A STUDY OF THE NATURE OF CREATIVE BEHAVIOR
IN INDUSTRIAL ARTS AND THE INDICATED
ENCOURAGEMENT OF THIS TYPE OF BEHAVIOR
BY MICHIGAN INDUSTRIAL ARTS TEACHERS

Thesis for the Degree of Ed. D.
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Kenneth R. Clay
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IN INDUSTRIAL ARTS AND THE INDICATED
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BY MICHIGAN INDUSTRIAL ARTS TEACHERS

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Kenneth R. Clay

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ABSTRACT

A STUDY OF THE NATURE OF CREATIVE BEHAVIOR
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By Kenneth R. Clay

STATEMENT OF THE PROBLEM. The central concern of this study was to define operationally the nature of creative or non-creative behavior in the field of industrial arts and to determine the extent to which industrial arts teachers in Michigan indicate they encourage this type of behavior in their classrooms.

It was hypothesized that differences would be found between indicated encouragement of creative behavior and such variables as: junior or senior high school teaching, multiple or limited area laboratory teaching, belief in the primary objective or purpose of industrial arts, educational background, length of teaching experience and interrelationships between these variables.

METHODOLOGY. Individual creative and non-creative behavioral items were developed based on a review of literature and research on creativity. Items were validated by a panel of six judges who were industrial arts educators and had written on the subject of creativity. The final inventory consisted of forty creative and twenty non-creative behavioral items agreed upon by five or all six of the judges.

The inventory was administered by mail to a random sample of 297 junior or senior high school industrial arts teachers in the State of Michigan. Returns were received from 236 or eighty percent of the total sample.

The Chi-square median test was employed to test all hypothesized differences. Reliability coefficients for the creative scale of .90 and .74 for the non-creative scale were computed by Hoyt's analysis of variance technique for unrestricted scoring methods. A complete inter-item correlation analysis was run between all items, individual items and the creative or non-creative scale, for the entire group and sub-groups. The .05 level of significance was used throughout the study.

FINDINGS AND CONCLUSIONS. Significant positive correlations ranging from .29 to .63 were found between each creative scale item and the entire creative scale and negative or low non-significant correlations between these same items and the entire non-creative scale. The same general relationship was found for nineteen of the twenty non-creative scale items with correlations ranging from .21 to .57 between these individual items and the entire non-creative scale. A correlation of .30 was computed between the entire creative and non-creative scales.

Major conclusions were:

1. Teachers who teach in multiple area laboratories indicate a greater encouragement of creative behavior and less encouragement of non-creative behavior than teachers who teach in limited area or unit shop laboratories.

2. Junior high school teachers who teach in multiple area laboratories indicate a greater encouragement of creative behavior and less encouragement of non-creative behavior than junior high school teachers who teach in limited area or unit shop laboratories.

3. Senior high school teachers who teach in limited area or unit shop laboratories indicate a greater encouragement of non-creative behavior than senior high school multiple area teachers.

4. Teachers who indicate they emphasize skill development or interpreting industry objectives of industrial arts also indicate greater encouragement of non-creative behavior than teachers who indicate they emphasize a self-realization objective of industrial arts.

5. Differences in teaching level (junior or senior high), educational experience (masters or bachelors degree) and number of years teaching experience have no effect on indicated encouragement of creative or non-creative behavior.

6. Creative and non-creative behavior in industrial arts can be described by the forty creative and twenty non-creative behavioral items found in the inventory used in this study.

IMPLICATIONS AND RECOMMENDATIONS. The effect of environment as described by multiple and limited area laboratories, influenced the indicated encouragement of creative or non-creative behavior more than any other variable tested in this study. It was suggested that if creative behavior is to be effectively encouraged, the multiple area laboratory provides a better creative learning environment than the limited area laboratory. Furthermore, the limited area laboratory

tends to be more restrictive on the indicated encouragement of creativity at the junior high school level than senior high school level.

Industrial arts teacher training institutions should examine their programs of preparation to determine the extent curricular experiences either inhibit or promote an understanding and sensitivity to the nature of creativity in industrial arts. Undergraduate and in-service programs should provide experience with: the nature of creative behavior in industrial arts, creative learning activities, effects of different environmental conditions on creativity and the evaluation of creative behavior.

State departments of education, individual school districts and publishers of instructional materials should examine the extent to which their curriculum guides, courses of study, suggested projects and other instructional materials permit flexibility and latitude for the development of the students creative abilities.

Since the study was limited to an analysis of industrial arts teachers indicated encouragement of behavior identified as creative or non-creative, it was recommended that the extent to which these teachers actually do encourage this type of behavior be investigated.

A STUDY OF THE NATURE OF CREATIVE BEHAVIOR IN INDUSTRIAL ARTS AND THE INDICATED ENCOURAGEMENT OF THIS TYPE OF BEHAVIOR BY MICHIGAN INDUSTRIAL ARTS TEACHERS

By

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CHAPTER I

THE NATURE OF THE STUDY

I. STATEMENT OF THE PROBLEM

In recent years there has been increased interest and writing on the subject of creativity. Today our educational system is being challenged to provide for the fullest development of the creative abilities of all students. Historically, educators have made claims of fostering and developing the creative abilities of students but little evidence exists in support of these claims. Particularly lacking has been concrete evidence of what is creative behavior in specific subject fields. One of the few descriptions of creative behavior in industrial arts was Wilbur's behavioral analysis of the objectives of industrial arts. (11:47-54) He analyzed the objective, "to encourage creative expression in terms of industrial materials" and suggested eight expected behavioral outcomes:

1. They will design and make new projects.
2. They will think through the correct procedure for making a project and will then follow their plan.
3. They will experiment with new ways of solving construction problems and will make improvements on the basis of their experiments.
4. They will develop skill and facility in the use of many materials.
5. They will appreciate or criticize constructively design in the work of others.
6. They will choose materials which are best suited for a given project or use.
7. They will take ideas from different sources and create new designs.
8. They will increasingly attempt to solve their own problems. (11:52)

Examination of these outcomes has revealed guidelines for achieving such an objective, but fall short of identifying general and specific behavior, that could be classified as creative in industrial arts. The need for a complete identification and description of creative behavior in industrial arts has persisted.

Two interrelated problems were investigated in this study. One problem was to determine the nature of creative or non-creative behavior in industrial arts at the secondary school level. This phase was described as the development of an operational definition of creativity in industrial arts. The second problem was to determine the degree industrial arts teachers in Michigan indicate they encourage their students to behave in a creative or non-creative manner.

