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# A study of the relationship between intelligence and creativity

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# A STUDY OF THE RELATIONSHIP BETWEEN INTELLIGENCE AND CREATIVITY

An Abstract of a Thesis

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ABSTRACT

The purpose of the present research study was twofold. The first purpose was to determine the relationship between creativity and intelligence when intelligence was assessed by a group test (CAT-V) and an individual test (WISC-R, V). The second purpose was to examine the threshold hypothesis, which states that below a critical IQ level, usually 120, the two constructs appear to be positively and moderately related. Above this level, the correlation between the two constructs lessens.

Theoretical and statistical foundations regarding the relationship between the two constructs were addressed. The theoretical model addressed divergent/convergent thinking properties. Creativity was considered a divergent thinking process; intelligence a convergent thinking process. It was postulated that the two processes represent very different skills that cannot be equally present in the same person, nor equally assessed by the same test. When testing the relationship between the two thinking processes, one would arrive at low correlations because the two processes are distinctly different types of mental production. The statistical model dealt with the methodology of the studies reviewed. Both the use of a homogeneous population and the unreliable tests used were given as possible reasons for low correlations found between the two constructs.

Seventy-three children from the fourth, fifth, and sixth grades of a parochial school in a metropolitan area in Iowa

participated in the study. The Verbal form of the WISC-R was administered to 33 of the Ss. Scores from the Verbal form of the CAT were removed from the files of 71 of the Ss. The Verbal form of the Torrance Test of Creative Thinking (TTCT) was administered to all of the Ss. The subtests of the TTCT were scored for fluency, flexibility, and originality. A Pearson $\underline{r}$ correlation matrix was used to analyze the data.

Results indicated a significant, yet low, relationship between intelligence and creativity when intelligence was measured by a group test. When intelligence was measured by an individual test, no significant relationship was determined between intelligence and creativity. Support for the threshold hypothesis was determined when data from the group intelligence test were analyzed. Data analyzed by grade level indicated that fluency, flexibility, and originality scores of the fourth graders were significantly related to both their CAT and WISC-R scores. All of the creativity scores of the sixth graders were negatively correlated with their WISC-R scores, originality significantly so.

Results from the present study suggest that the theoretical foundation may have some merit in explaining the relationship between the two constructs. Statistical considerations need to be addressed when studying the relationship between intelligence and creativity. Finally, recommendations for future research were suggested.

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# CHAPTER 1

# INTRODUCTION

Studies of the relationship between creativity and intelligence are numerous. There are some researchers who say the two are positively related (Hicks, 1980); others say there is little relationship at all (Guilford & Christensen, 1973). Still others say the degree of relationship depends on the level of IQ in the population being studied (Yamamoto, 1965). Disparate views exist concerning the relationship between creativity and intelligence. Before these are addressed further, some background needs to be presented. In the following paragraphs, a summary of the theories behind creativity and intelligence will be discussed. These theories will be expanded in Chapter 2.

Several theoretical approaches provide a variety of explanations regarding the determinants of creativity. The psychoanalytic approach views creativity as occurring from conflict and defense mechanisms, i.e. creativity represents a defense against "libidinal" energies that are a hazard to society. Environmentalists believe creativity is a natural process which grows out of a favorable climate, i.e. creativity can be increased by environmental reinforcement. The associative approach views creativity as the process of combining distant associative elements of thought, i.e. the creative individual puts ideas together that previously were not related.

Several theories of intelligence have been proposed. The views of the composition of intelligence range from a general factor to a multiple factor. The general factor theory of intelligence states that a unitary factor underlies all mental activities. The multiple factor theory of intelligence states that mental activities are composed of a variety of semi-independent factors.

The rapid increase of creativity research since the 1950's has been accompanied by an emphasis on the distinction between creativity and intelligence. Traditional intelligence tests sample tasks of convergent thinking, and many researchers have tried to demonstrate that a high IQ may be a detriment to creative achievement, which requires divergent thinking abilities (Anastasi & Schaefer, 1971). It is thought that a child with a high IQ is too locked into the convergent thinking process to be able to think divergently, or creatively. The presence of a high degree of intelligence enables a child to think convergently, but hampers any possible divergent thinking. Researchers holding that the presence of a high level of intelligence almost certifies that creative thinking abilities do not exist propose the "threshold hypothesis" that creativity involves only divergent thinking abilities and that convergent thinking abilities can be a detriment to the creative process. The hypothesis states that below a critical IQ level, usually 120, intelligence and creativity appear to be positively and moderately correlated. Above this level, the correlation between intelligence and creativity lessens (Dacey & Madaus, 1971; Edwards & Tyler, 1965; Guilford & Christensen, 1973; Schubert, 1973; Yamamoto, 1964a).

## Major Concerns in the Field

Research on the relationship between creativity and intelligence presents conflicting views as to the magnitude of that relationship. Reviewing this literature, one impression the author attained was that there were several design characteristics needing particular attention in future research. One is the need to study the impact of differing theoretical models, and another is to control for the effects of attenuated correlation coefficients as a by-product of either inadequate sample sizes, too homogeneous a sample, or inadequately designed measuring scales.

The major theoretical issue addresses divergent/convergent thinking properties, theorizing that children who are accustomed to thinking convergently cannot think divergently. The more convergent thinking properties children possess, the less divergent thinking properties they will have. Children who are used to memorizing facts, spewing out knowledge, and striving for the "correct response" will have a hard time generating ideas that are different from the norm or discovering new relationships between things. They have become so accustomed to thinking of the "right" answer, they do not allow themselves to think creatively. Hence, the relationship between creativity and intelligence will be an inverse one, producing negative correlation coefficients.

The primary statistical issue deals with the attenuation of the correlation coefficient. Yamamoto (1965) cited both the population and the unreliability of tests used as possible reasons for low correlations found between intelligence and creativity. He cited various articles in his study which discussed these factors. The problem with choice of population was dealt with by Ripple and May (1962). Their study reported that the magnitude of the relationship between measures is, in part, a function of the variability of the groups studied. If the Ss in the study achieved IQ scores in a restricted range and with reduced variability, this could lead to mistaken inferences concerning the relationship between intelligence and creativity in groups where the distribution of intelligence is more representative of a classroom. In studies investigating the relationship between intelligence and creativity, the use of a homogeneous population tends to reduce the size of the correlation coefficient.

Yamamoto (1965) cited Cureton's (1964) article to point out how well-known technical requirements had been ignored by research workers in construction and application of tests to measure creativity. The author's impression of the research published during the 1960's is that the majority of the studies used a combination of tests from different authors and theories as the measure of creativity. The tests did not correlate highly with each other, leading one to believe that they may not have been measuring the same construct.

## Statement of the Problem

The present study assessed the relationship between intelligence and creativity in a nonrandom sample of fourth, fifth, and sixth grades. The questions to be answered in the study were as follows: (a) what is the relationship between creativity and intelligence when the latter is assessed by the verbal section of the Cognitive Abilities Test, (b) what is the relationship between creativity and intelligence when the latter is assessed by the verbal section of the Wechsler Intelligence Scale for Children--Revised, and (c) will the correlation between creativity and intelligence for students with IQ's of 120 and above be lower than the correlation between creativity and intelligence for students with IQ's below 120?

## Importance of the Study

Intelligence as possessed by children has been generally defined as a score on an IQ test. This limits the concept to a single metric which places a bigger predictive burden on the concept than should be. It also restricts our thinking to believe that intelligence represents all mental abilities (Getzels & Jackson, 1962). By treating creativity as being applicable only to the arts, we limit our abilities to foster cognitive growth. If we recognize that learning involves not only memorization but also production of novelty and discovering as well as recalling, then measures of creativity also become necessary in the definition of intelligence.

By determining the relationship between creativity and intelligence, we can add to the understanding of their interaction. The study will also add to the empirical literature on the understanding of the threshold hypothesis.

## Limitations of the Study

Generalizability of the findings is restricted because of the narrow representation of socioeconomic, geographic, and racial groups in the study. Attenuation of the correlations may also occur due to homogeneity of the sample, sample size, and subtest independence. Construct validity limitations are also present as varying definitions exist for intelligence and creativity. Lacking a definitive, single definition of the two constructs leads the researcher to rely on the measuring devices used in the study as the definition of the constructs. While an operational definition is useful, the richness of meaning involved in intelligence and creativity is severely limited by the measuring device definition.

# CHAPTER 2

## REVIEW OF LITERATURE

When preparing a review of such varied and controversial topics as are both intelligence and creativity, one is forced to make choices as to which theories, definitions, and studies are to be considered major and which are to be considered minor. The major positions and studies chosen by the author are presented in this chapter; the minor positions are not presented at all. The reader then should be aware that humanistic, cognitive-developmental, and holistic theories of creativity have not been presented because they do not as directly relate to the design of the study as do the positions presented. Similarly, the genetic endowment, the single factor, and the environmental aspects of some of the interactive models of intelligence are either not presented at all or are not discussed at any length.

Varying definitions and constructs are available for the terms creativity and intelligence. Intelligence can be viewed as the presence of high grades in school, high scores on tests, achievements attained, verbal ability, the ability to manipulate objects to construct figures, or any number of other observable criteria. Some of the literature reviewed even defined intelligence as a score on a test purported to measure that construct. Creativity can be viewed as a musical composition, a painting critically acclaimed, an outstanding novel, a Nobel Peace Prize winner, a social change agent, a scientific breakthrough, an outstanding entertainer, or any number of other occurrences. Again, some of the literature reviewed defined creativity as a score on a test purported to measure that construct.

Since the purpose of the present study was to explore the magnitude of the relationship between intelligence and creativity, it was necessary to explore the theories of each and the measures used for each. The theories have frequently defined the measures to be used, but the converse has also been true. The reader will find the literature presented in the following sequence: Theories of Creativity, Theories of Intelligence, Theoretical Relationship Between Creativity and Intelligence, Research Relationship Between Creativity and Intelligence, The Threshold Hypothesis, and Statistical Foundations. In sections dealing with the research relationship between creativity and intelligence, the research was organized according to the creativity test batteries used to determine the relationship between the two concepts. The studies were organized historically.

## Theories of Creativity

### Psychoanalytic

Freud saw creativity as arising from conflict at a young age and representing a defense against "libidinal" energies injurious to society (Bloomberg, 1973). Creativity was a behavioral manifestation of sublimation, the unconscious process through which an individual directs his sexual or aggressive energies into culturally approved behaviors. The creative person partially abandons reality for fantasy to provide an outlet for his unconscious energies. Creativity, in part, meant a continuation of play from childhood (Bloomberg, 1973).

Other psychoanalytic explanations of creativity have been offered; according to Bloomberg, the most significant being those of Kris (1952) and Schafer (1958), who form a concept called "regression in the service of the ego." The statement refers to the ego's suspensions of control over the flow into awareness of unconscious elements which are then molded into creative behavior. Creative behavior is seen as having two integral features: the uninhibited expression of previously unconscious memories, fantasies, and impulses together with the rational control to mobilize them in the original solution to a problem (Bloomberg, 1973). The ego uses irrational thinking to play a constructive role in problem solving. Creativity becomes a vehicle for coping with impulses which otherwise might culminate in neurosis.

