approached significance (p < .15).

The lack of significance for anxiety was due, as might have been expected from the findings above, to the lack of significant differences between high and low anxious females (t = .71); whereas for males the differences were significant (t = 2.04; df = 58; p < .05).
Thus the sample, as selected for the treatment conditions, would seem to represent well the population from which it was drawn. And further, the effect of intelligence level on level of ideational fluency scores would appear to be well established for these pre-treatment data, as would the effect of level of anxiety on ideational fluency scores for males.

Analysis of Post-treatment Data

An analysis of the differences in ideational fluency scores following experimental treatments was accomplished first, by means of a four-way analysis of covariance; second, an analysis of the simple effects for the significant interactions found; and finally an examination of the regression and correlation coefficients within the various experimental conditions.

The purpose of performing these analyses was twofold: 1) to examine the appropriateness of the model developed in Chapter I, in which, for example, it was predicted that a change in arousal level should be found to interact with intelligence, gender, and anxiety to produce different levels of ideational fluency; and 2) to examine whether or not relative rank order of individuals on ideational fluency scores was changed from pretreatment to post-treatment conditions.

Statistical manipulations used in this section were taken from Winer (1962) and Cohen and Cohen (1977).
Analysis of covariance procedures were used in order to provide a statistical control for differences in baseline (pre-treatment) ideational fluency among the different experimental conditions. That is, if the experimental variables were found to display any effect on ideational fluency scores, it was desirable to ensure that the differences did not already exist prior to post-treatment assessment. Thus analysis of covariance was used with baseline ideational fluency scores as the covariate and post-treatment ideational fluency scores as the criterion.

The four way analysis of covariance consisted of two levels of intelligence (high and low) by three levels of treatment (relaxation, tension, and control); two levels of anxiety (high and low) and two gender classifications (male and female).

Assumptions which apply to the analysis of variance model also apply to the analysis of covariance. Considering the robust nature of this type of analysis with respect to violations of the assumptions, there was no reason to test them. However, it was decided to test an assumption which applies only to the analysis of covariance model. This is the hypothesis of homogeneity of within-cell regression. When the test for assessing violations of this assumption was performed (Winer, 1962, pg. 591), an F ratio of 1.0413 was obtained (df = 11, 96) which was nonsignificant. Thus the experimental data did not contradict the assumption of homogeneity of within-cell regression.
Results from the four-way analysis of covariance are presented in Table 11.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Intelligence</td>
<td>188.00</td>
<td>1</td>
<td>188.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B - Treatment</td>
<td>276.46</td>
<td>2</td>
<td>138.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C - Anxiety</td>
<td>653.82</td>
<td>1</td>
<td>653.82</td>
<td>2.44</td>
<td></td>
</tr>
<tr>
<td>D - Gender</td>
<td>427.26</td>
<td>1</td>
<td>427.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>245.23</td>
<td>2</td>
<td>122.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>74.98</td>
<td>1</td>
<td>74.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD</td>
<td>38.95</td>
<td>1</td>
<td>38.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC</td>
<td>311.65</td>
<td>2</td>
<td>155.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BD</td>
<td>1588.26</td>
<td>2</td>
<td>794.13</td>
<td>2.96</td>
<td>.10</td>
</tr>
<tr>
<td>CD</td>
<td>639.62</td>
<td>1</td>
<td>639.62</td>
<td>2.39</td>
<td></td>
</tr>
<tr>
<td>ABC</td>
<td>751.76</td>
<td>2</td>
<td>375.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABD</td>
<td>3305.58</td>
<td>2</td>
<td>1652.79</td>
<td>6.17</td>
<td>.005</td>
</tr>
<tr>
<td>ACD</td>
<td>536.84</td>
<td>1</td>
<td>536.84</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>BCD</td>
<td>30.23</td>
<td>2</td>
<td>15.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABCD</td>
<td>1040.01</td>
<td>2</td>
<td>520.01</td>
<td>1.94</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>25447.41</td>
<td>95</td>
<td>267.87</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The effect of anxiety, anxiety X gender, intelligence X anxiety X gender, and intelligence X treatment X anxiety X gender all approached significance at p < .20. F-ratios for these variables are presented above.
As can be seen, the only effect which was highly significant was the interaction among intelligence, level of arousal (treatment), and gender identification.

These results are consistent with the model developed in Chapter I. That is, when an adjustment is made for the linear effect of baseline ideational fluency, an individual's ideational fluency is determined to a large extent by the product of his intelligence level, level of arousal, and gender.

The only factor which is missing is the level of anxiety. The reason for the absence of this factor becomes clearer when one considers results reported in the preceding section: anxiety by and large operates independently of intelligence and does not interact with gender. Specifically, level of arousal as manipulated through the relaxation and tension training, is operating on a different dimension from anxiety. That is, training in muscular tension or relaxation probably did not lead to high or low anxiety levels as was expected they might.

To understand what has occurred it is instructive to compare the four-way analyses of variance for the pre-treatment ideational fluency scores with post-treatment ideational fluency scores. Relevant portions of both analyses of variance are presented in Tables 12 and 13.
TABLE 12. Selected portions of the summary of $k$-way analysis of variance on pretreatment ideational fluency (WKCB-1) scores.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Intelligence</td>
<td>5200.83</td>
<td>1</td>
<td>5200.83</td>
<td>5.58</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>B - Treatment Groups</td>
<td>2771.62</td>
<td>2</td>
<td>1385.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C - Anxiety</td>
<td>3182.70</td>
<td>1</td>
<td>3182.70</td>
<td>3.42</td>
<td>&lt;.10</td>
</tr>
<tr>
<td>D - Gender</td>
<td>172.80</td>
<td>1</td>
<td>172.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>89405.60</td>
<td>96</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: all interactions were nonsignificant

TABLE 13. Selected portions of the summary of $k$-way analysis of variance on post-treatment ideational fluency (WKCB-2)

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Intelligence</td>
<td>589.63</td>
<td>1</td>
<td>589.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B - Treatment Groups</td>
<td>1115.50</td>
<td>2</td>
<td>557.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C - Anxiety</td>
<td>3141.63</td>
<td>1</td>
<td>3141.63</td>
<td>5.94</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>D - Gender</td>
<td>187.50</td>
<td>1</td>
<td>187.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABD</td>
<td>4764.50</td>
<td>2</td>
<td>2382.25</td>
<td>4.50</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Error</td>
<td>50778.60</td>
<td>96</td>
<td>528.94</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: No unlisted source approached significance with the exception of the anxiety x gender interaction which was $p < .15$. 
Thus, while intelligence displayed an effect on pretreatment ideational fluency scores, following treatment the effect of intelligence was found only in interaction with treatment level and gender.

Anxiety on the other hand displayed only a marginally significant effect ($p < .10$) on pretreatment ideational fluency scores, but following treatment the effect of anxiety was significant at less than the .05 level. Note also that anxiety did not interact with the other variables with the possible exception of gender ($p < .15$).

It next became important to clarify the nature of the significant interaction effects obtained in the analysis of covariance, specifically the interaction among intelligence, level of arousal, and gender which was highly significant ($p < .005$), and the interaction between level of arousal and gender which was marginally significant ($p < .10$). To achieve this, an analysis of covariance for the simple effects of these interactions was performed. A summary of this analysis of covariance is presented in Table 14.
TABLE 14. Summary of Analysis of Covariance for Simple Effects of intelligence X treatment X gender interaction and treatment X gender interaction. The following designations are used in this table:

Factor A = Intelligence
a₁ = high intelligence
a₂ = low intelligence

Factor B = Treatment
b₁ = relaxation
b₂ = tension
b₃ = control

Factor C = Gender
C₁ = Females
C₂ = Males

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB for C₁</td>
<td>990.55</td>
<td>2</td>
<td>495.28</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>AB for C₂</td>
<td>2505.34</td>
<td>2</td>
<td>1252.67</td>
<td>4.56</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>AC for B₁</td>
<td>57.33</td>
<td>1</td>
<td>57.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC for B₂</td>
<td>2276.09</td>
<td>1</td>
<td>2276.09</td>
<td>8.28</td>
<td>&lt;.005</td>
</tr>
<tr>
<td>AC for B₃</td>
<td>931.64</td>
<td>1</td>
<td>931.64</td>
<td>3.39</td>
<td>&lt;.10</td>
</tr>
<tr>
<td>BC for A₁</td>
<td>2008.26</td>
<td>2</td>
<td>1004.13</td>
<td>3.65</td>
<td>&lt;.10</td>
</tr>
<tr>
<td>BC for A₂</td>
<td>2892.90</td>
<td>2</td>
<td>1446.45</td>
<td>5.26</td>
<td>&lt;.025</td>
</tr>
<tr>
<td>B for C₁</td>
<td>898.12</td>
<td>2</td>
<td>449.06</td>
<td>1.63</td>
<td></td>
</tr>
<tr>
<td>B for C₂</td>
<td>1023.39</td>
<td>2</td>
<td>511.70</td>
<td>1.86</td>
<td></td>
</tr>
<tr>
<td>C for B₁</td>
<td>2040.59</td>
<td>1</td>
<td>2040.59</td>
<td>7.42</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>C for B₂</td>
<td>10.20</td>
<td>1</td>
<td>10.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C for B₃</td>
<td>32.55</td>
<td>1</td>
<td>32.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within-Cell Error</td>
<td>29424.75</td>
<td>107</td>
<td>275.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The following interactions were marginally significant at p < .20: AB for C₁; B for C₁; and B for C₂.
The pattern of significant results for the intelligence by treatment by gender interactions is best understood by displaying the relations geometrically. Accordingly, figures were constructed for the simple effects of this interaction. Displayed on the y-axes of these figures are adjusted treatment means. (See Appendix M.) These are post-treatment ideational fluency means (WKCB-2).