II. PURPOSES OF THE STUDY

The specific purposes or objectives of this study were:

1. To develop an operational definition of the nature of creative and non-creative behavior in the field of industrial arts.
2. To determine if Michigan industrial arts teachers at the secondary school level differ in their indicated encouragement of creative or non-creative behavior by their students on the basis of junior or senior high school teaching, limited or multiple area laboratories, teaching experience, educational background, and interrelationships between these variables.
3. To determine if Michigan industrial arts teachers at the secondary school level differ in their indicated encouragement of creative or non-creative behavior by their students

on the basis of their selection of the primary role or objective of industrial arts that they strive to achieve.

III. NEED FOR THE STUDY

The objectives and purposes of industrial arts are found in many statements. Two widely accepted lists of objectives are those stated by Wilbur (11:42-43) and the list of nine goals of industrial arts in A Guide to Improving Industrial Arts (1:18). Two major questions could be raised about these goals or objectives: (1) Is the type of student behavior exemplified by these objectives known, and (2) Are these goals and purposes of industrial arts being achieved?

There have been several attempts to analyze in behavioral terms the general goals of industrial arts. Most significant have been the analysis of objectives by Wilbur (11:47-54), the American Vocational Association statement of educational objectives and behavior changes (1:19-28) and indiviudal state and city curriculum guides.

These behavioral descriptions have provided a general overview of the type of behavior that should be developed or encouraged to achieve a particular objective but are not very extensive or specific. Swanson indicated that in the case of the American Vocational Association statement no means of obtaining such statement of behavior was given but rather "it was implied that such statements must be developed by the individual teacher." (6:49)

The need to define operationally or behaviorally the objectives of industrial arts was further highlighted in a survey of industrial arts teacher educators in thirty-two states, where problems and issues in the field of industrial arts were identified. Robert Hutchcroft

found that many respondents felt statements of goals were too theoretical and what was needed were more concrete and tangible statements and "the desirability of defining objectives in terms of behavior outcomes." (4:8) Lindbeck found in his study a lack of evidence which supported the claims or goals held for industrial arts. As a result he formulated nine major hypotheses with appropriate sub-hypotheses based on nine generalizations of the claims or objectives held for industrial arts. He suggested that these hypotheses be empirically tested. (5:128-139)

The goal of developing creative thinking or creative abilities has been a particularly elusive objective. The contention has sometimes been held that in many cases the type of activities employed and the behavior expected of students in our schools operates in opposition to the development of creative thinking abilities. Emphasis has been placed on learning subject matter instead of developing thinking abilities. Torrence points out that: "schools of the future will be designed not only for learning but for thinking." (9:4) Today objectives are rarely stated in terms of thinking and the instructional activities employed and relationships established with students are calculated to produce learning instead of thinking. Educational research and psychology have largely been devoted to the investigation of learning and the learning process; seldom to the thinking process or the psychology of thinking.(9:4)

Bauer emphasized the need for research on creativity in industrial arts when he stated:

> Much has been written and said about creativeness in industrial arts. Exploration of the elements in industrial arts which further the creative drive of individual students, as well as our appraisal of the real objectives of industrial arts in respect to opportunities for creative expression, requires intensive research. (3:112)

Since 1961, two studies have been made on creativity and industrial arts. A study by Sommers has shown that: "It is possible, by the use of specific methods designed to increase creative thinking, to improve certain abilities associated with creative thinking in an industrial arts [free hand drawing laboratory course]." (7:116) A similar study by Anderson (2:158) has shown significant differences between three methods of increasing creative problem solving ability in industrial arts as measured by selected tasks from the Minnesota Creative Thinking Tests. (10:213-253) The investigators in both of these studies pointed out certain limitations inherent in the criterion instruments employed. A broad or total concept of creativity was not considered. Conclusions concerning gains in creativity referred only to gains on measures of abilities as defined by and limited in magnitude to a composite of scores on the criterion instrument. Many other factors are known to influence creative productivity. Such factors as knowledge, personality traits, motivation, skill, physical stamina, environmental conditions and others were not considered in either study.

Anderson sharpened these limitations when he indicated that the ultimate criteria are the only completely satisfactory ones when evaluating the degree to which educational objectives are achieved. He suggested that a "list of behavioral changes which might be expected to accompany an increase of creative problem solving ability could have been developed." (2:105) Difficulties inherent in assessing changed behavior led him to select a test of creative ability as the best criterion measure for his study.

As so often is the case in practice, a substitute must sometimes be accepted. However, if a concentrated effort is going to be made in assessing the contribution industrial arts can make toward the development of creative abilities, some ultimate and inclusive criteria of creativity in industrial arts must be determined. Instruments must then be developed that will measure this total concept. This study has attempted to develop an operational definition of creativity in industrial arts by identifying certain student behaviors indicative of creativity. Eventually techniques could be developed that will measure these behavior changes and provide a broader assessment of creativity in industrial arts.

IV. BASIC ASSUMPTIONS OF THE STUDY

The previous discussions concerning the nature of this study and general views on creativity presented in Chapter II have provided guidelines for the following assumptions upon which this study was based:

1. The abilities involved in being creative are universal and everyone possesses these abilities to some degree.
2. There are conditions that facilitate the development of creative abilities and there are conditions and circumstances that restrict or prohibit the development of creative potential.
3. Creative abilities can be fostered and developed through the educative process.
4. Creativity is not limited to one or several fields but manifests itself in all phases of human endeavor in diverse ways.

5. The goal of developing creative abilities or encouraging creative behavior is a significant and important goal or objective of industrial arts education.
6. There is a need for increased knowledge about the nature of creative behavior in the field of industrial arts.
7. The nature of creative and non-creative behavior in the field of industrial arts can best be described by a series of creative and non-creative behavioral statements.
8. Creative and non-creative behavioral statements in the field of industrial arts can be derived through analysis of the research on the characteristics and identification of creative individuals.

V. DELIMITATION OF THE STUDY

This study was delimited in the following ways:

1. The description of creative and non-creative behavior, while perhaps applicable to some other fields, was developed specifically for the field of industrial arts.
2. The factors, attributes, traits and characteristics of creative people from which specific behavioral statements were extracted for industrial arts were limited to those intellectual factors of: fluency, flexibility, originality, problem sensitivity and a general category of non-intellectual characteristics, for example: personality and motivation.
3. The final inventory was limited to those creative and non-creative behavioral statements agreed upon by five or six

judges as representative of that type of behavior in industrial arts.

4. The survey involving the use of the inventory was confined to a sample of 300 Michigan industrial arts teachers who taught in school districts that had separate junior and senior high school facilities. Vocational industrial teachers and those industrial arts teachers who taught both junior and senior high school classes were eliminated from the study.
5. Comparisons between teachers, sub-groups of teachers and responses to the inventory were limited to the following variables and combinations: senior high school teachers, junior high school teachers, limited area laboratory, multiple area laboratory, industrial arts primary objective orientation, teaching experience and educational background.
6. The assessment and analysis of the sample population was restricted to their responses to the inventory and its individual items. No empirical evidence involving the effectiveness of these teachers in the encouragement or discouragement of this type of student behavior in their classrooms was presented.