A third view is held by Kubie (1958), a contemporary psychoanalyst. He denies the supremacy of the id over creativity and assigns that duty to the preconscious symbolic, which is the essential implement of all creativity. Unless the preconscious processes can flow freely, creativity cannot occur. Because of the need for free-flowing ideas, Kubie rejects sublimination as being involved with creativity. Sublimation involves a non-creative id, which represents overpowering, repetitive drives and does not allow the necessary freedom to be creative. The preconscious processes do not operate alone, being under the influence of two other systems of symbolic functions. At one end are the symbolic processes of the conscious, meaning that the relationship between symbol and its meaning are knowable. At the other end are the symbolic processes called the unconscious, meaning that although the symbol is known, what it stands for is unknown and inaccessible.

Conscious symbolic processes perceive past external and internal experiences, abstracting their symbolic representations into words, which produce reality. This production of reality is essential to the major function of the conscious system, yet it limits the imagination and free play of the conscious symbolic processes. Unconscious symbolic processes impair and distort the relationship of the symbol to what it represents, not allowing conscious or preconscious experiences to penetrate. This results in a rigid relation of the symbol to what it represents, even more so than in the conscious system. The influence of this rigidity can be seen in stereotyped and repeated forms of works of art. The artist's unconscious is leaving a personal mark on his or her work, being unchangeable and therefore non-creative.

Because of this symbol-representation rigidity, the free-play of preconscious symbolic processes is very important to creative productivity. It operates in between the conscious and unconscious symbolic processes. Preconscious symbol-representation receives the symbol and allows for modifying and shaping a new, creative meaning.

Environmental

Proponents of this theory seek to specify the situational antecedents related to creativity, believing that it is a natural process growing out of a favorable climate. Because of their belief, they make systematic attempts to isolate the important variables in a climate, reinforcing the variables in order to produce more creative behavior. Torrance, a leading environmentalist, holds the belief that the level of creativity can be raised by reinforcement from the environment (Bloomberg, 1973). More emphasis is placed on outer controls (environment) than inner controls (desire or ability).

Associative

Mednick's associative approach regards creativity as the process of combining mutually distant associative elements of thought (Bloomberg, 1973). The creative individual solves problems by putting together ideas not previously related to each other. The theory borrows from stimulus-response psychology the principle of temporal contiguity. This principle states that associations close together in time tend to be learned. Thus creativity is defined as the arrangement of temporally adjacent associations to a given stimulus; the distribution of an individual association around ideas.

Mednick calls the distribution the association hierarchy of responses which assumes distinctive contours. A peaked hierarchy exists when many stereotyped responses are available but unique responses are infrequent. A level hierarchy exists when there is no sharp difference in the relative availability of the two classes of associations. In a short period of time, a peaked hierarchy should yield a greater number of stereotyped responses, while a level hierarchy should produce a greater combined quantity of common and rare responses over a longer period of time. The associative approach presumes creativity is dependent on a balanced associational system. An individual whose associational hierarchy is flat rather than steep continues to make associations after stereotyped responses have ended. During this time, there is a greater chance that creativity will occur.

To Mednick, the creative process consists of the forming of associative elements into new combinations (Riegel, 1966). Thus, a person with creative ability should have a large number of associative responses available, with a flat rather than peaked distribution. Mednick (1962) stated three ways of achieving a creative solution in terms of associative theory. The following are methods of bringing the required associative elements together: serendipity, similarity, and mediation. Serendipity is an "accidental" appearance of stimuli which elicits associative elements. Many creative discoveries have occurred in this manner. Another mode of creative response occurs as a result of the similarity of the associative elements or stimuli eliciting them. This mode of creativity could be encountered in creative writing utilizing rhyme, homonyms, or rhythm. The final method of evoking creative responses, according to Mednick, is mediation. This is the bringing together of common elements and is very important in areas where use and knowledge of symbols is required.

Factorial

Factorial theorists conceptualize creativity as being a function of separate intellective factors, each of which can be isolated through appropriate statistical analyses. Usually, a test battery is administered to a large sample of Ss and the resulting data factor analyzed, determining which test operations load on a specific factor.

Guilford is a leading proponent of the factorial theory. He is best known for his attempts to factor-analyze the intellect, discovering 120 separate factors he feels compose the structure-of-intellect. As his model postulates that intelligence is made of primary and independent abilities, the same holds for creativity. Guilford's test results seem to support his idea that creativity is not a unitary but rather a collection of different components (Guilford, 1957). Also, the creative factors found in artists will be different from those found in scientists, technologists, and managers.

To Guilford, the use of a factorial approach in the study of creativity is the most defensible way of discovering dependable trait concepts (Golann, 1963). The factorial traits he believes to be related to creativity are ability to see problems, fluency of thinking, flexibility of thinking, originality, redefinition, and elaboration.

## Theories of Intelligence

### Two Factor

One of the early proponents of a factor analytic approach to intelligence was Charles E. Spearman. Spearman (1927) proposed a two-factor theory to account for the correlation among tests of intelligence. His interpretation of tables of intercorrelations of intelligence tests was that there was a general intelligence, which he termed _g_ (Matarazzo, 1972). _G_ was a unitary, underlying causal factor which revealed itself in all cognitive activities. In addition to _g_, numerous specific factors (_s_) were acknowledged. These _s_ factors were specific to a single activity. Any intellectual activity, Spearman theorized, involved both a general factor, which it shared with all other intellectual activities, and a specific factor, which it shared with none (Sattler, 1982).

### Multiple Factors

Edward L. Thorndike believed intelligence was a product of a large number of interconnected intellectual abilities, each of which represented a distinct ability (Sattler, 1982). These mental activities had common elements and could be combined to form clusters. Thorndike (1927) identified three such clusters as social, concrete, and abstract. The social cluster identified the ability to deal with people, the concrete cluster identified the ability to deal with things, and the abstract cluster identified the ability to deal with verbal and mathematical symbols.

L. L. Thurstone's view of intelligence was the most divergent from Spearman's. Thurstone (1938) believed intelligence could not be regarded as a unitary thing. He replaced the general factor g with several group factors called primary mental abilities. The factors included the following: verbal meaning, number facility, inductive reasoning and perceptual speed, spatial relations, memory, and verbal fluency (Thurstone, 1938). These factors were constructed into a battery of tests called the Primary Mental Abilities Test. While Thurstone's multidimensional theory first eliminated g as a significant component of intellectual functioning, the primary factors were found to correlate moderately among themselves, leading Thurstone to acknowledge that g did exist (Sattler, 1982).

One of the most prominent multifactor theorists is J. P. Guilford. He developed a structure-of-intellect (SI) model which consisted of three dimensions: operation, content, and product (Guilford, 1967). Intellectual activity could be understood by the mental operations performed, the type of content on which the operation was built, and the resultant product. Five different kinds of operations were proposed by the model (cognition, memory, divergent thinking, convergent thinking, and evaluation), four types of contents (figural, symbolic, semantic, and behavioral), and six products (units, classes, relations, systems, transformations, and implications). One hundred twenty factors are thus postulated.

## Other Theories

John Horn and Raymond B. Cattell have provided another theory of intelligence. They hold that there are two types of intelligence: fluid and crystallized (Horn & Cattell, 1966). Fluid intelligence reflects biological inheritance, nonverbal, and culture-free mental efficiency. Crystallized intelligence reflects acquired skills and knowledge that are strongly dependent on exposure to culture for their development.

Jensen (1970) has proposed two classes of intelligence: associative (Level I) and cognitive (Level II). Associative abilities involve rote learning and short-term memory. Cognitive abilities involve abstract reasoning and problem-solving skills.

## Summary

The preceding pages have provided a background description of creativity and intelligence by presenting the major theories for each. The theories are important to the research of the relationships between the two concepts because test authors construct their batteries according to such theories. Because a difference in theories exists, a difference in batteries will exist. This difference could lead to a possible reason for the varying magnitudes of reported coefficients when intelligence and creativity are correlated. In the following pages, other possible reasons for the varying magnitudes of relationship between creativity and intelligence will also be discussed.

## Theoretical Relationships Between Creativity and Intelligence

In past years, it has been suggested that there is a unique aspect of functioning not sampled by conventional intelligence tests (Cropley, 1966). The aspect has been termed "creativity" and is defined by tests which involve the capacity to think of new responses and ideas, instead of reproducing previously learned information. These are tests of divergent thinking. The aspect of creativity is not sampled by conventional IQ tests, because these are tests of convergent thinking which do not allow for the expression of novel ideas.

J. P. Guilford has repeatedly stressed the differentiation between the two types of thinking. His view is that creative potential is part of intelligence, when intelligence is conceived broadly as in the structure-of-intellect (SI) model (Guilford & Christensen, 1973). Within the SI model, IQ represents only abilities dealing with cognition. This differs from creativity, which deals with divergent production operation. From Guilford's view, the problem of determining the relationship between creativity and intelligence concerns the relation of divergent production abilities to cognitive abilities.

The concept of the relationship of divergent thinking to convergent thinking is central to the theoretical foundation of testing the relationship between creativity and intelligence. The issue theorizes that children who are used to thinking convergently cannot think divergently. The more children are "locked into" convergent thinking, the less they will be able to exhibit divergent thinking abilities. The children have become so accustomed to memorizing facts and striving for the "correct response" that they cannot allow themselves to think creatively and generate uncommon ideas.

Guilford and Christensen (1973) feel that intelligence and creativity are slightly related when the two variables are thought of in terms of the SI model. The SI model portrays intelligence as consisting of four content areas: figural, symbolic, semantic, and behavioral. The content areas represent distinct basic categories of intelligence. Figural represents non-verbal intelligence. Verbal intelligence is represented by the semantic content. Intelligence involving letters and numbers is depicted by the symbolic content. The behavioral content area refers to a "social intelligence," the ability to draw inferences from a person's behavior. Each content area consists of operations relating to cognition, memory, divergent production, convergent production, and evaluation. Each of these operations is divided into products of units, classes, relations, systems, transformations, and implications.

In the SI model, divergent production operations are relatively independent of cognition operations. Intercorrelations between tests of these two categories are also low. Guilford (1967) concludes that because IQ tests emphasize cognition abilities, a low correlation between divergent production (DP) test scores and IQ will be found.

The rationale for the theoretical foundation becomes apparent. Intelligence, as Guilford structured it, is composed of four content areas. Each of these may be composed of five operations, one of which is divergent production. Divergent production forms a small part of the 120 presently identified facets of intelligence. It does not comprise a large part of cognitive abilities. The relation of divergent production abilities to cognitive abilities is small. Cognitive abilities are measured by IQ tests which are tests of convergent thinking, because they do not allow for the expression of novel ideas. As stated earlier, Guilford felt the problem of determining the relationship between creativity and intelligence concerns the relation of divergent production abilities to cognitive abilities. Since divergent production factors are relatively independent of cognition factors and since IQ tests stress cognition abilities, a low correlation will exist between DP test scores and IQ.