FIGURE 7. Geometric display of the intelligence by treatment interaction for females. (p < .20)

adjusted for the linear effect of pre-treatment ideational fluency means (WKCB-1).

In figure 7, a nonsignificant (p < .20) interaction is portrayed. However, it appears that there is some tendency for high intelligent girls to respond positively to both relaxation and tension, whereas the low intelligent girls seem to have responded positively to the relaxation condition and negatively to the tension condition.
A significant interaction is portrayed in figure 8 (p<.05). High intelligent males responded negatively to both changes in level of arousal, i.e., tension and relaxation. Note that this is the exact opposite of the trend for high intelligent females as displayed in figure 7. Further, note that the low intelligent males appeared to respond positively to the tension condition and very little to the relaxation training. Again, this is the exact opposite of the trend for low intelligent girls as portrayed in figure 7.
FIGURE 9. Geometric display of the intelligence by gender interaction for the relaxation treatment (n.s.).

In figure 9, a nonsignificant interaction is portrayed. With respect to ideational fluency, under the relaxation treatment the interaction between intelligence level and gender made no difference. Also note that there is virtually no difference between high and low intelligence groups for both males and females.
FIGURE 10. Geometric display of the intelligence by gender interaction for the tension treatment. \((p < .005)\)

A highly significant interaction is displayed in figure 10 \((p < .005)\). Low intelligent girls responded negatively whereas high intelligent girls responded positively to the tension condition. The response of the males to the tension condition was exactly the opposite. Low intelligent males responded positively to the treatment whereas high intelligent males responded negatively.
A marginally significant interaction is displayed in figure 11 ($p < .10$). A curvilinear trend appears to exist. Of great interest here is the trend noted before for the high intelligent girls to respond in a fashion exactly the opposite of the high intelligent boys.
FIGURE 12. Geometric display of the treatment by gender interaction for low intelligent subjects. \((p < .025)\)

A highly significant interaction is displayed in figure 12 \((p < .025)\). Low intelligent girls responded positively to relaxation and negatively to tension conditions whereas for the low intelligent males the trend is in the opposite direction.

To summarize, the highly significant interaction obtained in the four-way analysis of covariance of intelligence by treatment by gender appears to be highlighted by a tendency for boys and girls to respond in opposite directions to changes in level of arousal depending upon level of intelligence. This is displayed
most dramatically in figures 11 and 12.

The next question asked of the data was whether the relative rank order of individuals in ideational fluency was changed from pre-treatment to post-treatment conditions. As noted in Chapter I, it has been the consensus of those interested in this issue that low correlations between baseline and post-treatment conditions would be evidence for a motivational basis to individual differences in ideational fluency. Correlational comparisons as in Milgram and Feingold (1977) and comparisons of regression coefficients as in Ward, Kogan, and Pankove (1972) were thus applied to data from the present investigation.

These comparisons were made, of course, at the level of interaction where significant results were obtained in the four-way analysis of covariance; specifically, the interaction between intelligence, treatment, and gender.

Correlations between pre-treatment ideational fluency (WKCB-1) and post-treatment ideational fluency (WKCB-2) for cells of the significant interaction are presented in Table 15.
Table 15. Correlations between pre-treatment ideational fluency (WKCR-1) scores and post-treatment ideational fluency (WKCR-2) scores for intelligence X treatment X gender cells (n = 10). R = Relaxation; T = Tension; C = Control.

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th></th>
<th></th>
<th></th>
<th>Males</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>T</td>
<td>C</td>
<td></td>
<td>R</td>
<td>T</td>
<td>C</td>
</tr>
<tr>
<td>High Intelligence</td>
<td><em>477</em></td>
<td>.831</td>
<td>.911</td>
<td>.859</td>
<td><em>.463</em></td>
<td>.616</td>
<td></td>
</tr>
<tr>
<td>Low Intelligence</td>
<td>.611</td>
<td>.915</td>
<td>.832</td>
<td></td>
<td>.424*</td>
<td>.817</td>
<td>.603</td>
</tr>
</tbody>
</table>

Note: The critical value for the .05 level of confidence with 9 degrees of freedom is .6021. The " * " denotes nonsignificant correlations.

As is shown in Table 15, nine of twelve correlations were significant at the .05 level of confidence; three were nonsignificant. These findings have important implications for the reliability of the Wallach-Kogan Creativity Battery and more will be said about this later. But insofar as implications for the issue of baseline differences is concerned, these findings are ambiguous and may be used to support either the cognitive or motivational position or a combination of both.

Comparison of regression coefficients are, of course, a much more potent method for assessing the significance of any rank order changes. Accordingly, the regression coefficients for the intelligence by treatment by gender cells are presented in Table 16.
TABLE 16. Regression coefficients describing slopes from pre-treatment to post-treatment ideational fluency scores for individual cells of the intelligence X treatment X gender matrix (n = 10). R = Relaxation; T = Tension; C = Control.

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th></th>
<th>Males</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>T</td>
<td>C</td>
<td>R</td>
</tr>
<tr>
<td>High Intelligence</td>
<td>.642</td>
<td>.705</td>
<td>.505</td>
<td>.557</td>
</tr>
<tr>
<td>Low Intelligence</td>
<td>.521</td>
<td>.528</td>
<td>.645</td>
<td>.274</td>
</tr>
</tbody>
</table>

Inspection of Table 16 reveals that the most variable regression coefficients occur for the males. Significantly different regression slopes occur between the high intelligent males and the low intelligent males in the tension condition (t = 2.28; df = 16; p < .05). What this means in practical terms is that the low intelligent males significantly improved their rank order with respect to the high intelligent males following experience in the tension condition.

Similarly, the low intelligent male in the tension condition significantly improved his rank order on ideational fluency in comparison to his low intelligent counterpart in the relaxation condition (t = 2.32; df = 16; p < .05)

Marginaly significant differences were obtained (t = 1.60; df = 16; p < .10) by comparing the high intelligent, tensed female
with the high intelligent, tensed male. In this analysis, the high intelligent girl who received tension training improved her rank order on ideational fluency in comparison with her male counterpart.

Finally, the low intelligent boys in the tension condition significantly improved their rank order on ideational fluency in comparison to their low intelligent female counterpart (t = 2.06; df = 16; p < .05).

These findings taken together would seem to indicate some support for the notion of a motivational-type basis to individual differences in ideational fluency, at least for males. This is discussed in more detail in the next chapter.

Next, recall that the findings reported in the pre-treatment data analysis indicated that anxiety appeared to operate independently for males as opposed to females. Accordingly, it was decided to examine the regression coefficients for high and low anxious males and females. These are presented in Table 17.

---

**TABLE 17.** Regression coefficients describing slopes from pre-treatment to post-treatment ideational fluency for cells of the anxiety by gender matrix (n = 30).

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Anxiety</td>
<td>.571</td>
<td>.178</td>
</tr>
<tr>
<td>Low Anxiety</td>
<td>.520</td>
<td>.648</td>
</tr>
</tbody>
</table>
There is thus a large difference in the regression coefficients of high and low anxious boys, but this is not true for girls. The difference between the slopes for high and low anxious boys is significant \( (t = 2.37; \text{df} = 58; p < .05) \) with the low anxious boys significantly improving their standing on the ideational fluency dimension in comparison to the high anxious boys. Incidentally, this finding would probably account for the previously noted result that prior to treatment, anxiety had only a marginally significant effect \( (p < .10) \) but following treatment it was clearly significant \( (p < .05) \).

Pursuing this finding one step further, the regression slopes for high and low anxious males for the treatment and intelligence dimensions were computed. Only on the intelligence dimensions were computed. Only on the intelligence dimension were the regression coefficients sufficiently different to warrant presentation here. These are presented in Table 18.

<table>
<thead>
<tr>
<th></th>
<th>High Anxiety</th>
<th>Low Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Intelligence</td>
<td>.395</td>
<td>.597</td>
</tr>
<tr>
<td>Low Intelligence</td>
<td>.099</td>
<td>.763</td>
</tr>
</tbody>
</table>
A comparison of the regression slopes in Table 18 was made. It was found that the low intelligent, low anxious males significantly improved their relative ideational fluency standing in comparison with the low intelligent, high anxious males \( t = 2.206; \ df = 26; \ p < .05 \).

Marginally significant differences were obtained in comparing the low intelligent, high anxious males with the high intelligent, low anxious males \( t = 1.819; \ df = 26; \ p < .10 \).

Thus, the comparisons of the regression coefficients for the dimension of anxiety would appear to indicate that anxiety plays a significant role in changing the relative rank order on ideational fluency scores for boys but not for girls. And this, of course, is similar to the indications noted earlier that a change in the arousal level of males, in terms of relaxation or tension, appears to have some effect in changing the relative rank ordering of males but not females.