VI. THEORY AND THE FORMULATION OF HYPOTHESES

The type of instructional activities employed in many industrial arts classes often are problem-centered or involve the identification and eventual solution of problems. Even in the strict project-centered approach, an awareness or recognition of eventual problems is an important asset to success. Another important aspect of problem-solving

is the ability to suggest many alternative ideas or solutions to problems that vary considerably from each other. Unique, new or original ideas are often encouraged and contribute to achievement of effective solutions to problems. Since these traits and abilities are important ingredients in solving many problems that are presented to students in industrial arts classes, it was hypothesized that many industrial arts teachers will indicate they encourage student behavior that is characteristic of these traits.

Although the above theory is generally accepted, there still remains a wide and often distinct divergency among various industrial arts programs. For example: junior high school industrial arts programs are usually offered to a heterogeneous group of students and present a broad exploratory type of program. Senior high school industrial arts programs usually become more specialized and serve a more homogeneous population. As a result of the differences in the population and the breadth of programs between junior and senior high school industrial arts offerings, it was hypothesized that junior high school industrial arts teachers will indicate greater encouragement of creative behavior traits than senior high school industrial arts teachers.

Indirectly related to the above hypothesis is the concept of limited area or multiple area laboratory type programs.* In a multiple area program, students come in contact with many different materials, and in general have a wider range of experiences. Since "experience provides fuel for ideation" (6:54) and fluency of ideas is an attribute of creativity, another likely hypothesis was that teachers of multiple area

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*These are often called unit shop or general shop programs.

industrial arts programs will indicate greater encouragement of creative behavioral traits than limited area industrial arts teachers.

Not only was it hypothesized that different situations or types of programs reflect the encouragement of creativity, but the primary role or objective of industrial arts, as perceived by different teachers, may be related to the encouragement of creative or non-creative behavior and remain independent of the level of teaching or type of laboratory programs. For instance, teachers who view industrial arts as a program that provides exploratory experiences with materials and processes in order to help students gain a better understanding of themselves and their potentiality, may indicate greater encouragement of creative behavioral traits than teachers who view industrial arts as closely identified with manipulative skill development, or teachers who view industrial arts as interpreting industry and the role it plays in our industrial society.

The last area from which hypotheses were generated was related to educational background and teaching experience. No directional hypothesis was specified with regard to the effect of experience on teachers indication of encouragement of creative behavioral traits. Hence, the null hypothesis of no difference was tested. In the area of educational background, it was hypothesized that teachers with master degrees will indicate greater encouragement of creative behavioral traits than bachelors' degree industrial arts teachers.

Assessment of the degree industrial arts teachers indicate they encourage their students to exhibit various creative behavioral traits was based on the total scores of individual teachers responses to the

creative and non-creative behavior inventory. Specific differences between various sub-groups of teachers were hypothesized to exist between the proportionate number of teachers whose total score on the creative scale was above or below the median score for the combined group. The following effects were hypothesized.

Major Hypotheses

1. A larger proportion of junior high school industrial arts teachers will score above the median score on the creative scale than high school industrial arts teachers.
2. A larger proportion of multiple area industrial arts teachers will score above the median score on the creative scale than limited area industrial arts teachers.
3. A larger proportion of industrial arts teachers who rank the self-realization objective (B) as number one will score above the median score on the creative scale than those teachers who rank the skill development objective (A) or interpreting industry objective (C) as number one.
4. A larger proportion of industrial arts teachers with master degrees will score above the median score on the creative scale than teachers with bachelor degrees only.
5. A larger proportion of industrial arts teachers within some length of teaching experience category will score above the median score on the creative scale than teachers in other length of teaching experience categories.

Sub-Hypotheses

1. A larger proportion of junior high school multiple area industrial arts teachers will score above the median score on the creative scale than junior high school limited area teachers.
2. A larger proportion of senior high school multiple area industrial arts teachers will score above the median score on the creative scale than senior high school limited area industrial arts teachers.
3. A larger proportion of junior high school multiple area industrial arts teachers will score above the median score on the creative scale than senior high school multiple area industrial arts teachers.
4. A larger proportion of junior high school limited area industrial arts teachers will score above the median score on the creative scale than senior high school limited area industrial arts teachers.

The reverse effects were hypothesized for all groups with respect to the non-creative scale.

VII. SUMMARY AND OVERVIEW

The major problem of this study was to define operationally creative or non-creative behavior in the field of industrial arts and to determine the degree industrial arts teachers in Michigan indicate they encourage their students to exhibit creative behavior in their classrooms. The need for such a study was supported by the consistent

inclusion of an objective of creativity in generally accepted lists of industrial arts objectives. Furthermore, Lindbeck has indicated the need to test experimentally the goals and objectives of industrial arts. In the case of an objective of creativity, he reported no primary evidence, only secondary evidence of support for such an objective. (5:97) Before such an objective can be experimentally tested the need for a broader understanding of the nature of creative behavior in industrial arts was suggested.

It was assumed in this study that: (1) the abilities involved in being creative are universal and possessed by everyone to some degree, (2) creative abilities can be developed through the educative process and (3) creativity is not limited to one or several fields, but manifests itself in all phases of human endeavor.

This study was delimited to the field of industrial arts. Factors and characteristics of creativity from which behavioral statements were extracted were limited to the attributes of fluency, flexibility, originality, problem sensitivity and a general category. The final inventory included only those items agreed upon by five of six judges. A survey of the degree individuals or groups of industrial arts teachers indicate encouragement of students to exhibit the described type of behavior was limited to a sample of Michigan junior or senior high school industrial arts teachers.

It was hypothesized that many industrial arts teachers would indicate encouragement of creative behavior, but their expressed encouragement of creativity was dependent upon such variables as junior or senior high school teaching, multiple or limited area laboratory teaching, primary objective of industrial arts orientation, educational

background, teaching experience, and interrelationships between these variables.

The remainder of this report was organized in the following manner. An intensive review of literature related to general creativity was summarized in Chapter II. Topics such as the meaning of creativity, who is creative, factors of creativity, measuring creativity and developing creative abilities were discussed. In Chapter III a selected review of the literature associated with behavioral analysis of educational objectives and the development of operational definitions was presented with relationships and implications for this study. Research and literature related to the factors, attributes, traits and characteristics of creative persons was summarized and discussed in terms of implications for the extraction of creative and non-creative behavioral items in industrial arts. In Chapter IV, a description of the design and instrumentation of the survey phase of the study was given, the sample was described, statistical hypotheses were stated, analysis procedures were discussed and instrument development, testing and administrative procedures described. Data were presented, analyzed and interpreted in Chapter V. Chapter VI included a summary of the study, conclusions and recommendations.