Guilford is the major proponent of the theoretical foundation, stressing a distinction between the convergent and divergent production abilities. Rekdal (1977) agreed with Guilford's distinction, stating that IQ tests stressed convergent thinking abilities and creativity required divergent thinking abilities. Another viewpoint stressing the distinction between convergent and divergent production abilities has been formulated using creative problem-solving models. These models grew out of the research of Guilford's work (Feldhusen & Guthrie, 1979).

Guilford and his associates have concluded there is not a single problem-solving ability, but rather a number of abilities involved in the complex process. From factor analytic studies, they have concluded that the following abilities are the major cognitive functions involved in problem solving: (a) thinking rapidly of several characteristics of an object or situation, (b) classifying objects or ideas, (c) perceiving relationships, (d) thinking of alternative outcomes, (e) listing characteristics of a goal, and (f) producing logical solutions (Guilford & Hoepfer, 1971). Feldhusen and Treffinger (1977) have combined creativity and problem solving into a single concept. By reviewing the six cognitive functions, it can be seen that fluency, flexibility, and originality are components of problem-solving behavior.

Problem-solving behavior can be defined as a new combination of existing ideas (Davis, 1973). This definition has several helpful implications. First, considering a solution to be a rearrangement of existing ideas is more meaningful than attributing the solution to insight or the unconscious. Second, the definition of a problem solution as a unique combination of ideas leads to a translation of the theory into the training of creative problem solving. Third, the definition is generalizable across many different situations (Davis, 1973).

The actual stages of problem solving vary according to each author. Problem solving requires that a person become aware of the problem, then proceed to solve it (Davis, 1973). The best known stages of problem solving are as follows: (a) preparation, composed of clarifying and defining the problem coupled with the gathering of pertinent information; (b) incubation, a period of unconscious mental activity; (c) inspiration, the "Aha!" experience; and (d) verification, the checking of a solution (Wallas, 1926).

Guilford and his associates view problem solving as being composed of five phases which are not clear-cut and, at times, overlap. The phases are as follows: (a) preparation, (b) analysis, (c) production, (d) verification, and (e) reapplication (Merrifield, Guilford, Christensen, & Frick, 1962). The preparation phase is where the problem occurs and is perceived as such. A motivational aspect is involved in this phase. In the analysis phase, the solver receives and develops information concerning the present situation and the potential situation achieved when the problem is solved. Alternative solutions are generated in the production phase. Better perceptions of the two situations are determined. Models and goals are set to bring the two situations closer together. A tentative solution is reached. The verification phase can lead to acceptance or rejection of the tentative solution, based on the solver's standards of success. If the solution is accepted, the problem is solved. If the solution is rejected, the solver moves into the final phase--reapplication. This involves backtracking to previous stages, reworking through the model, and arriving at another tentative solution. This phase may occur any number of times (Merrifield et al., 1962).

Creative problem solving involves the ability to assess a situation and produce many possible ideas or solutions. The potential solver must use a range of creative, conceptual, and logical thinking abilities to produce a number of possible solutions. The solver's divergent thinking abilities allow him to do this. Creative problem solving is divergent thinking. The solver cannot arrive at or test many possible solutions if he is thinking convergently and looking for the one "correct" response.

Because of the distinction between the type of thinking involved in creative production/creative problem solving and intelligence, intelligence tests cannot adequately assess creative potential and any attempt at correlating the two variables will result in a low relationship. Smillie (Torrance, 1962) claimed the limited notions of intelligence represented by the Stanford-Binet and Wechsler scales conceal the creative qualities of people who do not fit the patterns measured on the tests. McNeil (1960) argued that if the process of creativity requires divergent production, then it must be concluded that true creativity and conformity (as measured by tests of convergent thinking) are opposite and should not be measured by a single test.

Summary

In summary, the theoretical foundation is central to the testing of the relationship between creativity and intelligence. The two variables are said to be represented by two distinctive types of thinking, divergent production and convergent production. To Guilford, the major proponent of the theory, creativity is slightly related to intelligence when the latter is thought of as in the SI model. One will arrive at low correlations when testing the relationship between the two variables, because the two variables are distinctly different types of mental production. Intelligence tests cannot assess creative thinking abilities because they are tests of convergent thinking and do not allow for divergent responses. This view was also supported by the work of Feldhusen, Treffinger, and Davis. Intelligence tests do not allow for utilization of creative problem-solving skills, as they test only convergent thinking processes.

## Research Relationship Between Creativity and Intelligence

The following sections will be concerned with review of the literature regarding the relationship between creativity and intelligence. They will be organized according to the various creativity test batteries used to assess the relationship. Each section will be organized historically. The relationship between the two concepts will be discussed according to the coefficients determined with batteries by Guilford, Getzels and Jackson, Torrance, Wallach and Kogan, and a combination of various tests and authors.

Guilford Battery

The degree of the relationship between divergent thinking abilities and convergent thinking abilities has been the subject of investigation. Recognition of the absence of divergent-production tasks from traditional intelligence tests has driven some researchers to prove that a high IQ does not imply high creativity. Three hundred eighth graders were the Ss in a study by Seitz (1964). Intelligence was measured by the Kuhlman-Anderson. The mean IQ for the Ss was 105. Creativity was assessed by a Guilford battery consisting of the following six tests: Word Fluency, Ideational Fluency, Expressional Fluency, Associational Fluency, Consequences, and Alternate Uses. The correlation between creativity and intelligence was reported to be .56, which appeared to be a significant correlation.

Klausmeier (1965) set out to determine the effect of IQ upon performance on divergent thinking tests. The Ss were 240 seventh-grade students attending five public junior high schools. Intelligence was measured by the Otis Quick-Scoring Mental Ability Test. These scores were used to divide the Ss into three groups: low IQ, 71-95; average IQ, 96-114; and high IQ, 115-141. Creativity was assessed by Klausmeier with a battery of seven tests adapted from Guilford, Kettner, and Christensen. The tests were entitled: Object Uses, Word Uses, Plot Titles, Expressional Fluency, Plot Questions, Object Improvement, and Sentence Improvement. The results show the rank order of mean scores on all tests of divergent thinking to be identical to those of the IQ groups. The Ss in the low IQ group were also those who scored low on the creativity battery. The same relationship applied for the average and the high IQ groups. A two-way, IQ level by sex, analysis of variance was computed for the scores on each measure. This analysis was used to test differences due to IQ level and sex. All of the subtests, except Plot Titles, were significantly related to IQ at the .05 level. The following F-ratios were reported: Object Uses, fluency, 5.74; Object Uses, flexibility, 56.94; Word Uses, flexibility, 77.35; Plot Titles, cleverness, 74.39; Expressional Fluency, 94.09; Plot Questions, 36.1; Object Improvement, 16.54; and Sentence Improvement, 45.22.

A significant correlation between the two variables was found in a study by Anastasi and Schaefer (1971). Subjects were 989 students in grades 10 through 12 of a New York metropolitan area. Intelligence was assessed by the Pintner General Abilities Tests and the Otis Quick-Scoring Mental Ability Test. Creativity was measured by Guilford's tests of Alternate Uses and Consequences. Results showed the following correlations between IQ and creativity: Alternate Uses, .274, and Consequences, .103 ($p < .01$). The two creativity tests correlated with each other only .31. The authors caution that because the use of different intelligence tests introduced random error, the correlations between the two variables would be lowered and represented a conservative estimate.

A study by Guilford and Christensen (1973) assessed the relationship between the two variables within the SI model. Four hundred thirty-five upper elementary students from two schools were the Ss. IQ was assessed by the Lorge-Thorndike Test in School 1 and by parts of the Stanford Achievement Test and Comprehensive Tests of Basic Skills in School 2. The sections used in the latter two tests were Word Meaning, Paragraph Meaning, and Arithmetic Concepts. The "gifted" children (those having an IQ over 130) were removed from the groups. Creativity was measured by a battery of tests formulated by Guilford, consisting of the following subtests: Names of Stories, What to do with It, Similar Meanings, Writing Sentences, Kinds of People, Making Something Out of It, Different Letter Groups, Making Objects, Hidden Letters, and Adding Decorations. Results show these 10 creativity tests correlated with IQ from .07 to .43 with the mean correlation being .25. All of the subtests, with the exception of Different Letter Groups, were significantly related to IQ (significance level was not reported). The following coefficients were reported: Names of Stories, .26; What to do with It, .24; Similar Meanings, .35; Writing Sentences, .27; Kinds of People, .31; Making Something Out of It, .19; Making Objects, .17; Hidden Letters, .43; and Adding Decorations, .07.

In summarizing the previous studies, when Guilford constructed his test battery, he wanted to assess divergent production abilities. He feels these abilities cannot be measured by intelligence tests because they measure convergent production abilities. Therefore, a low correlation should be found when correlating his battery with tests of intelligence. Generally, this was the case with the reported correlations ranging from .07 to .56.

Getzels and Jackson Battery

Getzels and Jackson have long been proponents of expanding the definition of giftedness to include the concept of creativity. This has not been easy. Usually, "gifted" meant a person with a high IQ, one who did well on an intelligence test. This psychometric definition can cause confusion and error (Getzels & Jackson, 1958). First, there is the limitation of that single number, which does not possess as great a predictive ability as some would like to believe. Second, this definition causes us to become blind to other types of "giftedness" such as the performing arts or literary talent. The authors wondered whether the heavy reliance on intelligence tests as depicting accurately the concept of intelligence was impeding the progress of understanding gifted children. They felt other qualities representing giftedness, yet not sampled by intelligence tests, existed. Creativity was one of these qualities. However, most studies assumed creativity and giftedness to be so highly correlated that if a student were very intelligent, he or she would also be very creative (Getzels & Jackson, 1958). Therefore, there was no need to include a separate concept of creativity in the definition of intelligence. There certainly was no need to measure creativity separately for inclusion into gifted programs, because the creative children would be "picked up" through the measure of intelligence by the IQ test. Torrance (1959) would vehemently disagree with this thought. He stated that regardless of the IQ measure used, about 70% of the Ss scoring in the top 20% on a creativity measure would have been excluded from gifted groups selected only on the basis of IQ. The statement by Torrance, along with assumptions made regarding the relationship between creativity and intelligence, revealed many questions which needed to be answered through research. Getzels and Jackson provided some research when they conducted the following study which concerned the relationship between the two concepts.

A Midwestern private school in Chicago was chosen as a setting for the study (Getzels & Jackson, 1962). The major effort was directed toward four groups of gifted children representing creativity, intelligence, morality, and psychological adjustment. The focus of the study was on the following: (a) the identification of two groups of students exhibiting a different type of cognitive excellence--one high in intelligence but not creativity, the other high in creativity but not intelligence; (b) the identification of two groups of students exhibiting a different type of psychosocial excellence--one high in morality but not psychological adjustment, the other high in psychological adjustment but not morality; and (c) the intensive study of each pair of groups. The following discussion will be concerned only with the findings regarding the creative and intelligent groups. Subjects were 449 students, grades 6-12. The IQ range was 108-179, with a mean IQ of 132. The two experimental groups, students scoring high on one variable but not the other, were formed on the basis of the intelligence and creativity instruments. Intelligence was assessed by the Henmon-Nelson or Binet, with a dozen scores derived from the WISC. Creativity was measured by the students' abilities to deal inventively with verbal and numerical symbol systems and with object-space relations. There were five creativity measures: Word Association, Uses for Things, Hidden Shapes, Tables, and Make-up Problems. Results show the following correlation coefficients between intelligence and the creativity subtests: Word Association, .37; Uses for Things, .17; Hidden Shapes, .33; Tables, .12; and Make-up Problems, .32. The authors caution that this sample is very homogeneous with a high mean IQ, and some of the attenuation may be due to this.