Finally, the correlations between pre-treatment and post-treatment ideational fluency scores should be reported for each level of the four variables under consideration. This will provide a general impression of the stability of ideational fluency across variations in motivational status.

First, the overall correlation between pre- and post-treatment ideational fluency was .70. This is a surprisingly high correlation and actually compares favorably with the original Wallach-Kogan coefficient of stability \( r = .77 \) in which there was no
manipulation of level of arousal, and further, no time
interval of four consecutive school days. The Wallach-
Kogan correlation reported above was derived by the present author
by converting their split-half reliability coefficients for each
of the three verbal tests used into coefficients of stability
as per Brumig and Kintz (1968).

Correlation coefficients for the three treatment levels
are as follows: Control = .689; Relaxation = .575; Tension = .434.
Using Fisher's z-transformation, significant difference was
found between the correlations for control versus tension condi-
tions (z = 1.64; p = .05). Other comparisons were nonsignificant.

Correlations for the two levels of intelligence were as
follows: High Intelligence = .702; Low Intelligence = .700.

Correlations for the two gender classifications were as
follows: Females = .765; Males = .655.

Correlations for the two anxiety levels were as follows:
High Anxiety = .495; Low Anxiety = .792. The difference between
these two correlations was highly significant (z = 2.835; p = .002).

Viewing the experimental results from this last perspective,
it is clear that "level of arousal" as operationalized in this
study and also anxiety resulted in greater instability of correla-
tions between baseline and post-treatment conditions than did manipu-
lations of the other two variables, intelligence and gender.
CHAPTER IV
DISCUSSION

The role of intelligence in ideational fluency

Prior to manipulation of level of arousal, intelligence seemingly played a significant, independent role in ideational fluency. Following administration of relaxation, tension, and control conditions intelligence no longer displayed this effect. Instead, intelligence was a crucial variable only if level of arousal and gender of subjects were also considered.

Prior to treatment intelligence was associated with different levels of ideational fluency irrespective of anxiety scores and gender. First, a significant positive correlation between intelligence and ideational fluency was observed ($r = .21$). This correlation was similar for males ($r = .20$) in comparison with females ($r = .22$). Second, when anxiety was partialled out of the overall correlation only a small reduction was obtained (from $r = .21$ to $r = .19$). Third, pretreatment ideational fluency differences between high intelligent and low intelligent subjects were highly significant irrespective of anxiety and gender. Fourth, the
pretreatment three-way ANOVA (Table 10) revealed a significant effect of intelligence and no significant interaction with gender or anxiety, or any combination thereof. Fifth, in the four-way ANOVA (Table 12) for pre-treatment data a significant effect of intelligence was, of course, observed, and with no interaction with any of the other variables including treatment condition. All of these findings are in accordance with Hypothesis 1 that different levels of intelligence should be associated with different levels of ideational fluency on a positive, linear basis.

Following manipulation of level of arousal a much different picture emerges: intelligence no longer exerted an independent effect. No significant effect of intelligence on ideational fluency was observed in either the analysis of covariance (Table 11) or in the analysis of variance of post-treatment scores (Table 13). This indicates that not only when a linear correction is made for baseline differences in ideational fluency does intelligence show no independent influence, but also when no such correction is made, i.e., in absolute terms. An inspection of adjusted treatment means (Appendix I) reveals that the low intelligent group is actually above the high intelligent group in terms of ideational fluency.

In addition, an inspection of figures 7 - 10 emphasizes visually the lack of a consistent independent effect of intelligence. For example, very little difference exists between
high and low intelligent groups in the relaxed condition for both males and females. A larger difference exists in the tension condition, but the direction of differences is opposite for males and females.

It is somewhat difficult to place this finding into perspective with previous research primarily because other studies have not used intelligence as an independent classification variable. For example, Milgram and Feingold (1977) used intelligence as a covariate and Ward, Kogan and Pankove (1972) made use of their limited intelligence data only for correlational analyses. Griffith (1976) used intelligence as an independent variable, and, following administration of three treatment strategies, found that intelligence had no effect on post-treatment ideational fluency. This finding is in agreement with that of the present investigation. Further comparisons with this study are limited in that Griffith did not report a similar analysis for pretreatment ideational fluency. Further, no controls were made for gender of subject, and initial baseline differences in ideational fluency are substantially different.

To summarize, in the present investigation the advantage which accrued to an individual seemingly because of his higher intelligence was significantly reduced following changes in level of arousal. The role of intelligence in ideational fluency does not seem to be independent but instead dependent upon level of arousal and gender. These findings are in partial accord with
Hypothesis #4 in which it was suggested that changes in level of arousal should interact with intelligence, anxiety, and gender of subjects based on implications of the model developed in Chapter I. First, intelligence did not interact with anxiety level, but only with level of arousal and gender considered together. Second, implications of the model were only partially supported. This is discussed in a later section of this chapter.

Finally, it has been suggested that the role of intelligence in ideational fluency is as a necessary but insufficient condition. This was discussed in Chapter I. However, intelligence, at levels assessed in this investigation, would not seem to be a necessary condition for the plentiful production of ideas. First, there was a large difference in intelligence between the high (mean IQ = 117.1) and low (mean IQ = 93.32) intelligence groups. Yet these differences were not potent enough to result in significant differences in post-treatment ideational fluency. If intelligence were a necessary condition for ideational fluency then the low intelligent males with a mean IQ of only 90.8 should not have surpassed the high intelligent males with a mean IQ of 116.2. Yet this is what occurred. Second, if intelligence were a necessary condition for ideational fluency then 23% of students who were in the lower third of the intelligence score distribution should not have placed in the upper third of the
pre-treatment ideational fluency score distribution. Yet, this
is, in fact, what occurred.

Thus, although intelligence does have some effect on ideational
fluency it is probably not as a necessary condition, nor does it
operate independently, across different levels of arousal and gender.
Rather, intelligence seems to interact with level of arousal, and
gender to produce differences in ideational fluency.

The role of anxiety in ideational fluency.

Results of this study indicate that level of reported anxiety
operates on ideational fluency scores in a more specificable manner
for males than for females. First, although the overall correla-
tion between ideational fluency and anxiety was low but significant
($r = -0.13$), the difference between this correlation for males and
females considered separately was highly significant. For males
the correlation between ideational fluency and anxiety was $-0.23$,
which was highly significant. For females the same correlation
was $-0.03$ which was nonsignificant.

Second, as is shown in Table 7, differences between high and
low anxious males were significant whereas the same differences
for females were not. Third, although the overall effect of
anxiety in the three-way anova was nonsignificant (See Table 10.),
this was due to the lack of significance for females, whereas for
males differences were significant. Fourth, although the effect
of anxiety on ideational fluency was only marginally significant
(p < .10) in the four-way pretreatment anova (Table 12), following treatment, it was significant (p < .05) (See Table 13.). This would seem to be due to the significant augmentation of differences between high and low anxious males (See Table 17). That is, initially the low anxious males were higher on ideational production than high anxious males. Changes in ideational production following treatments were such that the regression slope for the low anxious males was much steeper (.65) than that for the high anxious males (.18). The difference in slopes was significant. Regression slopes for the females were not significantly different. Interestingly enough, the high anxious females actually improved (.57) slightly more than the low anxious female (.52).

Note, however, that the interaction between anxiety and gender was nonsignificant in all anovas and in the analysis of covariance. The lowest probability level associated with the effects of this interaction was p < .15 in the four-way anova on post-treatment ideational fluency scores. Thus the anova procedure would seem to obscure an important relationship between test anxiety and ideational fluency when males and females are considered jointly. Although the difference between genders is not large enough to produce a significant interaction, differences for males are significant and should not be ignored. Thus the present author would tend to disagree with Cronbach's (1958) position that the sexes should be considered jointly until a significant interaction is demonstrated.
It should also be noted that the present findings are at variance with those of Wallach and Kogan (1965a) in that they found no significant effect of test anxiety on ideational fluency for boys. Differences between the two studies would seem to account for these discrepant findings. First Wallach and Kogan used only 19 of the 30 Test Anxiety Scale for Children (TASC) items; whereas the entire set was used in the present investigation. Second Wallach and Kogan used a split median procedure to define high and low anxious groups; whereas the present study utilized upper and lower thirds of the frequency distribution. Additional differences have already been noted in Chapter II. Wallach and Kogan do not report the correlation between test anxiety and ideational fluency nor do they report mean anxiety scores for high and low anxiety groups. Thus it is difficult to make meaningful comparisons.

White's (1968) results are similar to those obtained in the present investigation. Using 200 male freshman university students, he used the Consequences Test (Christensen, et. al., 1960) as a measure of ideational fluency and several factors on the 16 PF (Cattell and Eber, 1957) as measures of anxiety. For factors "O" (apprehensive) and "Q4" (tenseness) the correlation with ideational fluency was -.19 for both factors. In the present investigation the corresponding correlation for males was -.23.

Further, an analysis of variance in the White study revealed a significant main effect of anxiety with the low anxious group scoring higher on ideational fluency than the high anxious group.
In the present investigation similar significant differences existed between high and low anxious males.

Thus despite the use of different anxiety and ideational fluency measures and the use of an adult population, there is a strong similarity between the findings of the present study and those of White (1968).