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CHAPTER II

REVIEW OF THE LITERATURE RELATED TO GENERAL VIEWS OF CREATIVITY

I. INTRODUCTION

Introduce the topic of creativity and you can obtain almost as many views on the subject as individuals involved. Even to obtain consensus on a generally acceptable definition of creativity is extremely difficult. Most definitions of creativity range from the very simple to the highly complex and involved. In a previous investigation more than thirty definitions of creativity and the creative process were found and nineteen listed that provided the most meaning for industrial arts. (14:1-2) Rhodes presented thirty-two different meanings of creativity but also cautioned that: "Investigations have too frequently accepted one specific definition without recognizing the existence of many others and wandered into the maze created by those that were neglected." (58:13)

In the discussion that followed Ghiselin's report at the 1957 Research Conference on the Identification of Scientific Talent, a responder suggested: "that maybe we need more than one definition of creativity. . . it depends on . . . the purpose for which we're using it." (22:152)

II. A CONCEPTUAL MODEL APPROACH

Mooney has developed a framework that was helpful in arriving at a pattern of organization when considering the varying views and definitions of creativity. He called this framework a "Conceptual Model For Integrating Four Approaches To The Identification of Creative Talent." (44) Much of the confusion and seemingly contradictory statements often made concerning creativity stem from the approach one takes. Mooney identified:

> four significantly different approaches to the problem, depending on which of four aspects of the problem a person uses to gain his initial hold, i.e.; the aspect of (1) the product created or (2) the process of the creator or (3) the person of the creator or (4) the environment in which creation comes about. (44:170)

Each of these four approaches are evident today in the writings and research. The acceptance of one of these positions largely determines the manner in which one looks at the criterion of creativity, the definition of creativity, the means for identifying creative persons and the possibility of developing creative abilities. Mooney further suggested that "each is likely to have an appeal to a different group of people." (44:170)

All these approaches suggested by Mooney included the same basic elements. Each approach was distinguished from another by the emphasis placed on a particular element or from the point of departure. For example, the product approach commences with the product but eventually must consider the person who produced the product, the process and the environment where the product was produced. The approach through the environment while initiating with the environmental pattern required for

creativity must eventually consider the individual involved, the process employed and the product produced. Each of these approaches are reflected in the various meanings and definitions of creativity that follow.

III. THE MEANING OF CREATIVITY

Petersen highlighted the variation found in definitions of creative and creativity.

> Usage of the word "creative" and "creativity" ranges from an extreme of equating the meaning with "originality," to reserving the term to include the process which produced novel things or ideas which have been recognized by society, and have withstood the test of time as a measure of their validity. (57:421)

Paul Smith, speaking about the common elements of creativity in different fields, suggested that the fundamental ability present in all creative endeavors is: "The ability to relate previously unrelated things." (62:18) Other general definitions were: Osborn's "Creativity is the ability to generate ideas" (51:1) and Flanagan's view that "Creativity is. . . bringing forth almost anything new in the way of an idea, a formulation, a model, a theory, or an esthetic or practical product." (17:111-112)

Product or Individual

Many definitions or descriptions of creativity can be categorized into two classifications: (1) those that place the primary emphasis on the end product or contribution to society and (2) those that emphasize the individual person as a creator.

The following descriptions by Stein, MacKinnon and Ghiselin were characteristic of the first classification. Stein suggested that creativity is that process which results in a "novel work that is accepted

as tenable or useful or satisfying by a group in some point in time." (65:311) MacKinnon holds that true creativeness must fulfill at least three conditions. First, the idea or product must be novel or at least statistically infrequent. Second, it must serve to solve a problem, fit a particular situation or accomplish some recognizable goal. Third, true creativeness sustains original insight, and provides an evaluation, elaboration and development of it to the fullest. (37:485)

Definitions which emphasized the individual or second classification are those of Brown, Drevdahl, Rogers, Bruner and Wilson.

A test for creativeness, Brown indicated, must be made in terms of the producer, "It is creative if it is original or an improvement of a past performance no matter how it compares with the production or performance of others." (8:85) In a study exploring relationships between rating of creativity in a high level population and certain objectively measured personality and intellectual factors, Drevdahl provided the following definition to each of the raters:

> Creativity is the capacity of persons to produce a composition, products, or ideas of any sort which are essentially new or novel, and previously unknown to the producer. It can be imaginative activity, or thought synthesis, where the product is not a mere summation. It may involve the forming of new patterns and combinations of information derived from past experience, and the transplanting of old relationships to new situations and may involve the generation of new correlates. It must be purposeful or goal directed, not mere idel fantasy-although, it need not have immediate practical application or be a perfect and complete product. It may take the form of an artistic, literary or scientific production or may be of a procedural or methodological nature.(16:22)

Carl Rogers made no distinction between good and bad creativity and eliminated the concept of group acceptance or social novelty when he defined the creative process as:

> the emergence in action of a novel relational product, growing out of the uniqueness of the individual on the one hand, and the materials, events, people, or circumstances of his life on the other. (59:71)

Bruner defined creativity as "an act that produces effective surprise." (9:20) To Bruner, effective surprises need not be rare or seldom recognized and experienced, but rather are quite obvious when they occur, producing a shock of recognition, following which there is no longer surprise. The content of this surprise can be as varied as the continuum of human activities.

Wilson provided one of the clearest and comprehensive descriptions of creativity.

> One might define it as the process by which something new is produced-an idea or an object, including a new form or arrangement of old elements. The new creation may contribute to the solution of some problem, or it may be the production of an aesthetic effect or the clarification of a concept. Indeed it may be any intellectual, emotional, or social problem with which an individual in our society is interested or concerned. The creative solution is aimed primarily at solving a problem which concerns the person engaged in the process. It may or may not solve a problem for someone other than the creator. (83:19)

Newness and Novelty

Writers appeared to agree that an element of newness or originality must be present for an act to be considered creative. But there is some question raised as to whom such an element should be new - the individual, his society, or the whole universe. (63:11) The two classifications of definitions presented divide on the basic points of new to whom and new in what context. Stein and MacKinnon viewed the creative idea or product as a statistical infrequent event accepted by a group at some point in time. On the other hand, the Bruner, Brown and Drevdahl definitions suggested that newness means new to the individual

or creator in the context of the world as he understands it or the total of all his experiences. A quality of creativity has been shown: if the individual arrives at something new to himself that is satisfying and in that same sense useful to him, if he has related things that were unrelated previously in his experience, and if the product is surprising to him.