A summarization of the study by Getzels and Jackson revealed it was the first of its magnitude to consider the relationship between creativity and intelligence. The authors voiced disagreement with the idea that creative children will be admitted to a gifted program on the basis of an IQ test only, simply because of the notion that creativity is highly correlated with intelligence. The results of their study, showing a low relationship between the two variables, provided a basis to question that notion.

### Torrance Battery

E. Paul Torrance has done extensive work on the creative-thinking process and its relationship to intelligence. He has consistently obtained small but positive, and at times statistically significant relationships between the two variables (Torrance, 1967). The relationship has been higher for girls than boys, for the lower half or lower quarter of the intelligence range than for the upper half or upper quarter, for verbal than for figural measures, and for fluency than for originality (Torrance, 1967).

A tabulation was made of the 178 studies to date (Torrance, 1967) that reported product-moment correlation coefficients between measures of intelligence and the Minnesota Tests of Creative Thinking or the Torrance Tests of Creative Thinking. A median correlation coefficient of .20 was determined for these 178 studies, with a range of -.30-.60. The median of 88 coefficients between intelligence and verbal creativity is .21, and the median of 114 coefficients of correlations between intelligence and figural creativity is .06. In the following paragraphs, some studies will be presented which utilized a Torrance battery to determine the relationship between creativity and intelligence.

Two populations of students provided data for a study by Yamamoto (1964a). In each population, those in the top 20% of creative thinking were identified and further divided into three groups based on their IQ scores. The IQ points of 120 and 135 were chosen as cutoffs for this classification. This IQ distinction was used in a correlation study with an achievement variable, not the creativity variable. For both populations, intelligence was assessed by the Lorge-Thorndike. Creativity was assessed by the Test of Imagination and the Ask-and-Guess Test. The first group consisted of 272 Minnesota high school students, grades 9-12.

From this group, 54 students were identified as highly creative and divided into the three IQ groups. A statistically significant correlation was found between the two variables for the total population ($r = .30$, $p < .01$). A breakdown by grades revealed only the tenth grade achieving a significant relationship ($r = .56$, $p < .01$). The second group of students consisted of 461 fifth graders, also from Minnesota. From these pupils, 124 were identified as highly creative and further classified into the three levels of intelligence. Another significant correlation was determined between the two variables ($r = .14$, $p < .01$).

Another study directed by Yamamoto (1964b) correlated some subtests from the TTCT with intelligence. The 272 high school students mentioned in the previous study served as Ss again for this study. His purpose was to obtain more information regarding the relationship between intelligence and creative thinking. Subjects were divided into groups as follows: (a) high intelligence group--Ss ranking in the upper 20% on IQ but not creativity; (b) high creativity group--Ss ranking in the upper 20% on creativity but not IQ; and (c) high intelligence-creativity group--Ss scoring in the upper 20% on both IQ and creativity. Intelligence was assessed by the Lorge-Thorndike Intelligence Test (Verbal Battery). The Test of Imagination and Ask-and-Guess Test, scored for Fluency, Flexibility, Adequacy, Cleverness, Inventive Level, and Constructiveness, served as the measure of creativity. Results show the correlation between the two variables in the general population to be significant ($r = .30$, $p < .01$). The correlations between creativity and all of the three groups were not significant.

Yamamoto (1965) directed another study concerned with the relationship between the two variables, this time involving elementary students. Subjects were 1,288 fifth graders from two separate school systems. School System A consisted of six schools in a suburban area of Minnesota. School System B consisted of 10 schools from a mid-sized industrial city in Ohio. In both systems, intelligence was assessed by the Lorge-Thorndike and creativity by the Ask-and-Guess Test and Test of Imagination. In each system, the Ss were divided into five subgroups according to their IQ: (a) 89 or below, (b) 90-110, (c) 111-130, (d) 131 and above, and (e) full-range IQ, an unselected group. Within each subgroup, 38 Ss were randomly selected, with all subsequent analyses based on these samples. Results show the only correlations to be significant were the unselected group of full-range IQ's from both schools. In School System A, the correlation was .33 ($p < .05$); and for School System B, the correlation was .39 ($p < .05$).

Dacey and Madaus (1971) conducted a study on two separate samples of Ss designated Eastern and Midwestern. Subjects in the Eastern sample were 867 eighth graders enrolled in 23 junior high schools in New York, New Jersey, and Pennsylvania. The IQ test used in this sample was the Lorge-Thorndike Intelligence Test. Scores from this test were used to divide the Ss into three groups:

low IQ, 85-104; middle IQ, 105-124; and high IQ, 125-144. Creativity was assessed by four of Torrance's subtests: Imagination, Asking Questions, Guessing Causes, and Guessing Consequences. Results show the correlation between the two variables for the entire population to be .26 ($p < .05$). Correlations achieved for the low and middle IQ groups were .16 and .17, both significant at the .05 level. The correlation obtained between creativity and the high IQ group was not significant.

The Midwestern sample consisted of 583 high school freshmen and sophomores from Chicago. The School and College Ability Test (SCAT) served as the measure of intelligence. Creativity was assessed by summing scores from four subtests of the Minnesota Tests of Creative Thinking. Results did not determine any significant relationship between creativity and intelligence, either for the total population or the three IQ groups.

The final study cited was conducted by Hicks (1980). Her purpose was to investigate the relationship between IQ and creativity. Subjects were 23 fourth graders from a middle-income, suburban school district. They were members of the same heterogeneously grouped, self-contained class. Creativity was assessed by the TTCT. Verbal Form A served as the pretest, Form B as the posttest. Scores were obtained in terms of fluency, flexibility, and originality. These Ss participated in eight weeks of creative thinking activities designed to stimulate fluency, flexibility, and originality. Intelligence was assessed by the Lorge-Thorndike.

Results showed the following correlations between IQ and creativity variables on the pretest: fluency, .59; flexibility, .49; and originality, .81. All coefficients were significant at the .05 level.

A summarization of the previous research revealed that numerous studies have been conducted correlating a creativity battery authored by Torrance with intelligence. Batteries used have been the Minnesota Tests of Creative Thinking or the Torrance Tests of Creative Thinking. Generally, the relationship between intelligence and verbal creativity appears to be .21. A coefficient of .06 was reported to be the relationship between figural creativity and intelligence. Overall, the median correlation between creativity, as measured by a Torrance battery, and intelligence was reported to be .20.

Wallach and Kogan Battery

Wallach and Kogan (1965) conducted a study involving 151 fifth graders in a New England public school. The study was quite elaborate, extending over a seven-week time period. The children were observed in their classrooms for two weeks so they would become comfortable with the examiners' presence. The next five weeks involved administration of the tests. Most of these were administered in a game-like setting. Creativity was assessed by five tests scored for number of responses and uniqueness. The tests used were Instances, Alternate Uses, Similarities, Pattern Meanings, and Line Meanings; each scored for uniqueness and number.

Ten instruments were used to assess intelligence. These included the following: the Vocabulary, Picture Arrangement, and Block Design subtests of the WISC; the verbal and quantitative tests of the School and College Ability Tests; and the mathematics, science, social studies, reading, and writing subtests of the Sequential Tests of Educational Progress (STEP). The average correlation between the 10 measures of creativity and the 10 measures of intelligence was .09, with a range of -.13-.23.

Some of the reported coefficients were significant at the .05 level, with values ranging from .16 to .23. The significant relationships occurred between Instances-number with the Picture Arrangement subtest of the WISC, and the science and social studies subtests of the STEP; Alternate Uses-number with the Verbal SCAT, and the math, social studies, and writing subtests of the STEP; Similarities-number with the Vocabulary subtest of the WISC, the Verbal SCAT, and the math, science, and social studies subtests of the STEP; and Line Meanings-uniqueness with all measures of intelligence, excluding the Block Design subtest of the WISC. The authors felt their results showed the ability to generate many cognitive associates that are unique and independent of the realm of general intelligence. The ability of a child to display creativity has little to do with whether or not he/she does well on intelligence tests.

McKinney and Foreman (1977) conducted a study to determine the factor composition of the Wallach and Kogan creativity tests (three verbal and two figural) compared to that of the Primary Mental Abilities Test. Subjects were 129 second graders with an average PMA IQ of 102. The average correlation between the measurement of creativity and IQ was not significant, allowing the authors to assert the position that creativity as measured by the Wallach and Kogan battery involved abilities independent of abilities measured on intelligence tests.

If intelligence and creativity are slightly related, what effect will this have on Ss' enhancement of creative responses? Griffith and Clark (1981) hypothesized that verbal reinforcement paired with instructions to respond creatively would be more effective in increasing creative responses than would simple practice or instructions and that the more intelligent Ss would benefit more than the less intelligent students. Subjects were 82 sixth graders from four separate classrooms in Ohio. They were relatively low in creative ability as measured on a pretest. Creativity was measured by the Wallach and Kogan battery consisting of the following subtests: Alternate Uses, Similarities, Instances, Pattern Meanings, and Line Meanings. Intelligence was measured by the California Mental Maturity Scale. The authors' first hypothesis was supported. Subjects verbally praised for creative responses increased those responses. The second hypothesis was not supported. However, the main effect of intelligence was significant for both the number and percent of unique responses made. An analysis of variance was conducted with number of unique responses as the dependent variable.

Intelligence had a significant effect on the number of unique responses produced ($F = 9.5$, $p < .005$). The same analysis of variance also produced a significant effect between intelligence and percent of unique responses produced ($F = 7.89$, $p < .01$). The authors state the results suggest that intelligence has an important impact on some aspects of creativity.

A summarization of the three previous studies revealed differing results. Two of the studies determined a significant relationship between intelligence and creativity as measured by a Wallach and Kogan battery. The other study determined a non-significant relationship between the two constructs.

## Combination of Batteries

In the preceding pages, the relationship between intelligence and creativity has been discussed, with creativity being assessed by batteries constructed by Guilford, Getzels and Jackson, Torrance, and Wallach and Kogan. These were the batteries used in a large percentage of the research reviewed. However, they were not the only assessment of creativity cited in research. Other research included a combination of various tests. The following pages will review research examining the relationship between intelligence and creativity when the latter is assessed by a combination of batteries.

Because of the questions raised by research regarding the relationship between creativity and intelligence, researchers wondered if two separate factors were involved. Cropley (1966) conducted a study to determine if a special factor was needed to account for results obtained with divergent production tests and to what extent this factor was independent of those factors underlying tests of convergent thinking. The sample of Ss consisted of 320 seventh graders in Canada. Convergent production was assessed by the Lorge-Thorndike. Divergent production was assessed by tests authored by French, Torrance, and Mednick. A significant correlation between the convergent and divergent factor was found to be .52 (significance level not reported). The author interpreted this to suggest it would be wrong to argue either that convergent and divergent thinking cannot be distinguished from each other factorially or that they are completely independent of each other. It seemed possible to compile a set of data that will measure divergent thinking, yet also measure factors underlying convergent tests.