Feldhusen, Denny and Condon (1965) found a positive instead of a negative correlation between scores on Sarason's et. al. (1960) General Anxiety Scale for Children (GASC) and ideational fluency for both girls and boys in the seventh and eighth grades. And anxiety did not have a significant effect for males or for females. The difference between these findings and those at present might be explainable by the former's use of the GASC instead of the TASC. Sarason et. al., (1960) quite explicitly favor use of the TASC in the assessment of anxiety (pp. 7 - 10).

Finally, the present investigation should be contrasted with the Flescher (1963) investigation. Flescher (1963, pg. 263) concluded that his "results presented no convincing evidence that either general or test anxiety significantly affects performance on certain specified tasks of creativity." For a group of high intelligent subjects Flescher reported a correlation of .27 between TASC scores and ideational fluency. This of course would seemingly represent drastically discrepant results from that of the present study in which a correlation of -.13 was reported. However, Flescher operationalized ideational fluency as "the number of
obvious or ordinary titles" given to a story plot, discarding all original responses. This, in effect, is a measure of ideational fluency for stereotyped responses and not ideational fluency as is typically defined in the literature and also as it is defined in the present study.

It should also be noted that results in the present investigation indicate that intelligence probably interacts with anxiety at a low level for males. Note, for example, that when anxiety was partialled out of the relationship between intelligence and ideational fluency for males the change in correlation was from .20 to .13. This would indicate that at least some portion of the correlation between intelligence and ideational fluency is augmented by the relationship each has with anxiety. Further, note the differences among the regression coefficients in the intelligence by anxiety matrix displayed in Table 18. As noted in Chapter III the comparison of these regression slopes would appear to indicate that the interaction between intelligence and anxiety may play at least a moderate role in changing the relative rank order on ideational fluency for boys but not girls.

With respect to girls, the role of anxiety in ideational fluency needs to be further clarified. Sarason, et. al., (1960) interpret sex differences in their TASC by suggesting that girls more readily admit to anxiety symptoms, whereas boys are more defensive about admitting such symptoms. In this regard, the TASC may
be criticized on several grounds relating to test construction. To mention two, there is the problem of the "yea-sayers" versus the "nay-sayers" and the problem of social desirability responses. With regard to the first problem, all items on the TASC are scored in the positive direction. That is, a "yes" response is scored as always indicating the presence of anxiety. This is clearly poor test construction. With regard to the second problem, students may simply be responding to the TASC items not on the basis of their true feelings but on the basis of what they believe the most socially desirable response would be. The use of another instrument with more rigorous test construction might provide more insight into the role of anxiety in female ideational fluency. For example, Cattell's Child Personality Questionnaire might be appropriate, particularly in view of the similarity in findings noted above in White's (1968) use of the 16 PF and those in the present investigation.

Finally, it should be noted that anxiety did not interact with level of arousal as it was expected it might. Hypotheses six through eight and figure six were all based on the assumption that the ideational fluency scores of high and low anxious subjects would be affected differentially by relaxation and tension training. This however, did not occur.

Several explanations might be applied to the lack of support for these hypotheses. First, assuming that TASC scores were a valid reflection of anxiety, the five twenty-minute group treatment
sessions may not have been sufficient to have intruded on so basic a dimension as anxiety. When relaxation training is used in a therapeutic setting with adults, duration of training is at least one month (e.g., Lazarus, undated). Second, the correspondence between psychological tension and level of physical arousal is probably not exact. That is, low anxiety as a personality dimension probably does not correspond uniformly to low levels of physical arousal. Similarly, for high anxiety and high levels of arousal. Yet figures three thru six assume that the two dimensions are coextensive. Thus, evidence in this study indicates that development of the model in terms of anxiety was inaccurate. Third, TASC scores may not be a valid reflection of anxiety in this study. This possibility includes facets of test construction discussed above and any methodological limitations idiosyncratic to the present study.

The present author is inclined to consider all three possibilities as contributing in some way to the lack of significant interaction between arousal level and anxiety level, with perhaps the greatest weights being given to the first two.

The role of level of arousal in ideational fluency.

In Hypothesis #1, it was suggested that changes in level of arousal should interact with the other three independent variables to become associated with different levels of ideational fluency.
The finding that anxiety did not interact with level of arousal has already been discussed. For the other two variables—gender and intelligence—the hypothesis was supported. This interaction is discussed in a later section of this chapter.

When considered separately the different levels of arousal—relaxation, control, and tension—exhibited no independent effect on ideational fluency. That is, the main effect of level of arousal was not significant in either the analysis of covariance or in the post-treatment four-way analysis of variance.

It should be emphasized that this finding corresponds to a fundamental relationship contained in the model (see, for example, Figure Five). Changes in level of arousal should not have a uniform, independent effect because the changes would affect different groups of subjects differentially.

The role of gender in ideational fluency.

Evidence from the present study indicates that the role of gender in ideational fluency is best understood in conjunction with the other variables under consideration. This has already been done for anxiety, and the interaction for gender with the other variables is considered in the next section of this chapter.

It should be noted here that gender considered separately did not exhibit independent, differential effects on ideational fluency. This finding supports hypothesis #3 that no significant differences in ideational fluency should exist between males and females prior
to treatment. This is amply demonstrated in Tables 6 and 11 - 13.

The effects of the interaction among intelligence, level of arousal, and gender on ideational fluency.

Wallach and Kogan (1965a & b) achieved a significant advancement in the assessment of creativity when they were able to demonstrate that divergent tasks scored for ideational fluency were much more highly related to each other than they were to conventional intelligence measures. They presented as a fundamental basis for their achievement the procedure of assessing ideational fluency under a relaxed, permissive, game-like setting. They reasoned in their conclusion that their assessment context optimized creativity performance and thus the distinction from intelligence. Wallach and Kogan (1965a, pg. 306) write that "If one wishes to assess a form of creative thinking in children that is independent of intelligence, the assessment procedures and context that we have employed may offer the only course...it is probably safe to venture the hypothesis that the kind of creativity assessment described in the present volume optimizes the expression of creative thinking in elementary school children."

This line of reasoning, however, is not compelling. Not only is creativity supposedly enhanced but also the relationship with intelligence is reduced by their assessment context. For both of these events to occur, creativity would have to be differentially affected for different individuals. If everyone were to improve
his creativity by approximately the same amount there would be no change in the correlation with intelligence. Thus the questions left unanswered, and even unaddressed, by Wallach and Kogan are how and why might individuals' creativity be affected differentially by a relaxed, permissive, game-like assessment context.

Previous literature examined by the present author left the question unasked. Boersma and O'Bryan (1968) and Kogan and Morgan (1969) among others asked whether such an effect might be observed by comparing test-like versus game-like assessment contexts, but the rationale for even expecting such an effect was left unexplored.

In the present investigation, Chapter I, an attempt was made to provide such a rationale. This rationale was based initially upon a Yerkes-Dodson formulation; and additions to it were made by considering relevant literature. If at this point, one does not consider anxiety, the rationale in essence suggested that low intelligent subjects should respond positively to relaxation and negatively to tension in terms of their levels of ideational fluency. In contrast, it was suggested that high intelligent subjects should respond positively to tension and negatively to relaxation in terms of their ideational fluency. However, based upon the reasonably well-executed study by Kogan and Morgan (1969) in which a test-like context actually improved ideational fluency for males, the hypothesis of an interaction among level of arousal, intelligence, and gender was formulated as a part of hypothesis #4. Specific gender differences were not elaborated.
This part of the hypothesis received considerable support in this study from the significant intelligence by gender by level of arousal interaction in the analysis of covariance (Table 11) and in the contrasts in this interaction between the four-way anovas for pretreatment and posttreatment ideational fluency (Tables 12 & 13). Various aspects of this interaction are displayed visually in figures 7 - 12.

With respect to the model, all female groups at the level of this interaction were aligned in predicted fashion with the exception of the subjects in the high intelligent group who received relaxation training (See Figure 7.). That is, it was predicted that low intelligent subjects would respond positively to relaxation and negatively to tension. This is, in fact, what occurred for the girls. To the tension condition the high intelligent girls responded positively as predicted. But to the relaxation condition the response was also positive for the high intelligent group, a result which had not been predicted.

The contrast between males and females at the level of this interaction is striking. As can be seen in Figure 7, high intelligent boys responded uniformly negatively to both relaxation and tension, whereas high intelligent females responded uniformly positively to relaxation and tension. Similarly, as can be seen in Figure 12, low intelligent females exhibited higher ideational fluency under relaxed conditions and lower ideational fluency under
tension conditions; whereas for the low intelligent male the highest level of ideational fluency was associated with the tension condition and the lowest level of ideational fluency with the relaxed condition.

The strength of this finding was unanticipated although it was certainly presaged by the findings of Kogan and Morgan (1969). It would seem that the role of gender in ideational production becomes significant when one considers the affective/motivational component. First, gender differences exist along the anxiety dimension; these have already been discussed. Second, the two most significant effects in the analysis of covariance (Table II) were the interaction we have been discussing in this section and the interaction between gender and treatment which was marginally significant at $p<.10$. Third, significant differences in regression coefficients occurred between low intelligent boys and girls in the tension condition and high intelligent boys and girls in the tension condition.