Definition of Creativity in Industrial Arts

In a pilot study that attempted to validate Torrance's pencil and paper tests of creativity, using the creative abilities of junior high school industrial arts students as the criterion, Moss and Bjorkquist have defined creativity from both the product and individual approach:

> When a student organizes his past experience in such a manner as to reach an unusual and useful solution to a perceived problem, he has formulated a creative idea. When the idea is expressed in an observable, overt form, he has developed a creative product. A student's creative ability is evidenced by, (a) the relative degree of unusualness and usefulness of each of his products, and (b) the total number of his creative products. (46)

A new product was further defined as:

> An idea or combination of ideas expressed or manifested in any overt, observable form as a solution to a non-factual type problem is a product. Products may take many forms in the industrial arts, such as verbal (oral and written) communications, physical acts, two-dimensional representations, and three-dimensional objects. (46)

Unusualness is measured, according to Moss and Bjorkquist, in terms of probability of occurrence. They further state:

> The less the probability of its occurrence, the more unusual the product. The specific probability of occurrence of a particular student's product must be based on the actual or anticipated varieties of products of a peer group having similar experimental background. (46)

To satisfy the requirement of usefulness, a product "must satisfy the minimal principal requirements of the problem situation; to some degree it must 'work' or be potentially 'workable'." (46)

While this definition is in the process of refinement and clarification it was the most comprehensive and inclusive statement that has been made so far dealing with the central issues of creativity in industrial arts.*

IV. WHO IS CREATIVE?

Another issue frequently raised by writers in the field of creativity concerns who possesses the ability and capacity to be creative. In part, this question can often be answered by the accepted definition of creativity. For instance, to be consistent with a definition that emphasized the creative product and its criterion of "social novelty," only those individuals who can create such a product could be classified as creative or possessing creative abilities. However, acceptance of a definition that emphasizes the individual and maintains that novelty or newness is a function of the individual's experience and background, would cause one to believe that everyone has the ability and capacity to be creative. In recent years, as Taylor pointed out:

> The growing realization of the universality of creativity, of man's heretofore unsuspected capacity for creativeness, of the uniqueness of every individual, places the idea of creativity in new perspective. (28:142)

When summarizing the views of Rogers, Maslow, Combs, and Kelley, Calvin Taylor emphasized the agreement among these four authors regarding the nature of creativity, even though their points of reference may be different. Two basic premises were found underlying all of their views: (a) "Creativity is necessary for a fully adequate personality, and (b) every person has the capacity for creativity." (68:142)

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*The complete theoretical model developed by Moss and Bjorkquist is found in Appendix A.

According to Carpenter (10:392) and Franseth (18:306) the myth that some individuals are supposedly born with creative abilities while others are not has been a typical view held in the past by teachers. In recent years the realization has emerged that creative abilities and potential may not be confined to a few people and determined at birth. Evidence seemed to support the view that every person possesses creative abilities in some area and to some degree. Largely responsible for this changing opinion has been the work of Guilford and associates at the University of Southern California in their factor analytic studies of intellectual abilities and attributes of creativity. When commenting on the intellectual abilities that characterize the more creative individual, Guilford prefaced his discussion of these abilities and stated:

> When we say "the more creative individual," we mean that all individuals have some degree of the abilities that contribute to creative performance. Recognized creative artists, inventors, scientists, composers, and planners simply have more of certain abilities that all human beings have. Note, also that reference is made to creative "abilities" in the plural. Potentiality for creative performance is not just one ability; it involves quite a number of different abilities. A person may have much of some of these abilities and little of others. All of us tend to be uneven in our aptitudes but there are some persons who have large amounts of many or all of the abilities needed to be outstandingly creative. (29:5)

Levels of Creativity

Guilford, (29:5) Carpenter (10:391) and others have suggested that all individuals have, to some degree, the abilities that contribute to creative behavior. The problem of degree or level of creative behavior enters into most definitions. Irving A. Taylor, after reviewing and making a content analysis of over a hundred definitions of creativity, identified five distinct psycholinguistic clusters of usages. He identified these clusters, or levels of creativity as:

1. Expressive: independent expression, where skills, originality, and the quality of the product are unimportant. Spontaneity and freedom to explore are important. For example: children's spontaneous drawing.

2. Productive: shows some mastery over some portion of the environment, with a new level of proficiency achieved by the individual.

3. Inventive: ingenuity is displayed with materials, techniques and inventive talent is operative. Notes new and unusual relationships between previously separated parts.

4. Innovative: involves improvement through modification of basic principles, requires a great deal of abstract conceptualizing skills.

5. Emergentive: a new principle or assumption, around which new schools flourish, emerges at the most fundamental and abstract level. . . as exemplified by Einstein, Freud, Picasso, Frank Lloyd Wright. (62:55-60)

A somewhat different approach was taken by Smith and Tyler in categorizing levels or degrees of creativity. Instead of employing a content analysis approach, they identified six levels of creativity in terms of general student behavior, characterized by the following statements:

1. Unimaginative: has given practically no evidence of originality or creativeness in imagination or action.

2. Imitative: makes little or no creative contributions, yet shows sufficient imagination to see the implications in the creation of others and to make use of their ideas or accomplishments.

3. Limited: shows the desire to contribute his own thinking and expression to situations, but his degree of imagination and originality is not in general high enough to have much influence on his accomplishments.

4. Promising: shows a degree of creativeness that indicates the likelihood of valuable original contribution in some field although the contributions already made have not proved to be particularly significant.

5. Specific: makes distinctly original and significant contributions in one or more fields.

6. General: approaches whatever he does with active imagination and originality, so that he contributes something that is his own. (61:478)

An understanding of the concept of degrees or levels of creativity helps prevent individuals from making misleading generalizations about creativity that pass from one level to another. Furthermore, it assists educators in handling the problem of developing the creative abilities of students through a recognition that all students are capable of performing creatively at some level of behavior.

Creativity in Various Fields

Another misconception that Carpenter pointed out has been the erroneous notion that creativity is confined to just certain fields such as music, art, writing, and scientific inventions and discoveries. "This belief is not only false but extremely harmful. Creativity exists in all phases of human thought and endeavor." (10:392) Further support that individuals differ not only in the level of development of general creative ability, but also in the degree to which they can be creative in a particular field of endeavor comes from Guilford and Russell. Guilford contended that the inventor, writer and artist may have some creative factors or attributes in common, but that there was also considerable variation in their pattern of abilities. Russell concluded that "Creative thinking undoubtedly differs in terms of the field applied." (60:307) By way of illustration, he suggested that creative thinking in the field of art probably is influenced by personal and emotional factors while creative thinking in the field of science may be more closely related to objective or problem-solving abilities. (60:307)

V. FACTORS, ATTRIBUTES, OR CHARACTERISTICS OF CREATIVITY

Much of the current experimental research concerning creativity has been made possible by the identification of factors, attributes or characteristics of creativity. Major credit must be given to Guilford and his associates at the University of Southern California, who were the first to attempt, empirically, to isolate and identify factors of creativity. Since their early study in 1952 (32) other researchers such as Barron, MacKinnon and Lowenfeld have also extended the understanding of the nature of the creative person.