A substantial correlation between intelligence and creativity was obtained in a study by Kazelskis, Jenkins, and Lingle (1972). The Lorge-Thorndike was selected to provide the measure of intelligence. A combination of tests provided the measure of creativity. Two scales from Torrance, three from Getzels and Jackson, and all the scales from Wallach and Kogan were used. The average correlation among the creativity measures was .38. The sample consisted of 111 tenth and eleventh graders from a rural Mississippi high school. The mean IQ on the verbal scale was 82 and 84 on the non-verbal scale. Factor analysis produced three separate factors: intelligence; "traditional creativity," which was composed of the Torrance and Getzels and Jackson subtests; and creativity as measured by the Wallach and Kogan battery. The correlation between intelligence and traditional creativity was .66; between intelligence and creativity assessed by the Wallach and Kogan battery, .33. The authors suggested that these results indicated that creativity is substantially correlated with intelligence and that the correlation can be reduced by redefining the creativity construct, as Wallach and Kogan did.

Houtz, Rosenfield, and Tetenbaum (1978) conducted their study to demonstrate the need for creativity and problem-solving training for gifted children. A wide variety of tasks representing different conceptual states in the creative thinking process were used. It was felt that if gifted children demonstrated strengths and weaknesses across these tasks instead of consistently scoring high, the need for training in these areas would be supported. Subjects were 233 New York City children in grades two through six. Intelligence test score data were available from each child's file (names of intelligence tests were not reported). Creative thinking measures were identified by Houtz et al. from the work of Torrance, Guilford, Wallach, Houtz, and others. Tasks included alternate uses; plot titles; word associational, expressional, and ideational fluency; and spontaneous and adaptive flexibility. Factor analysis yielded two major factors: fluency-of-ideas factor and school achievement factor. Across all grades, few children performed consistently high on all tasks, leading the authors to conclude that intelligence and creative thinking can be conceptually separated.

Metcalfe (1978) found evidence to distinguish between divergent thinking and intelligence with a population of children in England. The children were 387 9-13 year olds. They were divided into six groups by sex and the following age divisions: 9 and 10, 11 and 12, 13 and older. Creativity was assessed through four tests: Circles, from Torrance; and Alternate Uses, Similarities, and Patterns from Wallach and Kogan. Intelligence was measured through Part 1 (verbal and numerical) and Part 2 (figural) of the AH4 Test. Product-moment correlations were calculated between the six tests. Coefficients ranged from .03-.41. Two groups, boys and girls ages 9 and 10, obtained significant correlations between the two variables (boys, $r = .35$, $p < .01$; girls, $r = .41$, $p < .001$).

Houtz, Montgomery, and Kirkpatrick (1979) introduced evaluation skills into their study of the relationship between creativity and intelligence. Evaluation abilities have been suggested as being a part of the creative thinking process in that a child must evaluate ideas and decide whether or not to make improvements on them. This evaluation ability was measured by the Purdue Elementary Problem Solving Inventory. Creativity measures were obtained from children's responses to cartoon-like drawings. Below each was a question focusing on one of five information processing skills: problem definition, question asking, guessing causes, foreseeing consequences, and generating solutions. Responses were scored for fluency, flexibility, and originality. Intelligence was measured by the Lorge-Thorndike. The mean verbal IQ of the sample was 92. Subjects were 156 fourth graders from nine classrooms in a Midwestern city. Results of a correlation between verbal IQ and creativity are as follows: fluency, .44; flexibility, .51; originality, .39; and elaboration, .27; all significant at the .01 level.

A summarization of the previous research revealed that various instruments, constructed with differing concepts of creativity in mind, have been paired with measures of intelligence to determine the relationship existing between the two. Although the instruments were not as commonly used as the TTCT, Guilford, Getzels and Jackson, or Wallach and Kogan batteries, the correlation coefficients obtained are similar. The range of correlation between creativity and intelligence found with these instruments is .03-.66, suggesting a wide range of relationship partially determined by the instrument used which is based on the authors' definitions of creativity. The presence of such a broad view of creativity causes problems when trying to determine the relationship between creativity and intelligence. The coefficients vary according to how the creativity construct was defined by the authors. Some concepts of creativity (as measured by certain tests) are moderately correlated with intelligence. Still, other concepts of creativity may not be related at all to intelligence. The previous section has demonstrated that this large variance does exist.

## The Threshold Hypothesis

The threshold hypothesis, attributed by Torrance to J. E. Anderson, states that below a critical IQ level some correlation exists between intelligence and creativity. Above this level, the two variables are not correlated. It is thought that intelligence, up to a point, enables a person to be creative. However, a certain point is reached when a higher IQ makes little difference and the creative thinking abilities become more important (Torrance, 1962). For certain creative activities, a specifiable minimum IQ is necessary, but beyond that minimum, creativity has little correlation with scores on IQ tests (Barron, 1969). This cutoff point has been proposed to be an IQ of 120. Guilford (1967) has described the relationship as being a triangular distribution. Those with a high IQ may be found anywhere along the range of a divergent-production test. Those who are low on the divergent-production test can be anywhere on the range of an IQ test. However, those high on the divergent-production test have a high probability of being above average on the IQ test. It would seem from this description that a high IQ is a necessary, though not sufficient, condition for production of creative thinking abilities.

The following paragraphs will include citations of research directed toward testing the threshold hypothesis. Some of the studies support the hypothesis; some refute it.

Yamamoto (1964b) utilized 272 ninth-twelfth graders to test the threshold hypothesis. Intelligence was measured by the Lorge-Thorndike Verbal Battery. Creativity was measured by the Test of Imagination and the Ask-and-Guess Test with results scored for

Fluency, Flexibility, Adequacy, Cleverness, Inventive Level, and Constructiveness. Subjects were divided into three groups based on scores of the tests. The groups were: high intelligence group, scoring in the upper 20% on the Lorge-Thorndike but not the creativity measurement; high creativity group, scoring in the upper 20% on the creativity measurement but not the Lorge-Thorndike; and high intelligence and creativity group, scoring in the upper 20% on both creativity and IQ. The overall correlation between intelligence and creativity for the entire population was significant ($r = .30$, $p < .01$). The correlation between the two variables for the three groups was not significant. The values for the two groups containing the high intelligence Ss were negative. These findings, the author states, agree with the generalizations that the correlation between measures of creativity and intelligence in the high ability populations is practically zero.

Another study by Yamamoto (1965) showed a more clear-cut affirmation of the threshold hypothesis. Subjects were 827 fifth graders from 10 elementary schools in Ohio. Intelligence was assessed by the Lorge-Thorndike Verbal Battery. Creativity was assessed by the Minnesota Tests of Creative Thinking. Based on scores on the Lorge-Thorndike, Ss were divided into five subgroups. These groups are as follows: (a) 90 or below, (b) 91-110, (c) 111-130, (d) 131 and above, and (e) full-range IQ of unselected and pooled Ss. Within each group, 38 Ss were randomly selected. Analyses were based on these Ss. Results show a consistent decrease in the size of the relationship between intelligence and creativity as the IQ level of the subgroups got higher. Correlation coefficients for respective groups are as follows: Group 1, .31; Group 2, .22; Group 3, -.09; and Group 4, -.02. Although these values are not significant, a pattern did develop. Correlation between the two variables for the entire population, Group 5, was significant ($r = .39$, $p < .05$).

A study by Klausmeier (1965), although not designed for such a purpose, cast doubt on the threshold hypothesis. Subjects were 240 students from five public junior high schools. Based on scores achieved on the Otis Quick-Scoring Mental Ability Test, the Ss were divided into three groups: low IQ, 71-95; average IQ, 96-114; and high IQ, 115-141. Along with the Otis, four other tasks of convergent thinking were used. These were: Current Events, Work-Study Skills, Problem Solving, and Analogies. Divergent thinking abilities were measured by tasks adapted from Guilford, Kettner, and Christensen. These were: Object Uses, Word Uses, Plot Titles, Expressional Fluency, Plot Questions, Object Improvement, and Sentence Improvement. A rank order of mean scores on all tasks of divergent thinking was identical to a rank order of convergent thinking tasks' mean scores. The low convergent thinking group scored the lowest on tasks of divergent thinking, with the same relationship applying to the average and high convergent thinking groups. These results cast doubt on the threshold hypothesis because those Ss in the highest convergent thinking group scored the highest on tasks of divergent thinking. If the threshold hypothesis were having an effect on these scores, Ss in the highest convergent thinking group would have lower scores on tasks of divergent thinking than those in the middle or lower IQ groups.

A study showing a linear relationship between the two variables was done by Castiglione (1966). Subjects were 90 New York University undergraduates, ranging in age from 17 to 23. Intelligence was assessed by the Otis Quick-Scoring Test, creativity by the RAT and Associational Fluency I Test. The Ss were divided into three groups according to IQ: Group 1, 96-109; Group 2, 110-119; and Group 3, 120+. Results showed that students in Group 3 scored higher on the creativity measure than did Group 2 or Group 1. In general, the creativity scores increased with the level of IQ.

A study by Hasan and Butcher (1966) provided evidence for the threshold hypothesis by comparing their population with Getzels and Jackson's. Subjects in this study were 175 Scottish pupils in their second year of secondary education. Intelligence was assessed by the Moray House Verbal Reasoning Test administered by the school. Creativity was assessed by ten tests: four from Getzels and Jackson, one from Thurstone, one from Guilford, two from Mednick, one from Torrance, and one constructed by the authors. The mean IQ of this sample was 102, compared to the mean IQ of 132 of Getzels and Jackson's sample. The correlations between intelligence and all of the creativity subtests in this study are significant ($r$ = .18-.74, $p < .05$). These results were compared to a correlation of .12-.39 in the Getzels and Jackson study. The authors concluded that a possible explanation for the discrepancy of these scores is the presence of the threshold effect.

A study by Dacey and Madaus (1971) tested a threshold hypothesis stated by Barron, "For certain creative abilities, a specifiable minimum IQ probably is necessary in order to engage in the activity at all. But beyond that minimum, creativity is not a function of intelligence as measured by IQ tests" (p. 213). Subjects were 867 eighth graders from New York, Pennsylvania, and New Jersey. Intelligence was assessed by the Lorge-Thorndike. Creativity was assessed by four subtests: Imagination, Asking Questions, Guessing Causes, and Guessing Consequences. Subjects were divided into three groups based on their IQ scores: (a) 85-104, (b) 105-124, and (c) 125-144. Results showed support for the threshold hypothesis by reporting the following coefficients for the three groups: low IQ, .16, $p < .05$; middle IQ, .17, $p < .05$; and high IQ, a positive, non-significant value.

One hundred seventy-six males were the Ss in a study by Schubert (1973). They were divided into two groups according to their score on the intelligence measure, the Army General Classification Test, which is a combination of arithmetic and vocabulary scales. In order to consider a restricted ability range, correlations were computed separately for Ss who received a score of less than 90 (N = 40) and more than 110 (N = 48). Creativity was assessed by the Creative Imagination Test. The relationship between creativity and intelligence in the high intelligence group was not significant. In the low intelligence group, the relationship was significant ($r = .44$, $p < .01$). This data tended to support the threshold hypothesis by showing that the concepts became more related as the range of intelligence was lowered.