Under conditions of relaxation both high and low intelligence groups appear to be at the same level of ideational fluency for both boys and girls (See Figure 9.). This finding would seem to support Wallach and Kogan's formulation that the lowest correlation between intelligence and ideational fluency should occur under a relaxed, permissive test context.
Under conditions of tension (See Figure 10.) large differences in ideational fluency exist between high and low intelligence groups, if, and only if, one considers males and females separately. The differences in ideational fluency between the levels of intelligence are in different directions for boys in comparison with girls. What this implies is that if one were to compute an overall correlation between intelligence and creativity under conditions of tension there would probably be very little difference from the same correlation under conditions of relaxation. That is, the high positive correlation for the females would be countered by the high negative correlation for the males. Wallach and Kogan (1965 a & b) suggested that a high correlation should exist between ideational fluency and intelligence when the assessment context is one of tension. Results from the present investigation support this suggestion for females but not for males (See Figure 10.).

Further research might be concentrated in this area. That is, figures 9 and 10 imply that correlations between ideational fluency and intelligence should differ in specific ways under conditions of relaxation and under tension for males and females. An experimental test of these implications would be relatively straightforward.
The nature of individual differences in ideational fluency

The present investigation has been structured around the orientation that creativity should be conceptualized as a concurrent cognitive-affective/motivation process. To specify as clearly as possible the nature of this conceptualization a hypothetical model was developed based upon a review of relevant literature. Two hypotheses concerning the nature of individual differences in creativity were discussed. These were, specifically, that either differences in cognitive capacity for ideational production or differences in motivational status were responsible for individual differences in creativity. The only two studies related to this issue—Milgram and Feingold (1977) and Ward, Kogan and Pankove (1972)—had been unable to demonstrate clearly that motivational differences played an integral role in describing individual differences in creativity. They were able to show that motivation (incentives) raised the levels of ideational production. However, it did not change the relative rank ordering of individuals.

The position taken in the present study was that the nature of creativity is sufficiently affective/motivational to be experimentally demonstrable. Lack of success in previous studies in demonstrating this were due, it was suggested, to at least two factors. First, an incorrect motivational variable was utilized; the use of incentives had not been indicated by previous literature. Instead, affective/motivational variables such as anxiety and level of arousal seemed much more appropriate. Second, the previous studies did not
adequately consider the role of intelligence and its interaction
with level of arousal. That is, creativity should be conceptualized
as a concurrent cognitive-affective/motivational process. The
present study conceptualized this interaction as a Yerkes-Dodson
function.

The question which remains to be answered, then, is do results
from the present study demonstrate that changes in affective/
motivational status not only affect levels of ideational production
but also affect the relative rank ordering of individuals? The
first portion of this question has already been answered affirmatively
in the preceding sections of this chapter. Attention is thus drawn
to the second aspect of the question, i.e., to changes in relative
rank order of individuals on ideational fluency.

Rank order changes, as reflected in comparisons of regression
coefficients, did occur. These changes occurred for boys, and between
boys and girls, but not for girls considered separately. More
specifically, in the tension condition the low intelligent boys
surpassed the high intelligent boys in relative rank order.
For low intelligent boys there was a significant change in relative
rank order between those in the relaxation condition and those
in the tension in favor of the latter. Between boys and girls
significant rank order changes occurred at both the level of high
intelligence and at the level of low intelligence. High intelligent
girls responded to the tension condition with significantly steeper
regression slope than that of the high intelligent boys. For low intelligence in the tension conditions comparisons of regression slopes were again significant but in different directions. Here the boys produced a significantly steeper regression slope than did the girls.

Thus significant rank order changes did occur. However, the question must be addressed as to whether or not a sufficient number of rank order changes occurred to demonstrate in an unqualified manner that affective/motivational variables account for a portion of individual differences in ideational fluency. The answer to this question is "no." That is, only qualified support can be given to this position. First, just as with anxiety, overall differences do no exist, but differences for boys do exist as they do between boys and girls, but not for girls considered separately. Second, the measures of ideational fluency utilized appear to be powerfully reliable and resistant to changes across external motivational conditions and time.

The comparison drawn with the effects of anxiety suggests that perhaps there is a somewhat different basis to individual differences in ideational fluency between males and females. In the past gender differences have been attributed to an insensitivity of measurement (e.g., Wallach and Kogan, 1965a and Sarason, et. al., 1960) implying that the differences were not real. However, the persistence of the same type of difference being found in the dimension of level of arousal suggests that the differences may
be more real than imagined. Thus further research describing gender differences in ideational fluency within different categories of affective/motivational status would be appropriate.
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APPENDIX A

Nonconsent form sent to all parents of participating subjects
Your child has been selected to participate in a research program being conducted in the

If you do not want your child to participate please sign this form and return it to school. Participation is voluntary; it is not mandatory.

The student will be tested for his level of test-anxiety, ability to supply divergent or creative responses, and intellectual level. Depending upon scores on these tests, students may be chosen to participate in a five day (20 minutes a day) training program for creativity. This is done as part of an investigation entitled "Interactions among creativity, intelligence and anxiety with changes in arousal level."

This procedure is to be done under the direction of Dr. Philip M. Clark who is authorized to use the services of others in the performance of this procedure. Following completion of the research a summary of the program and the results will be forwarded to teachers of participating classes. You will be invited to review the results.

1. The nature and purpose of this procedure is to establish the relationship among test-anxiety, intelligence, and different creativity training procedures.

2. There are no known risks involved in this procedure.

3. Possible benefits include acquisition of relaxation skills, reduction of test-anxiety, and improved creative responding.

STATEMENT OF CONFIDENTIALITY: The confidentiality of your child's responses will be observed in a manner consistent with the goals of the project and your individual right to privacy. Your child's responses will not be made part of his school record.

Any further questions you may have concerning the procedure described will be fully answered. You are free to stop your child's participation in the project at any time.

If you do not want your child to participate in this research program please sign below:

Signed: __________________________ DATE: ____________

(parent or guardian of student)

Name of student: __________________________
APPENDIX B

A listing of schools with the number of classes, participating students, returned consent forms, and absences during pre-treatment phase.

<table>
<thead>
<tr>
<th>Schools</th>
<th>Classes</th>
<th># of Returned Consent Forms</th>
<th>Absences</th>
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<td></td>
<td></td>
<td>Girls</td>
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</table>

** For this school consent forms were modified by the principal to require parental signatures. Permission was granted for 19 of 30 students.
APPENDIX C

Verbal portions of the Wallach-Kogan Creativity Battery and the answer sheets used in this study
THE WALLACH-KOGAN CREATIVITY BATTERY: VERBAL TECHNIQUES
(Wallach and Kogan, 1965)

1. **Instances**

  **Instructions**

  "In this game I am going to tell you something and it will be your job to name as many things as you can think of that are like what I tell you. For example, I might say 'things that hurt.' Now you name all the things you can think of that hurt." (The experimenter then lets the child try.) "Yes, those are fine. Some other kinds of things might be falling down, slapping, fire, bruises, or a knife." (Here the experimenter varies her suggestions so that they consist of ones which the child has not provided.) "So we see that there are all kinds of different answers in this game. Do you see how we play?" (If the child already indicates strong understanding, the last sentence is replaced by, "I can see that you already know how we play this game.") "Now remember, I will name something and you are supposed to name as many things as you can think of that are like what I've said. OK, let's go."

  **Items**

  a. "Name all the round things you can think of."
  b. "Name all the things you can think of that will make a noise."
  c. "Name all the square things you can think of."
  d. "Name all the things you can think of that move on wheels."

2. **Alternate Uses**

  **Instructions**

  "Now, in this game, I am going to name an object--any kind of object, like a light bulb or the floor--and it will be your job to tell me lots of different ways that the object could be used. Any object can be used in a lot of different ways. For example, think about string. What are some of the ways you can think of that you might use string?" The experimenter varies her suggestions so as not to duplicate any the child has provided.) "There are lots
more too, and yours were very good examples. I can see that you already understand how we play this game. So let's begin now. And remember, think of all the different ways you could use the object that I name. Here we go."

**Items**

a. "Tell me all the different ways you could use a newspaper."

b. "Tell me all the different ways you could use a knife."

c. "Tell me all the different ways you could use an automobile tire--either the tube or the outer part."

d. "Tell me all the different ways you could use a cork."

e. "Tell me all the different ways you could use a shoe."

f. "Tell me all the different ways you could use a button---the kind that is used on clothing."

g. "Tell me all the different ways you could use a key---the kind that is used in doors."

h. "Tell me all the different ways you could use a chair."