Several of these studies are reported in this section; however, only highlights and major findings are given. The results of these and other studies are explored in greater detail in Chapter III where relationships were drawn between the general research on creativity and implications for statements of creative and non-creative behavior in industrial arts.

The Guilford and Lowenfeld Studies

Guilford, in his historic speech on creativity before the American Psychological Association in 1950 emphasized the general neglect of the subject of creativity by psychologists and others. He presented his views and theory of creativity and proposed several specific hypotheses concerning creative abilities that should be tested. (27:444-454) Following this speech, Guilford set out to test these hypotheses by isolating and defining abilities which were important in the domain of creative thinking. In his study he hypothesized a number of intellectual abilities associated with creativity. He then developed and assembled a battery of possible tests of these factors and administered them to four hundred and ten air cadets and student officers in the U.S. Navy. A factor analysis resulted not only in the identification of expected intellectual factors, but also in the identification of several other factors which Guilford suggested were also factors of creativity. The original list of hypotheses and factors of creativity as identified by Guilford were as follows:

1. Sensitivity to problems: the ability to see defects, needs or deficiences.

2. Fluency
   a. Word fluency: the rapid production of words that fulfill restrictive structural requirements. By "structure" is meant that the letter combinations given are real words.
   b. Associated fluency: the rapid production of words meeting specific requirements of meaning.
   c. Ideational fluency: the rapid production of ideas in a situation in which there is relatively little restriction.

3. Flexibility
   a. Adaptive flexibility: the changing of one's mental set to meet new requirements imposed by changing problems.
   b. Spontaneous flexibility: the ability to change set not directed toward the solution of a narrowly defined problem, takes new directions with or without apparent good cause.

4. Originality: the ability to produce (1) uncommon or statistically infrequent responses, (2) remote or unconventional associations, and (3) clever responses as evaluated by ratings.

5. Penetration: no verification

6. Analysis: no verification

7. Synthesis: the production of perceived objects.

8. Redefinition: the ability to use common objects or their parts in new and unusual ways, or unusual adaption of common objects to new uses in order to solve practical problems. (32:19-23)

In a series of studies done at Pennsylvania State University, Lowenfeld reported, in 1958, that his own group working independently of Guilford,

"arrived at almost exactly the same eight criteria of creativity which significantly differentiate between creative and less or non-creative people." (36:538) In order to determine if the two tests actually measured the same attributes, Kenneth Beittel found significant multiple correlations (.45 and .54) in two studies between the attributes tested in both investigations. (36:538) The eight attributes of creativity identified by Lowenfeld were:

1. Sensitivity to problems
2. Fluency of ideas
3. Flexibility
4. Originality
5. Redefinition and the ability to rearrange
6. Analysis or the ability to abstract
7. Synthesis and closure
8. Coherence of organization (36:539-540)

The Barron Studies

In a series of studies carried on at the Institute of Personality Assessment and Research of the University of California, Frank Barron studied the characteristics of a large number of creative individuals in a group that included painters, writers, physicians, physicists, biologists, economists and anthropologists. The degree of creativeness of the subjects was estimated on the basis of opinions ventured by their colleagues or by experts in their particular field of expression. The following characteristics tended to differentiate this group of creative individuals from other individuals in similar fields:

1. Creative persons show a marked preference for drawings which are complex, asymmetrical and dynamic. They also exhibit considerable tolerance for drawings which most people would consider chaotic.

2. Creative persons may be attracted to disorder or ambiguity but their response to disorder is to find an elegant new order that is more satisfying than a simpler arrangement.
3. Creative persons are more independent in judgment than the less creative.
4. Creative people are especially observant, and they value accurate observations (telling themselves the truth) more than many other people do.
5. Creative individuals at times appear to be willing to stake their lives if this is what they think is necessary.
6. Creative people have exceptionally broad and flexible awareness of themselves.
7. Creative people have more contact than most people do with the life of the unconscious.
8. Creative persons are moved by an intense commitment that impels them to search for new forms of artistic vision. (7:150-166) (4:288-305)

The MacKinnon Study

In a study of the characteristics of a group of forty creative architects nominated by five professors of architecture, MacKinnon found marked differences between this group and two other groups of architects included in the study. Some of the more distinctive characteristics were:

1. Creative persons are discerning and observant in a differentiated way; they are alert, capable of concentrating attention readily and shifting it appropriately; they are fluent in

scanning thoughts and producing those that serve to solve the problems they undertake.

2. Creative persons are more inclined to expression rather than suppression or repression.
3. Creative persons have a greater openness to experience. This openness and their relative lack of self-defensiveness makes it possible for them to speak frankly, critically and openly about themselves and their problems as an adult.
4. Creative persons tend to prefer perceiving to judging and are inclined to be more interested and curious, more open and receptive and seeking to experience life to the fullest.
5. Highly creative persons are not conformists in their ideas, but are not deliberate nonconformists either.
6. Creative individuals are more flexible with respect to means and goals.
7. Creative persons are relatively less interested in small details or facts as such add more concerned with their meaning and implications. (38:15-17, 69) (37:484-495)

The Taylor Studies

At the University of Utah, Taylor has studied the problem of identification of creative scientific talent. The characteristics of creativity that he has identified from an analysis of scientific talent may be summarized as follows.

The ability to sense problems is an intellectual trait often associated with creativity. Curiosity in action or the ability to sense ambiguities plus effective questioning ability appear to be important to creative activity.

Motivational characteristics suggested by Taylor were curiosity; liking to think, manipulate and toy with ideas; intellectual persistence; need for recognition of achievement; need for variety; effective work habits; high energy; and the willingness to take risks.