Guilford and Christensen (1973) conducted a study to support the threshold hypothesis and ended up refuting it. Four hundred thirty-five upper elementary students in two California schools served as the Ss. In School Number 1, intelligence was assessed by the Lorge-Thorndike. In School Number 2, the IQ was derived from the Comprehensive Tests of Basic Skills (for grade six) and the Word Meaning, Paragraph Meaning, and Arithmetic Concepts subtests of the Stanford Achievement Test (for grades four and five). Creativity in both schools was assessed using a battery of Guilford's subtests. These were: Plot Titles, Alternate Uses, Associational Fluency, Writing Sentences, Possible Jobs, Sketches, Alternate Letter Groups, Making Objects, Hidden Letters, and Decorations. Results show no breaks in the relationship between intelligence and creativity. The degree of relationship showed a continuous, gradual shift from low to high IQ. It would be more correct to say, with the Ss in this study, the higher the IQ, the more likely that individuals with high creative potential will be found.

A study by Metcalfe (1978) cast doubt on the threshold hypothesis by suggesting that data which supposedly supported it might be interpreted as showing a difference in verbal and/or mechanical skills. He felt this could be especially true for younger Ss who could not write or draw quickly, thus impeding their ability to score highly in tests of creative thinking. Subjects were 387 children divided into three age groups: 9+, 11+, and 13+. Intelligence was assessed by the AH4 test. Creativity was assessed through the use of four tests: Circles, from Torrance; Alternate Uses, Similarities, and Patterns, from Wallach and Kogan. These creativity tests were scored for fluency only. Results show the following correlations between intelligence and creativity for the three age groups: boys 1, .35; girls 1, .41; boys 2, .18; girls 2, .19; boys 3, .03; girls 3, .05. Although only the first two coefficients were significant, the author interpreted the data to show three possible explanations for the lessening relationship occurring with age increases. These were: (a) effects of school environment, (b) an age-related phenomenon, and (c) greater verbal/mechanical skills among the older Ss. He felt the results cast doubt on the intelligence threshold hypothesis and suggested a need for caution in accepting simple explanations when there may be other variables interplaying.

## Summary

A number of studies testing the threshold hypothesis were reviewed. Research cited is divided as to whether or not a threshold effect does occur on the measurement of creative thinking abilities of Ss with IQ's over 120. Partial reasons for this indecision may be a lack of consistency in measuring devices used to evaluate the two concepts.

## Statistical Foundations

The studies reviewed concerning the relationship between intelligence and creativity have generally produced a positive, yet low, correlation. However, questions can be raised as to the accuracy of these correlations. Many factors affect the size of a relationship between two variables in a correlational study. Some of these factors are as follows: validity and reliability of the testing devices used, the effect of homogeneous samples, and the effect of using only Ss with high IQ's (restriction of range). These factors may lower the size of the correlation, thus presenting an inaccurate picture of the relationship between intelligence and creativity. In the following paragraphs, these three factors will be discussed, with emphasis placed on the effect they have on the size of the correlation between the two variables.

### Validity and Reliability of Creativity Measures

Most of the studies reviewed used the Lorge-Thorndike or the Otis Quick-Scoring Tests as measures of intelligence, which are fairly reliable and valid. Because the studies reviewed were fairly consistent in their use of the intelligence measure, reliability and validity of these will not be discussed. However, since the research cited used so many varying tests of creativity, their reliability and validity will be dealt with. The author is not concerned with the numerical coefficients of reliability and validity of the differing creativity measures. Rather, the issue centers around the effect on correlational coefficients of the use of so many different batteries of creativity and trying to generalize from such a conglomeration.

The issue of validity was dealt with by Thorndike (1963). He questioned whether we could even use the term "creativity" to describe the concept measured by "creative thinking" tests, because these tests have such low correlation among themselves. For a concept to be useful, most of the instruments which measure it should be highly correlated. Otherwise, the tests must be viewed as measuring separate abilities. This is important to research because identification of the creative child would depend on the collection of subtests chosen to measure his/her abilities. Also, it is important to research because the relationship between intelligence and creativity may be lessened just through the use of creativity measures that are not highly related themselves.

Cureton (1964) dealt with the issue of validity also. She lamented that tests used to measure creativity were not valid because they had not undergone analysis, nor were they backed by theory. These well-known technical requirements used to form tests of intelligence were ignored in the construction and application of tests of creative thinking. Most studies of correlation between intelligence and creativity used a variety of tests from different authors and theories as their measure of creativity. The tests did not correlate highly with each other and may not have been measuring the same construct.

Yamamoto (1964c) echoed some of Cureton's feelings. He stated that many investigations of creativity were based on untested assumptions, one of which was that the concept can be observed and reliably measured. Also hindering the investigation has been the absence of valid and reliable measurement instruments. Content validity is assumed, not proven, and predictive validity is nonexistent. At the present time, this was difficult to obtain because it was almost impossible to find a criterion which was not contaminated by other human traits, especially intelligence, as measured by IQ tests.

Cave (1970) agreed with Thorndike. He reported that the studies to date which have related IQ to creativity have typically used a biased experimental design. The studies usually consisted of an IQ taken from the school files and a battery of creativity tests. Because the tests were not administered at the same time, the correlation between the two variables could have been lessened.

### Homogeneity of Populations and Restriction of Range

Homogeneous populations are those consisting of Ss with the same characteristics. The characteristics can be any quality ranging from hair color to grades in school. When discussing the relationship between intelligence and creativity, a homogeneous population is one in which the Ss share the quality of a high IQ. Anastasi and Schaefer (1971) felt the use of homogeneous populations in studies dealing with the relationship between intelligence and creativity foster the belief that the two variables are independent entities. While they may be substantially correlated in the general population, the relationship is slim among the highly intelligent populations. Although this effect is found with all abilities, it should be considered a possible cause for low correlations when reviewing correlation coefficients determined by research using such a population.

Coupled with the problem of homogeneous populations is the effect of restriction of range. If the variability of a group of Ss is limited, the magnitude of relationship between measures is lessened (Ripple & May, 1962). Limitation of the minimum IQ among Ss in a study could lead to incorrect inferences concerning the relationship between intelligence and creativity in groups where IQ is distributed in a statistically normal pattern.

A reanalysis of the data by Getzels and Jackson was conducted for statistical purposes (Marsh, 1964). The author felt the relationship determined between intelligence and creativity was low, due to the use of highly intelligent and creative Ss. Freeman (1968) stated this effect would be particularly marked because the range was restricted on both variables. Generally, Marsh obtained higher correlations between the two variables when the Ss' ability was not restricted.

Yamamoto (1965) agreed that low correlations between measures of intelligence and creative thinking reported by researchers might be a function of the limited ability range represented in Ss rather than an actual relation. He cautioned against simply interpreting low correlations as being indications that intelligence and creativity are exclusive entities. Rather, creativity may be thought of as a component of intelligence.

### Summary

This section has demonstrated statistical reasons for caution in generalizing that creativity and intelligence are only slightly related. Correlation coefficients obtained may be low due to an absence of validity and reliability of the creativity tests used and to the effect of homogeneous populations coupled with restriction of range. Whether conducting a study to determine the relationship between intelligence and creativity or reviewing literature on the same, these factors need to be considered when interpreting the correlation coefficients obtained.

## Chapter Summary

The background of the two concepts was presented by reviewing the theories behind creativity and intelligence. Studies were reviewed which determined the relationship between intelligence and creativity. Intelligence was generally assessed using the Lorge-Thorndike or the Otis Quick-Scoring Intelligence Tests. Creativity was generally assessed with a battery by Guilford, Getzels and Jackson, Torrance, or Wallach and Kogan. In some studies, a combination of creativity batteries was used to assess the concept. Generally, the relationship between intelligence and creativity was determined to be positive, yet low. Theoretical and statistical foundations were presented as possible explanations for these low correlations. The theoretical issue dealt with convergent and divergent production abilities. Convergent production abilities are assessed by intelligence tests. Divergent production abilities are assessed by creativity tests. A child who possesses a high amount of convergent production abilities cannot possess a high amount of divergent production abilities. Therefore, the correlation between measures of intelligence and creativity will be low.

Statistical reasons for low correlations between the two variables were listed also. These were the use of homogeneous populations, coupled with restriction of range and lack of reliable and valid tests. When trying to determine a relationship between two variables, use of a population that is similar on a construct being measured will lessen the coefficient obtained. If one of the constructs is measured with tests that are not highly reliable or valid, the correlation coefficient will again be lessened.

# CHAPTER 3

# METHODOLOGY OF THE STUDY

The purpose of this research was to study the general relationship between creativity and intelligence, with an emphasis on the threshold hypothesis. The relationship was examined in view of the statistical and theoretical arguments. Subject selection, instrumentation, testing and scoring procedures, and inter-rater reliability are described in this chapter.

## Subjects

Initially the participants were 96 students, 54 females and 42 males, enrolled in three different classrooms in grades four through six at a parochial school in a metropolitan area in Iowa. Subjects (Ss) were originally tested for possible inclusion in a talented and gifted program, based on the assessment of intellectual and creative abilities. Written parental permission was required for the use of the scores of the intellectual and creative assessment in the present study. Of the initial 96 Ss, permission was obtained to use the scores of 73, with two refusals and 21 not returned. Grade levels were represented as follows: 24 fourth graders, 21 fifth graders, and 28 sixth graders; with a total population of 43 females and 30 males.

## Instrumentation

### TTCT: Description, Reliability, and Validity

In the Torrance Tests of Creative Thinking (TTCT, 1974) there are two tests, Verbal and Figural, and two equivalent forms of each test. In this study, the entire Verbal Test, Form B was administered. This consisted of the following subtests: Ask and Guess, Guessing Causes, Guessing Consequences, Product Improvement, Unusual Uses of Tin Cans, Unusual Questions About Tin Cans, and Just Suppose.

The Ask-and-Guess subtest was included in the battery to give children an opportunity to express their curiosity and provide a picture of their ability to develop hypotheses (Torrance, 1974). The Guessing Causes and Guessing Consequences subtests are designed to reveal the child's ability to formulate hypotheses relating to cause and effect. The ability to think of ways to improve an object is sampled by the Product Improvement subtest. The ability to free the mind from an established set of ideas and think of less common ones is sampled by the Unusual Uses subtest. The Unusual Questions subtest is a measure of Divergent Power, asking the child to think of questions that would lead to a variety of responses, not just factual ones. The final subtest, Just Suppose, was designed to elicit a high degree of fantasy by asking the child to predict possible outcomes to an improbable situation.

The TTCT were designed to measure four aspects of creativity: fluency, flexibility, originality, and elaboration. In this study, the TTCT subtests were scored for fluency, flexibility, and originality. Responses were not scored for elaboration because research was not as available for it as for the other three aspects of creativity, and interscorer reliability has been difficult to establish (Torrance, 1974). Fluency involves the production of a large number of possibilities or hypotheses (Torrance, 1970). Flexibility measures the use of many different approaches or strategies. Originality is the production of bold new ideas or the making of mental leaps.