3. **Similarities**

**Instructions**

"In this game I am going to name two objects, and I will want you to think of all the ways that these two objects are alike. I might name any two objects like door and chair. But whatever I say, it will be your job to think of all the ways that the two objects are alike. For example, tell me all the ways that an apple and an orange are alike." (The child then responds.) "That's very good. You've already said a lot of the things I was thinking of. I guess you could also say that they are both round, and they are both sweet, they both have seeds, they both are fruits, they both have skins, they both grow on trees---things like that. Yours were fine too." (The experimenter's suggestions are varied so as not to include any which the child has given.) "Do you see how we play the game?" (If the child indicates clear understanding already, the last sentence is replaced by, "I can see that you already know how to play this game.") "Well, let's begin now. And remember, each time I name two objects, you name as many ways as you can that these two objects are alike."
Items

a. "Tell me all the ways in which a potato and a carrot are alike."
b. "Tell me all the ways in which a cat and a mouse are alike."
c. "Tell me all the ways in which a train and a tractor are alike."
d. "Tell me all the ways in which milk and meat are alike."
e. "Tell me all the ways in which a grocery store and a restaurant are alike."
f. "Tell me all the ways in which a violin and a piano are alike."
g. "Tell me all the ways in which a radio and a telephone are alike."
h. "Tell me all the ways in which a watch and a typewriter are alike."
i. "Tell me all the ways in which a curtain and a rug are alike."
j. "Tell me all the ways in which a desk and a table are alike."
ANSWER SHEET

Name: ________________________________

Sex: Boy  Girl
   (Circle One)

Instances

1. ___________________________________ ___________________________________
2.

<table>
<thead>
<tr>
<th>Alternate Uses</th>
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<tbody>
<tr>
<td>1.</td>
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Alternate Uses (Cont.)

2. ____________________________

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Similarities (Cont.)

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Similarities (Cont.)

4. ______________________
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APPENDIX D

Test Anxiety Scale for Children (Sarason, et. al., 1960) with the answer sheet used in this study
INSTRUCTIONS

"I'm going to be asking you some questions—questions different from the usual school questions for these are about how you feel and so have no right or wrong answers. First I'll hand out the answer sheets and then I'll tell you more about the questions....

"Write your name at the top of the first page, both your first and your last names.... Also circle the B if you're a boy or a G if you're a girl.

"As I said before, I am going to ask you some questions. No one but myself will see your answers to these questions, not your teacher or your principal or your parents. These questions are different from other questions that you are asked in school. These questions are different because there are no right or wrong answers. You are to listen to each question and then put a circle around either "yes" or "no." These questions are about how you think and feel and, therefore, they have no right or wrong answers. People think and feel differently. The person sitting next to you might put a circle around "yes" and you may put a circle around "no." For example, if I asked you this question: "Do you like to play ball?" some of you would put a circle around "yes" and some of you would put it around "no." Your answer depends on how you think and feel. These questions are about how you think and feel about school, and about a lot of other things. Remember, listen carefully to each question and answer it "yes" or "no" by deciding how you think and feel. If you don't understand a question, ask me about it.

"Now let's start by everybody putting their finger on Number 1. Here is the first question. Number 1. 'Do you worry when the teacher says that she is going to ask you questions to find out how much you know?'

ITEMS

1. Do you worry when the teacher says that she is going to ask you questions to find out how much you know?

2. Do you worry about being promoted, that is, passing from the _____ to the _____ grade at the end of the year?

3. When the teacher asks you to get up in front of the class and read aloud, are you afraid that you are going to make some bad mistakes?
4. When the teacher says that she is going to call upon some boys and girls in the class to do arithmetic problems, do you hope that she will call upon someone else and not on you?
5. Do you sometimes dream at night that you are in school and cannot answer the teacher's questions?
6. When the teacher says that she is going to find out how much you have learned, does your heart begin to beat faster?
7. When the teacher is teaching you about arithmetic, do you feel that other children in the class understand her better than you?
8. When you are in bed at night, do you sometimes worry about how you are going to do in class the next day?
9. When the teacher asks you to write on the blackboard in front of the class, does the hand you write with sometimes shake a little?
10. When the teacher is teaching you about reading, do you feel that other children in the class understand her better than you?
11. Do you think you worry more about school than other children?
12. When you are at home and you are thinking about your arithmetic lesson for the next day, do you become afraid that you will get the answers wrong when the teacher calls upon you?
13. If you are sick and miss school, do you worry that you will do more poorly in your schoolwork than other children when you return to school?
14. Do you sometimes dream at night that other boys and girls in your class can do things you cannot do?
15. When you are home and you are thinking about your reading lesson for the next day, do you worry that you will do poorly on the lesson?
16. When the teacher says that she is going to find out how much you have learned, do you get a funny feeling in your stomach?
17. If you did very poorly when the teacher called on you, would you probably feel like crying even though you would try not to cry?
18. Do you sometimes dream at night that the teacher is angry because you do not know your lessons?

The examiner then makes the following statement before continuing:

"In the following questions the word "test" is used. What I mean by "test" is any time the teacher asks you to do something to find out how much you know or how much you have learned. It could be by your writing on paper, or by your speaking aloud, or by your writing on the blackboard. Do you understand what I mean by "test"--it is any time the teacher asks you to do something to find out how much you know."

19. Are you afraid of school tests?
20. Do you worry a lot before you take a test?
21. Do you worry a lot while you are taking a test?
22. After you have taken a test do you worry about how well you did on the test?
23. Do you sometimes dream at night that you did poorly on a test you had in school that day?
24. When you are taking a test, does the hand you write with shake a little?
25. When the teacher says that she is going to give the class a test do you become afraid that you will do poorly?
26. When you are taking a hard test, do you forget some things you knew very well before you started taking the test?
27. Do you wish a lot of times that you didn't worry so much about tests?
28. When the teacher says that she is going to give the class a test do you get a nervous or funny feeling?
29. While you are taking a test do you usually think you are doing poorly?
30. While you are on your way to school, do you sometimes worry that the teacher may give the class a test?
ANSWER SHEET

Name:______________________________

Sex: Boy Girl
(Circle one)

Circle either Yes or No for each of the following questions.

1. Yes No 16. Yes No
2. Yes No 17. Yes No
3. Yes No 18. Yes No
4. Yes No 19. Yes No
5. Yes No 20. Yes No
6. Yes No 21. Yes No
7. Yes No 22. Yes No
8. Yes No 23. Yes No
9. Yes No 24. Yes No
10. Yes No 25. Yes No
11. Yes No 26. Yes No
12. Yes No 27. Yes No
13. Yes No 28. Yes No
14. Yes No 29. Yes No
15. Yes No 30. Yes No
APPENDIX E

Short Form Test of Academic Aptitude answer sheets used in this study
<table>
<thead>
<tr>
<th>Test 1</th>
<th>Test 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 1 2 3 4</td>
<td>26. 1 2 3 4</td>
</tr>
<tr>
<td>2. 1 2 3 4</td>
<td>27. 5 6 7 8</td>
</tr>
<tr>
<td>3. 1 2 3 4</td>
<td>28. 1 2 3 4</td>
</tr>
<tr>
<td>4. 5 6 7 8</td>
<td>29. 5 6 7 8</td>
</tr>
<tr>
<td>5. 1 2 3 4</td>
<td>30. 1 2 3 4</td>
</tr>
<tr>
<td>6. 5 6 7 8</td>
<td>31. 1 2 3 4</td>
</tr>
<tr>
<td>7. 1 2 3 4</td>
<td>32. 1 2 3 4</td>
</tr>
</tbody>
</table>

| 8. 5 6 7 8 | 32. 1 2 3 4 | 40. 1 2 3 4 |
| 9. 1 2 3 4 | 33. 5 6 7 8 | 41. 5 6 7 8 |
| 10. 5 6 7 8 | 34. 1 2 3 4 | 42. 1 2 3 4 |
| 11. 1 2 3 4 | 35. 5 6 7 8 | 43. 5 6 7 8 |
| 12. 5 6 7 8 | 36. 1 2 3 4 | 44. 1 2 3 4 |
| 13. 1 2 3 4 | 37. 5 6 7 8 | 45. 5 6 7 8 |
| 14. 5 6 7 8 | 38. 1 2 3 4 | 46. 5 6 7 8 |
### Test 3

<table>
<thead>
<tr>
<th>C.</th>
<th>a b c d</th>
<th>51.</th>
<th>f g h j</th>
<th>59.</th>
<th>f g h j</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.</td>
<td>f g h j</td>
<td>52.</td>
<td>a b c d</td>
<td>60.</td>
<td>a b c d</td>
</tr>
<tr>
<td></td>
<td></td>
<td>52.</td>
<td>f g h j</td>
<td>61.</td>
<td>f g h j</td>
</tr>
<tr>
<td>66.</td>
<td>a b c d</td>
<td>54.</td>
<td>a b c d</td>
<td>62.</td>
<td>a b c d</td>
</tr>
<tr>
<td>67.</td>
<td>f g h j</td>
<td>55.</td>
<td>f g h j</td>
<td>63.</td>
<td>f g h j</td>
</tr>
<tr>
<td>68.</td>
<td>a b c d</td>
<td>56.</td>
<td>a b c d</td>
<td>64.</td>
<td>a b c d</td>
</tr>
<tr>
<td>69.</td>
<td>f g h j</td>
<td>57.</td>
<td>f g h j</td>
<td>65.</td>
<td>f g h j</td>
</tr>
<tr>
<td>50.</td>
<td>a b c d</td>
<td>58.</td>
<td>a b c d</td>
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### Test 4