Personality characteristics listed by Taylor were: devotion to autonomy, more self-sufficient than most people,more independent in making judgments, more complex as a person, more self-accepting, more resourceful and adventurous, more radical, more control over his own behavior, possibly more emotionally sensitive, and more introverted than bold. (67:62-79)

VI. CREATIVITY AND INTELLIGENCE

In his work since 1950 Guilford has consistently raised doubt concerning the coverage of typical measures of intelligence in assessing creativity abilities. These measures, he contended, have largely assessed the convergent thinking factors of intellectual abilities rather than factors of divergent thinking. "Convergent thinking pertains to well structured problems for which one right answer, or a restricted number of very similar answers, is called for." (25:67) Divergent thinking, on the other hand, "pertains to less structured situations, in which the individual's thinking is free to take different directions or it may pay him to think in different directions." (25:67) "It does not necessarily mean flying in the face of convention, but it frequently leads to unconventional results." (26:50) As a result of his factor analytic studies of creative abilities, Guilford classified the factors of fluency, flexibility and originality as divergent thinking factors. The factor of redefinition was considered a convergent thinking ability and sensitivity to problems was classified in the evaluation category. (25:68)

Studies by Getzels and Jackson, Torrance, Stein and MacKinnon of relationships between creativity and intellectual ability, as measured by standard intelligence tests, tend to support Guilford's contention that: "Creative people are more likely to excel in the divergent thinking abilities." (26:50)

Considering that relationships between measures of intelligence and creativity differed from grade to grade and between sexes, Torrance pointed out that: "Most of the coefficients of correlation are relatively low (around .30), and are higher among girls than boys." (78:218)

Taylor and Holland indicated that:

> The majority of studies suggest that the relation of intelligence tests. . . to creative performance is generally low (.20 to .40) in unselected populations (Getzels and Jackson and Torrance) and is zero or even negative for homogeneous samples at high levels of intelligence (MacKinnon, 1959; Holland, 1961; Mullins, 1959; and Yamamoto, 1961). (74:93)

Getzels and Jackson studied a group of 533 boys and girls in a private school in the Chicago area and found correlations ranging from .11 to .39 between intelligence and five creativity measures. Either a Binet or Henmon-Nelson IQ was available and all scores were converted by a regression equation to comparable Binet IQ's. Correlations between the two measures for boys and girls were summarized in Table 1. (20:19-20)

In similar studies both Getzels and Jackson and Torrance found that if a typical IQ test (Stanford, Binet, Wechsler, California or Otis) was used to select top level talent, about seventy percent of the persons who scored in the top twenty percent on a creativity test battery

would have been excluded from talented groups selected on the basis of intelligence only.(79:58-59)

TABLE 1

CORRELATIONS AMONG MEASURES OF CREATIVITY AND IQ

Measures of Creativity	Boys N=292	Girls N=241
1. Word association	.37	.37
2. Use of things	.18	.14
3. Hidden shapes	.36	.30
4. Fables	.13	.11
5. Make up problems	.24	.39

MacKinnon summarized his findings on creativity and intelligence with the following statement:

> Over the whole range of intelligence and creativity there is, of course, a positive relationship between the two variables. No feeble-minded subjects have shown up in any of our creative groups. It is clear, however, that above a certain required minimum level of intelligence which varies from field to field and in some instances may be surprisingly low, being more intelligent does not guarantee a corresponding increase in creativeness. It just is not true that the more intelligent person is necessarily the more creative one. (37:488)

At present, the best conclusion that can be drawn was that intelligence, as measured by typical tests, accounts for only a portion of the variation in creative performance and alone it is not an adequate measure of creativity.

VII. MEASURING CREATIVITY

Research knowledge about creativity has been limited, but as True has pointed out: "Most, if not all, of today's formal research in this area is devoted to attempting to identify the creative individuals in our society." (82:2)

Multivariable Approach

The general pattern of research assessing creative talent has not followed the same pattern of research on intelligence. In general, a broad multivariable approach has been used with emphasis on a range of assessment variables in contrast to identification of intelligence by means of a single measure such as an IQ score.

Guilford's (32:1-24) factor analytic studies of a large battery of creativity tests with adults explored other intellectual factors that he suggested were more closely related to creativity than typical factors measured by IQ tests. The Guilford battery consisted of thirty-one experimental tests of creativity and twelve reference tests of known factor content. Since his initial study, Guilford and his associates have continued to carry out studies in an attempt to perfect and validate these tests. (See Guilford and others (30), (31), (24) and Kettner, Guilford and Christensen (35).

Wide use has been made of Guilford's tests by other researchers. Usually they have employed some of his tests, or modified them slightly, rather than use the complete battery. Gerry and others in a validation study to determine whether selected Guilford tests predicted creative ability as measured by a creative activities score of a biographical inventory, found fifteen scores obtained by the Guilford tests that correlated significantly with the creative activities score. The factors of sensitivity to problems, ideational fluency, and originality were found to correlate the highest with the creative activities score.

(54:348) In another validation study by Mullins, four scores derived from the Guilford tests were significantly related to supervisors' ratings of creativity of 131 research scientists. The four test scores were word association (H), unusual uses (L), common situations, (F) and plot titles (H). Seven Guilford scores were significantly related to the number of publications criteria of creativity. These test scores were unusual uses (H), common situations (T), common situations (Fl), plot titles (L), consequences (H), brick uses (T) and brick uses (Fl). None of the scores were found to be related significantly to both scores. (42:12-13)

Two other studies indicated that evidence of the validity of such tests was still incomplete. Taylor and others found "evidences of restriction of range which make results unclear when significant validities are not obtained." (74:97) Chorness and Nottelmann found that an intelligence test measure predicted ratings on creativity criteria in teaching, for fifty-two students at the Instructor School, Lackland Air Force Base, as well as did selected tests from the Guilford battery.(11:346)

Torrance, in a series of studies of school age youth, developed alternate forms of several of the Guilford-type tasks and added new tasks which required several types of thinking. This was a divergent approach from Guilford's belief that predictor measures should represent single factors. (79:44-45)

While creativity measures have mainly included new intellectual characteristics not contained in IQ tests, several researchers have investigated motivational, biographical, sociometric and other personality characteristics. Meer and Stein (66:171) in their study of research chemists, subjected them to a two day individual and group psychometric

analysis designed to yield both self-evaluative and biographical information on certain variables. Barron reported on studies of highly creative individuals in the areas of writing, architecture, and mathematics at the Institute of Personality Assessment and Research. These subjects were evaluated on a multiplicity of variables during their three-day period of living-in-assessment. (6:74-75)

One of the most extensive examples of multivariable research in creativity were the Utah studies of Air Force scientists carried out by Taylor and others. Fifty criterion scores on each scientist were obtained from supervisors, peers, the individual, records, reports, publications, organization membership, college records and interviews by the project staff. Investigators spent one year in the various research organizations collecting the criterion data and securing 130 test scores in five interval test administration periods. (75:2-5)

While there remains an uncertainty about the degree to which these batteries of creativity tests are valid predictors of creative performance, Taylor and Holland suggested that: "These creativity tests are, without doubt, measuring intellectual characteristics that are not closely related to those involved in high intelligence test scores." (74:97)