Torrance (1974) summarized the results of several studies, with varying age ranges, as evidence for the test-retest reliability of the TTCT. Reviewing only the coefficients for upper elementary age children, one finds the following test-retest reliabilities (two-week interval): verbal fluency, .93; verbal flexibility, .84; and verbal originality, .88. These coefficients indicate that the variance accounted for between the two administrations is as follows: fluency, 86%; flexibility, 71%; and originality, 77%.

The 1974 test manual also cited evidence of construct, concurrent, and predictive validity. Construct validity studies primarily dealt with the relationship between scores on the TTCT and personality characteristics. For example, scores on the TTCT are reported to be significantly correlated with imagination (.50) and playfulness (.21-.36). TTCT scores were also reported to be significantly correlated (coefficients were not reported) with strength of self-image, a sense of humor, and independence.

Although Torrance and his associates have been able to find "no generally acceptable criteria of concurrent validity" (p. 35), peer and teacher nominations have been used and may provide insights into the validity of the TTCT. Regarding predictive validity, Torrance (1974) cited nine short-range (one week to nine months) and five long-range studies. The short-range studies dealt with three separate groups of elementary age children, consisting of 32, 125, and 40 Ss. These three studies predicted at the .01 level of significance (correlations were not reported) creative behavior such as humor, fantasy, creative ideas, and originality of imaginative stories. Of the long-range studies, the longest spanned 12 years and reported predictive validity coefficients between scores on the TTCT and measures of both quantity and quality of creative achievements at or beyond the .01 level of significance. A canonical correlation of .51 was obtained. The study dealt with 236 students in grades seven through 12 and can be interpreted as establishing an acceptable predictive validity for junior and senior high students.

### CAT: Description, Reliability, and Validity

The Cognitive Abilities Test, Multi-Level Edition, a revision and extension of the Lorge-Thorndike Intelligence Test, is organized into three batteries--Verbal, Quantitative, and Nonverbal. In this study, scores from just the Verbal battery were used, consisting of the following subtests: Vocabulary, Sentence Completion, Verbal Classification, and Verbal Analogies.

Evidence of test-retest reliability is provided by Nichols and Hopkins (Buros, 1978). The median correlation coefficient between scores over a three-year period for upper elementary age students was .74 for the Verbal battery. This coefficient indicates that the median variance accounted for between the two administrations is 55%. The two reviewers also cited evidence of concurrent and predictive validity. Concurrent validity correlations of the CAT-V with the Iowa Tests of Basic Skills were reported to typically be .80-.85. Regarding predictive validity, the CAT was reported to be correlated with teachers' grades .50-.65.

## WISC-R: Description, Reliability, and Validity

The WISC-R consists of two scales, Verbal and Performance, and yields three IQ's: Verbal, Performance, and Full scale. In this study, only the Verbal scale was administered, yielding a Verbal IQ. The scale consists of the following subtests: Information, Similarities, Arithmetic, Vocabulary, and Comprehension.

Wechsler (1974) provided evidence for test-retest (one-month interval) with three separate age ranges. Reviewing only the coefficients for the Verbal IQ, one finds the following test-retest reliabilities: ages 6 1/2-7 1/2, .90; ages 10 1/2-11 1/2, .95; and ages 14 1/2-15 1/2, .94. The average coefficient of reliability for the Verbal scale is .93, indicating that the variance accounted for between the two administrations is 87%.

The manual does not include a thorough discussion of validity of the WISC-R. However, some limited congruent validity comparisons between the WISC-R and the Stanford-Binet are included, showing a correlation of .71 between the Binet and the Verbal scale of the WISC-R. Petrosko (1975) reported the WISC-R appears to measure those things traditionally allowing white, middle-class students success in school. Sattler (1982) reported the following concurrent validity coefficients with the Verbal scale: group intelligence tests (Lorge-Thorndike, Otis-Lennon, Pintner-Cunningham, Revised Beta, and Culture Fair Intelligence Test), .61; Peabody Picture Vocabulary Test, .66; and the Metropolitan Achievement Test, .66. The WISC-R is considered to be a widely accepted, individually administered measure of intelligence (Sattler, 1982). It has adequate standardization, high reliabilities, and lends itself to relatively easy administration and scoring (Sattler, 1982).

## Administration Procedures

The Verbal scale of the WISC-R was administered to 33 of the Ss in March and April of 1982 by a professor and three graduate students in school psychology, one of whom was the author. These Ss had been nominated for possible inclusion into a talented and gifted program, warranting the administration of an individual intelligence test. The students were removed from their classrooms and tested in a semi-secluded area of the school. Administration instructions in the manual were adhered to.

The Cognitive Abilities Test was group administered as part of the school's general testing procedures in October, 1981. It is assumed instructions in the manual were adhered to, providing reliable and valid test scores. The scores needed for data analysis were taken from the Ss' files.

The TTCT was administered by the teachers to their respective classes in May, 1982. Again, it is assumed that administration instructions in the manual were adhered to and that the scores are valid and reliable.

## Scoring Procedures

The examiner did not score the CAT tests, as these were already a part of the Ss' files. Scores were reported with a mean of 100 and a standard deviation of 16. Scoring of the WISC-R subtests was done by the examiner, two graduate students in school psychology, and a professor of school psychology. Scoring instructions in the manual were adhered to. Scores were reported with a mean of 100 and a standard deviation of 15. Scoring of the TTCT subtests was done by the examiner. Scoring instructions and criteria were reviewed carefully and consistent application of these occurred during scoring. The raw scores derived from the use of the TTCT scoring system were submitted to a standard, normalizing, area transformation yielding T scores with a mean of 50 and a standard deviation of 10 on the entire pool of Ss treated as a whole.

## Inter-Rater Reliability Procedures with the TTCT

The examiner randomly selected 10 protocols to be scored by a professor of curriculum and instruction who is very familiar with the concept of creativity and the TTCT. When these scores were compared with those of the examiner, the following interscorer reliability coefficients, determined through a product-moment correlation, were obtained: fluency, .99; flexibility, .97; and originality, .95.

# CHAPTER 4

# RESULTS

This study was concerned with various aspects of the relationship between creativity and intelligence. The questions to be answered in the study were as follows: (a) what was the relationship between creativity and intelligence when the latter was assessed by the verbal section of the Cognitive Abilities Test, (b) what was the relationship between creativity and intelligence when the latter was assessed by the verbal section of the Wechsler Intelligence Scale for Children--Revised, and (c) will the correlation between creativity and intelligence for students with IQ's of 120 and above be lower than the correlation between creativity and intelligence for students with IQ's below 120? Pearson $r$ correlation coefficients were determined for the variables involved in the examination of the three questions.

## Creativity and the CAT-V

The first question addressed the relationship between intelligence and creativity when intelligence was assessed by the CAT-V. Data revealed that a low, yet significant, relationship existed between the two constructs. The three creativity variables were significantly correlated with the CAT-V. The following coefficients were determined: fluency, .34; flexibility, .41; and originality, .40 ($p < .05$). The creativity variances accounted for by the CAT-V were as follows: fluency, 12%; flexibility, 17%; and originality, 16%. These data are contained in Table 1.

Table 1

General Correlations for the Entire Population

| Variable | Flexibility | Originality | WISC-R, V | CAT-V |
|---|---|---|---|---|
| Fluency | .86* (73) | .87* (73) | .19 (33) | .34* (71)[a] |
| Flexibility | | .88* (73) | .21 (33) | .41* (71)[a] |
| Originality | | | .25 (33) | .40* (71)[a] |
| WISC-R, V | | | | .42* (31)[a] |

*Note*. Numbers in parentheses indicate number of subjects.

[a]CAT-V scores were not available for two of the Ss who completed the TTCT and the WISC-R.

*$p < .05$.

## Creativity and the WISC-R, V

The second question addressed the relationship between intelligence and creativity when intelligence was assessed by the WISC-R, V. Data contained in Table 1 showed that there was a positive, though not significant, relationship between the two constructs. None of the three creativity variables, fluency, flexibility, or originality, were significantly related to the WISC-R, V. The following coefficients were determined: fluency, .19; flexibility, .21; and originality, .25.

## Creativity and the Threshold Hypothesis

The third question addressed the threshold hypothesis. As can be seen by viewing Table 2, when the IQ is 119 or below, all three creativity variables were significantly related to intelligence as assessed by the CAT-V. The following coefficients were determined: fluency, .31; flexibility, .38; and originality, .39. When IQ is 120 or above, only one creativity variable, fluency, was significantly related to intelligence as assessed by the CAT-V. The following coefficients were determined: fluency, .45; flexibility, .18; and originality, .20. The correlations involving the WISC-R, V did not provide any data to support or refute the threshold hypothesis. None of the correlations, above or below the threshold of 120, were significant. The following coefficients were determined when the WISC-R IQ was below the threshold of 120: fluency, .03; flexibility, .08; and originality, .23. When the WISC-R IQ was above the threshold of 120, the following coefficients were determined: fluency, .22; flexibility, .08; and originality, .03. However, this was not surprising, as the WISC-R, V did not correlate significantly with creativity scores of the general population and with only the fluency, flexibility, and originality scores of the fourth grade.

Table 2

Correlation Between Creativity and Intelligence at the Threshold Level

| | WISC-R, V | | CAT-V | |
|---|---|---|---|---|
| Variable | IQ = 119 or below | IQ = 120 or above | IQ = 119 or below | IQ = 120 or above |
| Fluency | .03 (18) | .22 (15) | .31* (56) | .45* (15) |
| Flexibility | .08 (18) | .08 (15) | .38* (56) | .18 (15) |
| Originality | .23 (18) | .03 (15) | .39* (56) | .20 (15) |

*Note*. Numbers in parentheses indicate number of subjects.

*$p < .05$.

## Additional Findings

Data contained in Table 3 indicated the correlations of the creativity variables with the five variables in the study according to grade level. (The reader can refer back to Table 1 for correlation coefficients of the entire population.) The Table showed the strength of the inter-correlations of the TTCT variables across grade levels, with coefficients ranging from .84 to .94. The high relationship showed there was a common factor present in the three variables and that they are not independent constructs. Also shown were the relationships between each creativity variable and the two measures of intelligence for each grade level. All three of the creativity variables, fluency, flexibility, and originality, were significantly related to the WISC-R scores of fourth graders. All of the creativity scores of the sixth graders were negatively correlated with intelligence as assessed by the WISC-R, originality significantly so. All of the creativity scores of the fourth graders were significantly related to their CAT-V scores. The only other single creativity score significantly related to the CAT-V was the flexibility score of the sixth graders.