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<th>1 2 3 4</th>
<th>80.</th>
<th>1 2 3 4</th>
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<tbody>
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<td></td>
<td></td>
<td>73.</td>
<td>5 6 7 8</td>
<td>81.</td>
<td>5 6 7 8</td>
</tr>
<tr>
<td>66.</td>
<td>1 2 3 4</td>
<td>74.</td>
<td>1 2 3 4</td>
<td>82.</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>67.</td>
<td>5 6 7 8</td>
<td>75.</td>
<td>5 6 7 8</td>
<td>83.</td>
<td>5 6 7 8</td>
</tr>
<tr>
<td>68.</td>
<td>1 2 3 4</td>
<td>76.</td>
<td>1 2 3 4</td>
<td>84.</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>69.</td>
<td>5 6 7 8</td>
<td>77.</td>
<td>5 6 7 8</td>
<td>85.</td>
<td>5 6 7 8</td>
</tr>
<tr>
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<td>1 2 3 4</td>
<td>78.</td>
<td>1 2 3 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>71.</td>
<td>5 6 7 8</td>
<td>79.</td>
<td>5 6 7 8</td>
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APPENDIX F

SFTAA test sessions per school per class with the number of students and test settings listed

<table>
<thead>
<tr>
<th>School</th>
<th>Class</th>
<th># of Students</th>
<th>Setting</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>all</td>
<td>61</td>
<td>school library; 4 to a table</td>
</tr>
<tr>
<td>2</td>
<td>all</td>
<td>25</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td>3</td>
<td>all</td>
<td>61</td>
<td>cafeteria/gym; 3 to a table</td>
</tr>
<tr>
<td>4</td>
<td>all</td>
<td>72</td>
<td>cafeteria; 3 to a table</td>
</tr>
<tr>
<td>5</td>
<td>all</td>
<td>19</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td>6</td>
<td>i</td>
<td>31</td>
<td>regular classroom/desks</td>
</tr>
<tr>
<td></td>
<td>ii</td>
<td>32</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td>7</td>
<td>all</td>
<td>17</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td>8</td>
<td>all</td>
<td>44</td>
<td>cafeteria/gym; 3 to a table</td>
</tr>
</tbody>
</table>
APPENDIX G

TASC and WKCB-I tests sessions per school per class with number of students and test-setting listed

<table>
<thead>
<tr>
<th>School</th>
<th>Class</th>
<th># of Students</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>all</td>
<td>58</td>
<td>teacher's cafeteria; 4 to a table</td>
</tr>
<tr>
<td>2</td>
<td>all</td>
<td>22</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td>3</td>
<td>i</td>
<td>18</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td></td>
<td>ii</td>
<td>22</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td></td>
<td>iii</td>
<td>20</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td>4</td>
<td>all</td>
<td>72</td>
<td>cafeteria; 3 to a table</td>
</tr>
<tr>
<td>5</td>
<td>all</td>
<td>17</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td>6</td>
<td>i</td>
<td>30</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td></td>
<td>ii</td>
<td>30</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td>7</td>
<td>all</td>
<td>11</td>
<td>regular classroom; desks</td>
</tr>
<tr>
<td>8</td>
<td>i, ii</td>
<td>34</td>
<td>cafeteria/gym; two to a table</td>
</tr>
<tr>
<td></td>
<td>iii</td>
<td>8</td>
<td>projects room; 1/desk; 2/table</td>
</tr>
</tbody>
</table>
APPENDIX H

Relaxation Training Script
SCRIPT FOR STUDENTS IN THE LOW AROUSAL (RELAXATION) CONDITION

I have a question for you today. Do any of you ever get uptight or nervous when you want to do something very well? Like if you wanted to roller skate very well in front of your parents, or if you wanted to win a game of checkers, would you get nervous or anxious. Do you think that it might help you to do any better if instead of being nervous you could just relax? Well, I don't really know. So today we're going to do some special kinds of exercises called relaxation exercises. These exercises help you learn how to relax when you're feeling uptight and help you get rid of those butterflies-in-your-stomach kinds of feelings. They're also kind of neat, because you can do some of them in the classroom without anybody noticing.

In order for you to get the best feelings from these exercises, there are some rules you must follow. First, you must do exactly what I say, even if it seems kind of silly. Second, you must try hard to do what I say. Third, you must pay attention to your body. Throughout these exercises, pay attention to how your muscles feel when they are tight and when they are loose and relaxed. And fourth, you must practice. The more you practice, the more relaxed you can get. Does anyone have any questions?

Are you ready to begin? Okay. First, get as comfortable as you can in your chair. Sit back, get both feet on the floor, and just let your arms hang loose. That's fine. Now close your eyes and don't open them until I say to. Remember to follow my instructions very carefully, try hard, and pay attention to your body. Here we go.

Hands and Arms

Pretend you have a whole lemon in your left hand. Now squeeze it hard. Try to squeeze all the juice out. Feel the tightness in your hand and arm as you squeeze. Now drop the lemon. Notice how your muscles feel when they are relaxed. Take another lemon and squeeze it. Try to squeeze this one harder than you did the first one. That's right. Real hard. Now drop the lemon and relax. See how much better your hand and arm feel when they are relaxed. That's good. You really relaxed on that one. (Repeat the process for the right hand and arm.)
Arms and Shoulders

Pretend you are a furry, lazy cat. You want to stretch. Stretch your arms out in front of you. Raise them up high over your head. Way back. Feel the pull in your shoulders. Stretch higher. Now just let your arms drop back to your side. Good. Notice how your shoulders feel more relaxed. This time let's have a great big stretch. Try to touch the ceiling. Stretch your arms way out in front of you. Raise them way up high over your head. Push them way, way back. Notice the tension and pull in your arms and shoulders. Hold tight, now. Great. Let them drop very quickly and feel how good it is to be relaxed. It feels good and warm and lazy. Now stop, and remember how it feels to relax.

Shoulder and Neck

Now pretend you are a turtle. You're sitting out on a rock by a pond with your head out of your shell just looking around. Oh-oh! You sense danger. Pull your head into your house. Try to pull your shoulders up to your ears and push your head down into your shoulders. Hold in tight. It isn't easy to be a turtle in a shell. The danger is past now. You can come out into the warm sunshine, and once again, you can relax and feel the warm sunshine. Watch out now! More danger. Hurry, pull your head back into your house and hold it tight. Push your shoulders way up to your ears and try hard to hold tight. Don't let even a tiny piece of your head show outside your shell. Hold it. Feel the tenseness in your neck and shoulders. Okay. You can come out now. It's safe again. Relax and feel comfortable in your safety. There's no more danger. Nothing to worry about. You feel good. Remember what it feels like to relax.

Face and Nose

Here comes a pesky old fly. He has landed on your nose. Try to get him off without using your hands. That's right, wrinkle up your nose. Make as many wrinkles in your nose as you can. Scrunch your nose up real hard. Good. You've chased him away. Now you can relax your nose. Pay attention to how it feels. Oops, here he comes back again. Right back in the middle of your nose. Wrinkle up your nose again. Shoo him off. Wrinkle it up hard. Hold it just as tight as you can. Okay, he flew away, so you can stop. You can relax your face. Notice that when you wrinkled up your nose, your whole face wrinkled up too. Oh-oh! This time that old fly has come back, but this time he's on your forehead. Make lots of wrinkles. Try real hard to catch him between all those wrinkles. Hold it tight, now. Okay, you can relax now. He's gone for good. Now you can just relax. Let your face go smooth, nose wrinkles anywhere. Your face feels nice and smooth, and relaxed. Remember how it feels to relax.
Stomach

Hey! Here comes a cute baby elephant. But he's not watching where he's going. He doesn't see you lying there in the grass, and he's about to step on your stomach. Don't move. You don't have time to get out of the way. Just get ready for him. Make your stomach very hard. Tighten up your stomach muscles real tight. If he steps on you when your stomach is hard it won't hurt. Make your stomach into a rock. Okay, he's moving away so you can stop now. You can relax now. Kind of settle down, get comfortable, and relax. Notice the difference between a tight stomach and a relaxed one. That's how we want it to feel--nice and loose and relaxed. You won't believe this, but this time he's really coming your way. He's headed straight for you. Tighten up. Here he comes. Hold on tight. He's stepping on you. He's stepping over you. Now he's gone for good. You can relax completely. You're safe. Everything is okay, and you can feel nice and relaxed. Remember what it feels like to relax.

This time imagine that you want to squeeze through a narrow fence and the boards have splinters on them. You'll have to make yourself very skinny if you're going to make it through. Suck your stomach in. Try to squeeze it up against your backbone. Try to be as skinny as you can. You've got to try hard and get through that fence. Now relax. You don't have to be skinny now. Just relax and feel your stomach being warm and loose. Okay. Let's try again to get through that fence. Squeeze up your stomach. Make it touch your backbone. Get it real small and tight. Get as skinny as you can. Hold tight now. You've got to squeeze through. You did it! You got through that skinny little fence and no splinters. You can relax now. Settle back and let your stomach come back out where it belongs. You can feel really good now. You've done fine. Remember what it feels like to relax.

Legs and Feet

Now pretend that you are standing barefoot in a big, fat mud puddle. Squish your toes down deep into the mud. Try to get your feet down to the bottom of the mud puddle. You'll probably need your legs to help you push. Push down, spread your toes apart, and feel the mud squish up between your toes. Try to push real hard. Now step out of the mud puddle and stop pushing your legs. Relax your feet. Let your toes go loose and feel how nice that is. It feels good to be relaxed. Now back into the mud puddle. Squish your toes down. Let your leg muscles help push your feet down. Try to squeeze that mud puddle dray. Okay. Come back out now. Relax your feet, relax your legs, relax your toes. It feels so good to be relaxed. No tenseness anywhere. You feel kind of warm and tingly. Remember what it feels like to be relaxed.