Table 3

Correlations According to Grade Level

| Variable | Flexibility | Originality | WISC-R, V | CAT-V |
|---|---|---|---|---|
| Fluency | | | | |
| Grade 4 | .90* (24) | .86* (24) | .59* (9) | .62* (24) |
| 5 | .89* (21) | .84* (21) | .28 (8) | .12 (21) |
| 6 | .85* (28) | .94* (28) | -.37 (16) | .22 (26) |
| Flexibility | | | | |
| Grade 4 | | .89* (24) | .61* (9) | .67* (24) |
| 5 | | .91* (21) | .33 (8) | .12 (21) |
| 6 | | .86* (28) | -.09 (16) | .34* (26) |
| Originality | | | | |
| Grade 4 | | | .80* (9) | .67* (24) |
| 5 | | | .29 (8) | .15 (21) |
| 6 | | | -.42* (16) | .27 (26) |
| WISC-R, V | | | | |
| Grade 4 | | | | .89* (9) |
| 5 | | | | .02 (8) |
| 6 | | | | .12 (14) |

Note. Numbers in parentheses indicate number of subjects.

*$p < .05$.

The means and standard deviations for the five variables of the entire population are presented in Table 4.

Table 4

Means and Standard Deviations for Variables
of the Entire Population

| Variable | *n* | Mean | S.D. |
|---|---|---|---|
| Fluency | 73 | 50.0 | 10.0 |
| Flexibility | 73 | 50.0 | 10.0 |
| Originality | 73 | 50.0 | 10.0 |
| WISC-R, V | 33 | 117.8 | 9.1 |
| CAT-V | 71 | 110.2 | 11.1 |

*Note*. All values were rounded to the nearest tenth.

A breakdown of the means and standard deviations by grades for each variable is presented in Tables 5 and 6. Data presented in Table 5 revealed a consistent pattern in the means for fluency, flexibility, and originality. By just viewing the Table, one can see that an increase in mean scores occurred from the fourth graders to the fifth graders. A decrease in mean scores occurred from the fifth graders to the sixth graders. The same pattern appeared in the CAT-V scores as reported in Table 6.

Table 5

Mean Fluency, Flexibility, and Originality Scores and Standard Deviations Across Grade Levels

| | | Fluency | | Flexibility | | Originality | |
|---|---|---|---|---|---|---|---|
| Grade | n | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| 4 | 24 | 49.6 | 11.2 | 47.3 | 9.3 | 48.4 | 10.9 |
| 5 | 21 | 52.5 | 11.0 | 53.2 | 10.6 | 53.2 | 11.1 |
| 6 | 28 | 48.5 | 7.9 | 50.0 | 9.8 | 49.0 | 7.9 |

*Note*. All values were rounded to the nearest tenth.

Table 6

Mean WISC-R, V and CAT-V Scores and Standard Deviations Across Grade Levels

| | | WISC-R, V | | CAT-V | | |
|---|---|---|---|---|---|---|
| Grade | n | Mean | S.D. | Mean | S.D. | n |
| 4 | 9 | 117.8 | 11.8 | 106.5 | 11.1 | 24 |
| 5 | 8 | 118.5 | 7.9 | 112.9 | 10.7 | 21 |
| 6 | 16 | 117.5 | 8.4 | 111.4 | 10.9 | 26 |

*Note*. All values were rounded to the nearest tenth.

# CHAPTER 5

## DISCUSSION AND SUMMARY

The purpose of the present research study was twofold. The first purpose was to determine the relationship between creativity and intelligence when intelligence was assessed by a group test (CAT-V) and an individual test (WISC-R, V). The second purpose was to examine the threshold hypothesis, which states that below a critical IQ level, usually 120, intelligence and creativity appear to be positively and moderately correlated. Above this IQ level, the correlation between intelligence and creativity lessens.

A review of the literature revealed two major concerns in the field, the statistical and theoretical. The statistical model dealt with the methodology of the studies reviewed. Both the use of a homogeneous population and the unreliable tests used were given as possible reasons for low correlations found between intelligence and creativity in the literature reviewed. The theoretical model addressed divergent/convergent thinking properties. Creativity was considered a divergent thinking process; intelligence a convergent thinking process. It was postulated that the two processes represent very different skills that cannot be equally present in the same person, nor equally assessed by the same test. When testing the relationship between the two thinking processes, one would arrive at low correlations because the two processes are distinctly different types of mental production.

Subjects were 73 children from the fourth, fifth, and sixth grades at a parochial school. Instruments used in the study were the Verbal form of the Torrance Test of Creative Thinking (TTCT), the Verbal form of the Cognitive Abilities Test (CAT), and the Verbal form of the Wechsler Intelligence Scale for Children--Revised (WISC-R). The subtests of the TTCT were scored for fluency, flexibility, and originality. A Pearson $r$ correlation matrix was used to analyze the data.

Results indicated a significant, yet low, relationship between intelligence and creativity when intelligence was measured by a group test. When intelligence was measured by an individual test, no significant relationship was determined between intelligence and creativity. Support for the threshold hypothesis was determined when data from the group intelligence test were analyzed. Data analyzed by grade level indicated that fluency, flexibility, and originality scores of the fourth graders were significantly related to both their CAT and WISC-R scores. All of the creativity scores of the sixth graders were negatively correlated with their WISC-R scores, originality significantly so.

## Conclusions and Discussion

Correlation coefficients in this study were low, perhaps providing some substantiation of the theoretical model. Based on the results of the present study, creativity and intelligence appear to be representing two types of mental production that are only slightly related. Addressing the statistical model, in this study, the CAT-V range of 88-146 seemed to rule out restriction of range as a possible cause for low correlations. The range of WISC-R, V IQ scores was more limited, probably because this population was nominated for inclusion into a talented and gifted program, thus producing a select, homogeneous group. The scores ranged from 101-140, possibly providing a reason for low, non-significant correlations between creativity and intelligence as measured by the WISC-R.

Another possible cause of low correlations as reported in the literature, unreliability of tests, may have been lessened with the use of the TTCT. Although alternate form reliability presented some problems, the TTCT was the most reliable of the creativity measures reviewed. The intelligence measures implemented in this study demonstrated a relatively high degree of reliability.

It would seem then, that this study tried to deal with some possible statistical reasons for reduced correlations, yet the results showed that the relationship between intelligence and creativity is low, yet positive. Perhaps the theoretical model provides a good possible explanation for the slight relationship between creativity and intelligence. The two variables may indeed be representing two different types of mental energy and one cannot assume if one quality is possessed, so is the other.

The second question addressed the relationship between intelligence and creativity when intelligence was assessed by the WISC-R, V. None of the three creativity variables, fluency, flexibility, or originality, were significantly related to the WISC-R, V. These results can be compared to the results achieved when fluency, flexibility, and originality were correlated with the CAT-V. The group test provided significant correlations with all three aspects of creativity; the individual test provided none. Statistically, one would assume the results would be the opposite, as the individual intelligence test was much more reliable and demonstrated less variability in mean scores across grade levels. However, the number of cases involving scores from the individual intelligence test was much smaller than the number of cases involving scores from the group intelligence test, possibly creating the results achieved in the present study.

Another possible explanation for the significance of the relationship between creativity and intelligence, as measured by a group test, was the similarity of the two tests involved--the TTCT and the CAT. Both tests are a paper-pencil type format. The child responded to questions on the CAT by blackening an oval to mark the correct response. On the TTCT, the child responded to the situation by writing statements, questions, or words.

Both tests also share a commonality in administration procedures in that they are group tests. Both the TTCT and the CAT are administered to a group of children at one time. Children are not "singled out" or removed from the classroom to be tested, instead remaining in their comfortable, familiar classroom setting. Also, both tests can be, and were in the present study, administered by the child's teacher. This removed any possible anxiety associated with having to "perform" for a stranger.

During testing with both the CAT and TTCT, visual stimulation was present. The child had a booklet in front of him/her containing pictures or symbols. Cues may have been provided to assist the child in the answering of the questions.

The Verbal scale of the WISC-R provided a contrast to the previously mentioned points. The scale did not allow the use of paper or pencil to answer any questions. The child was asked to verbally respond to all of the subtests. The scale also required a "one-on-one" situation and could be administered only by a qualified person. This forced the child to work with a stranger in a setting which was different from his/her classroom. Finally, the scale did not provide any visual stimulation. The child must think "in his/her head" without the use of any cues possibly provided by visual stimulation.

By contrasting the two measures of intelligence, it would seem that, although they were supposed to be measuring the same construct, they were not. The method employed by the CAT is more closely related to the method of the TTCT than is the WISC-R, V. Perhaps these similarities accounted for the significant relationship between the TTCT and the CAT-V in the present study.

A final question to be addressed regarding the CAT and WISC-R has been alluded to. Are the two intelligence tests really measuring the same constructs? Table 1 of Chapter 4 reported a correlation coefficient of .42 between the CAT and the WISC-R, accounting for only 17.6% of the variance between the two measures. This leads one to believe that the two tests are measuring different constructs of intelligence, which could be another explanation for the difference in the significance of the relationship between creativity and intelligence measured by the CAT or the WISC-R. Perhaps the construct of intelligence measured by the CAT is more closely related to the construct of creativity than is the construct of intelligence measured by the WISC-R.

The third question addressed the threshold hypothesis, which was supported by the results of the present study. However, only the CAT-V provided support for this. The WISC-R, V did not correlate significantly with creativity below or above the threshold of 120. Again, this may have been a function of the lower number of WISC-R, V scores.

## Recommendations

On the basis of the findings of the present study, some further research may be warranted. However, the research should be more than "just a study on the relationship between intelligence and creativity." From this study and those reviewed in Chapter 2, it seemed the relationship was positive, yet low. Since the TTCT was designed primarily for research purposes, future research should lead to refinements in the tests, clarification of the concepts of creativity, and evidence of use in the classroom (Gronlund, 1981).

Refinements in the tests could deal with statistical properties. Research should be conducted with large samples of heterogeneous populations, using creativity batteries that are highly reliable. The implications and effects on the correlation coefficients when the population is homogeneous and batteries are not reliable have been discussed in previous chapters.

In the process of refining the tests, the questions of validity and clarification of the concepts arise. What is creativity? Are the creativity tests actually measuring this? Do all creativity tests measure the same construct? Each of the creativity batteries reviewed had their own construct of "creativity," with overlap occurring across some subtests. This led to confusion as to what characteristics a child must demonstrate in order to be considered "creative" and could also influence statistical values and relationships in studies.

Further research could be directed toward practical use of "creativity" or the relationship between creativity and intelligence in the classroom. How has this affected placement in talented and gifted programs? If placement is based on an IQ test, it would seem that another population of "talented" children would not be challenged. Also, how has research affected our definitions of "creative" and "intelligent?" Could we be limiting children when we refer to creativity when speaking only of the arts and intelligence when speaking only of classroom achievement?

Perhaps the most important future research could be directed toward the use of the concepts in the classroom. Some researchers believe that creative thinking skills can be used to enhance problem-solving skills (Feldhusen & Treffinger, 1977). Problem-solving skills are a complex set of skills and abilities composed of the following cognitive functions: (a) thinking rapidly of several characteristics of an object or situation, (b) classifying objects or ideas, (c) perceiving relationships, (d) thinking of alternative outcomes, (e) listing characteristics of a goal, and (f) producing logical solutions (Feldhusen & Treffinger, 1977). As can be seen, these functions relate to the fluency, flexibility, and originality components of creativity. In order to engage in problem-solving strategies, one must exhibit some creativity and logical thinking abilities. Thus, creative thinking skills do seem to have practical use in the classroom, warranting further research in the areas of refinements of the tests and clarification of the concepts.

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