Conclusion

In a minute I will ask you to open your eyes. But now I want you to stay as relaxed as you can. Let your whole body go limp and feel all your muscles relaxed. As you go through the day, remember how good it feels to be relaxed. Today is a good day. And you've
worked really hard. And I think that each of you know what it means to relax. But now I'm going to ask you to relax and do something different. I'm going to ask you to relax and give me as many different answers to some questions as you can. These questions may sound silly to you because they don't have any right answers or wrong answers. Now what I want you to do is to relax and give me as many different answers as you can. Okay, you may open your eyes now.

Note
On the fifth day of training, following the exercises the following instructions will be given for the second half of the Wallach-Kogan Creativity Battery: "Now I am going to give you a test. And I want you to relax to the best of your ability and to answer each question. Remember to relax."
APPENDIX I

Tension Training Script
SCRIPT FOR STUDENTS IN THE HIGH AROUSAL (TRYING HARD) CONDITION

I have a question for you today. When you try real hard to do something does it help you do it any better? Like if you wanted to roller skate very well in front of your parents, or if you wanted to win a game of checkers, do you think that if you tried real hard to do it that this would help you? What do you think? Well, I don’t really know. So today we are going to do some special kinds of exercises called “trying hard” exercises.

Now there are some rules that you must follow when we do these “trying hard” exercises. First, you must do exactly what I say, even if it seems kind of silly. Second, you must try hard to do what I say. Third, you must pay attention to your body. Throughout these exercises, pay attention to how your muscles feel. Fourth, do not practice these exercises when we are finished. Just forget about them until I return tomorrow.

Does anyone have any questions? Are you ready to begin? Okay. First, sit back in your chair, get both feet on the floor. That’s fine. Now close your eyes and don’t open them until I say to. Remember to follow my instructions very carefully, try hard, and pay attention to your body. Here we go.

Hands and Arms

Pretend you have a whole lemon in your left hand. Now squeeze it real hard. Try to squeeze all the juice out. Feel the tightness in your hand and arm as you squeeze. Okay, stop. Now take another lemon and squeeze it. Try to squeeze this one harder than you did the first one. That’s right, try real hard. Try hard to squeeze all the juice out. Don’t leave a single drop. Squeeze hard. That’s good. Now stop. You tried real hard on that one. (Repeat the process for the right hand and arm.)

Arms and Shoulders

Shoulder and Neck

Now pretend you are a turtle. You're sitting out on a rock by a pond with your head out of your shell just looking around. Oh-oh! You sense danger. Pull your head into your house. Try to pull your shoulders up to your ears and push your head down into your shoulders. Hold in tight. It isn't easy to be a turtle in a shell. You have to try hard. Okay, you can stop. Bring your head out and pretend to look around. Pull in your head. Push your shoulders way up to your ears and try hard to hold tight. Don't let even a tiny piece of your head show outside your shell. Hold it. Feel the tenseness in your neck and shoulders. Okay. You can stop now. There's no more danger. But remember what it feels like to try hard.

Face and Nose

Here comes a pesky old fly. He has landed on your nose. Try to get him off without using your hands. That's right, wrinkle up your nose. Make as many wrinkles in your nose as you can. Scrunch your nose up real hard. Good. You tried real hard and chased him away. So you can stop. Oops, here he comes back again. Right back in the middle of your nose. Wrinkle up your nose again. Shoo him off. Wrinkle it up hard. Hold it just as tight as you can. Try hard. Okay, he flew away, so you can stop. Notice that when you wrinkled up your nose, your whole face wrinkled up too. Oh-oh! This time that old fly has come back, but this time he's on your forehead. Make lots of wrinkles. Try real hard to catch him between all those wrinkles. Hold it tight, now. Okay, you can stop. He's gone for good now. But remember how it feels to try hard.

Stomach

Hey! Here comes a cute baby elephant. But he's not watching where he's going. He doesn't see you lying there in the grass, and he's about to step on your stomach. Don't move. You don't have time to get out of the way. Just get ready for him. Make your stomach very hard. Tighten up your stomach muscles real tight. Try real hard. If he steps on you when your stomach is hard it won't hurt. Make your stomach into a rock. Okay, he's moving away so you can stop. But remember how it feels to try hard with your stomach. You won't believe this, but this time he's really coming your way. He's headed straight for you. Tighten up. Try real hard. Here he comes. You've got to try hard and hold on tight. He's stepping on you. He's stepped over you. Now he's gone for good, so you can stop. But remember what it feels like to try hard.
This time imagine that you want to squeeze through a narrow fence and the boards have splinters on them. You'll have to make yourself very skinny if you're going to make it through. Suck your stomach in. Try to squeeze it up against your backbone. Try to be as skinny as you can. You've got to try hard and get through the fence. Now stop. Okay. Let's try again to get through that fence. Squeeze up your stomach. Make it touch your backbone. Get it real small and tight. Get as skinny as you can. Try hard to hold tight now. You've got to squeeze through. You did it! You got through that skinny little fence and no splinters. You can stop now. But remember what it feels like to try hard. You've done fine.

Legs and Feet

Now pretend that you are standing barefoot in a big, fat mud puddle. Squish your toes down deep into the mud. Try to get your feet down to the bottom of the mud puddle. You'll probably need your legs to help you push. Push down, spread your toes apart, and feel the mud squish up between your toes. Try to push real hard. Now step out of the mud puddle and stop pushing your legs. Now back into the mud puddle. Squish your toes down. Let your leg muscles help push your feet down. Try hard to push your feet. Try to squeeze that mud puddle dry. Okay. Come back out now. Stop pushing your legs. But remember what it feels like to try real hard.

Conclusion

In a minute I will ask you to open your eyes. Today is a good day and you've worked really hard. And I think that each of you know what it means to try hard. But now I'm going to ask you to try hard to do something different. I'm going to ask you to try hard and give me as many different answers to some questions as you can. These questions may sound silly to you because they don't have any right answers or wrong answers. Now what I want you to do is try hard and give me as many different answers as you can. Okay, you may open your eyes now.

Note

On the fifth day of training, following the exercises the following instructions will be given for the second half of the Wallach-Kogan Creativity Battery: "Now I am going to give you a test. And I want you to try real hard to answer each question to the best of your ability. Remember to try hard,
APPENDIX J

Open-ended questions used in treatment sessions and answer sheet
OPENENDED QUESTIONS USED FOLLOWING RELAXATION OR TENSION TRAINING SESSIONS

Day One

1. Tell me all of the different things that you think might happen—or that people might do if everyone in the world was blind.

2. Name all the green things you can think of.

3. Tell me all the different ways you could use a cardboard box.

4. Tell me all the ways in which a nose and an ear are alike.

5. Tell me all of the different things that you think might happen or that people might do if all of the clouds in the sky were connected to the earth by strings.

Day Two

1. Tell me all of the different things that you think Old Mother Hubbard might have done when she found out her cupboard was bare.

2. Name all the things you can think of that smell good.

3. Tell me all the different ways you could use a coat hanger.

4. Tell me all the ways in which a baseball and a football are alike.

5. Tell me all of the different things that you think might happen or that people might do if everyone in the world looked exactly alike.

Day Three

1. Tell me all of the different things that you can think of or that people might do if the sun burned out.

2. Name all the things you can think of that are very hard.

3. Tell me all the different ways you could use a tin can.

4. Tell me all the ways in which a mountain and a hill are alike.

5. Tell me all of the different things that you think might happen or that people might do if men were owned by dogs.
Day Four

1. Tell me all of the different things that you think might happen or that people might do if people could turn invisible at will.

2. Name all the things you can think of that burn easily.

3. Tell me all of the ways you could use a pencil.

4. Tell me all of the ways in which a church and a grocery store are alike.

5. Tell me all of the different things that you think might happen or that people might do if people could live forever.
Name: ________________________________

Sex:  Boy  Girl  
(Circle One)

ANSWERS

1. ________________________________

2. ________________________________

3. ________________________________

4. ________________________________

5. ________________________________
APPENDIX K

Number of students per treatment condition per school.
LI = Low Intelligence; HI = High Intelligence; IA = Low Anxiety;
HA = High Anxiety; R = Relaxation; T = Tension; C = Control

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<th>LI-IA</th>
<th></th>
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Totals   | 10    | 10    | 10    | 10    | 10    | 10    | 10    | 10    | 120    |
APPENDIX I

Pre-treatment (WKCB-1), post-treatment (WKCB-2), and adjusted treatment means (ATMs) for different levels of intelligence, treatment, gender, and anxiety.

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<td>61.9</td>
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High     | 79.4         | 79.4     | 54.9      | 65.1       | 54.9   | 65.1     |
Low      | 88.2         | 88.2     | 62.8      | 62.8       |        |          |
APPENDIX M

Pre-treatment (WKCB-1), post-treatment (WKCB-2), and adjusted treatment means (ATMs) for cells of the intelligence by treatment by gender matrix.

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