Other researchers exploring intellectual characteristics related to creativity have developed their own tests of creativity. One of the earliest tests developed for the identification of creative ability in a specific field was the A.C. Test of Creative Ability. As a pencil and paper test suitable for either group or individual administration, it was developed for the purpose of assigning supervisory and technical

personnel in industry according to creativity requirements of a particular assignment. Originated by R. Harris in association with A. Simberg of the A.C. Spark Plug Company, the test was published in two parallel forms containing five parts. Scores yielded by the test were in three areas: quantity, uniqueness and quality. The quantity score corresponded to fluency, uniqueness compared to originality and the quality score was a modification of the quantity score. Several validation studies have been made by a comparison of scores made by high and low creative groups as determined by supervisors ratings in two studies and number of suggestions for improvements submitted on a third study. (76)

In a study of the effectiveness of a fifty minute presentation of principles of creativity, G. Herbert True developed a test using items adapted from or suggested by the tests of Guilford and Richard Harris (A.C. Test). Scores on the factors of fluency and, its modification, quality were obtained. Reliability estimates, employing Hoyt's technique, were reported as .66 and .75 for the two forms of the test with a correlation of .49 between forms. According to the test, the presentation was effective in increasing fluency and quality of ideas among both high level industrial personnel and students at the University of Iowa. (82)

A Multi-Media Test of Creativity was developed and reported by Mosing in 1958. Mosing's study was designed "to develop valid and convenient measures of some generic aspects of creativity and originality." (45:2) In order to make his tests general, Mosing used items that sought responses with stimuli commonly and frequently experienced by everyone or so unique that no one had prior experience with them. Validation studies supported the following hypotheses:

1. Creative persons produce more numerous and varied associative responses to commonly experienced stimuli than do less creative persons.
2. The number and variety of associative responses to common stimuli are valid indicators of creative ability in differently defined populations. (45:2)

Scores yielded by the final instrument were in terms of fluency, variety (similar to flexibility) and uniqueness (similar to originality).

Tests and measures of creativity summarized in this section lend support to the validity of using divergent thinking factors such as: fluency, flexibility, originality and a modification of fluency identified as quality as characteristics of creativity in general and specialized areas.

VIII. DEVELOPING CREATIVITY

Carpenter has characterized the weakest single phase of American education as the matter of developing the creative abilities of school youth. (10:391) For years some educators have debated whether creative thinking or imaginative abilities can be developed through instruction. Those who said no, were usually concerned with the "emergentive" and "innovative" levels of creativity as classified by Taylor.* There is a complete lack of evidnece of the effectiveness of instruction for creativity on these levels. Longitudinal studies would be required of the complete adult life span of all individuals studied in order to assess adequately the effectiveness of such instruction. However, within the past ten years there has been a steady expansion of evidence that creativity at the "expressive," "productive," and intentive levels can be increased by instruction.

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*Description found on page 24.

Indirect evidence was found in the number of institutions and individuals that have set up courses for the purpose of increasing creativity. Industry has given widespread acceptance to inclusion of creative problem-solving courses in their management training programs. Blake Clark reported that "some 100 leading industrial firms now give some form of creative problem-solving courses to managers, supervisors, and other employees." (12:66) Some industries offering such courses are A.C. Spark Plug Division of General Motors; U.S. Steel Co.; National Cash Register; General Electric and Smith, Kline and French Laboratories. In 1959, J. Clark reported that thirty-five universities and nine colleges were offering integrated courses in creative thinking. By an integrated course Clark meant that the goal of the course was the creative use of specific subject matter. He listed seventeen subject areas ranging from "such technical fields as chemistry and engineering, to the humanities and social sciences." (13:3)

It is difficult to measure the contribution of the Creative Education Foundation founded by Alex Osborn to the development of courses based on Osborn's text, Applied Imagination or the related teaching materials provided by the Foundation. While exact figures are unavailable, Osborn estimated in 1960 that:

> There have been over 1,000 such courses in industry and in education. We do know that over 37,000 members of the Air Force have taken this subject in the ROTC, on some 200 campuses. Another index is the fact that my textbook is now in its 12th edition, 100,000 copies. (52)

Since 1955, several research studies have contributed evidence that suggest creative abilities can be improved through deliberate instruction. Some of the more pertinent studies reported were those conducted by: Parnes and Meadow; Maltzman and Associates; Gerry, Chorness and DeVeau; True; Nicholson; Torrance; Sommers; Anderson; Metz; and Hutchinson. Each of these studies have differed in terms of organization, instructional activities, methods, length of instruction, and criteria measures of creativity employed. However, each investigator has reported gains in creativity, as measured by the instrument employed, as an outcome of specific instruction.

In the following section only studies by Parnes and Meadow, Nicholson, Torrance, Sommers, Anderson, Metz and Hutchinson will be summarized. Studies by Maltzman and Associates; Gerry, Chroness and DeVeau; and True will not be discussed since they were included in an earlier section of this chapter.

Creative Problem-Solving Course Evaluation

During the years from 1959 to 1963, Parnes, with Meadow, and occasionally other collaborators, launched the first scientific investigation concerning the effectiveness of the University of Buffalo Creative Problem-Solving Course. Designed for the improvement of creativity, this course and others from coast to coast have been based on the principles and procedures set forth by Osborn in his book, Applied Imagination. (51) Pre-and post-tests have generally indicated that such courses enabled students to improve their idea production ability, but results were far from conclusive because experimental conditions had not prevailed.

A series of studies (42), (53), (55), and (56) involving over 350 students in the course at the University of Buffalo have provided the first objective evidence of the effectiveness of such courses. In general, these studies have been of the experimental-control group, test-retest design. Groups were carefully matched on the basis of intelligence, age and sex. Criterion measures employed were: The A.C. Other Uses (quantity and quality) Tests of Creative Ability, Guilford Plot Titles (low and high), Guilford Unusual Uses (quantity and quality), Guilford Apparatus Test (quality) and The Thematic Appreciation Test (originality and need achievement).

In 1963 Parnes summarized the most significant conclusions derived from these studies as follows:

> 1. Creative imagination can be deliberately developed.
> 2. Creative problem-solving courses can measurably improve the ability of students of average intelligence to produce good ideas, the criteria of quality being uniqueness and usefulness.
> 3. A systematic course of instruction in applied imagination can also produce significant gains in personality traits such as confidence, initiative and leadership potential. (54:186)

An experiment designed to evaluate the persistence of the effects produced by a creative problem-solving course provided evidence for an additional conclusion that: "Increased productivity in creative thinking produced by the creative problem-solving course persists for a period of eight months or more after completion of the course." (56:361)

<u>Nicholson Study</u>

In 1959 Nicholson reported results on the effects of a forty-five hour creative training course on an experimental group of thirty-two psychology students at the University of Houston. A control group of twenty-five other psychology students was selected and completed pre- and post-testing procedures. Six varied creativity instructional methods were employed with the experimental group ranging from Osborn's principles and techniques, the "other-world" technique of Arnold to locally produced materials. Several creativity and personality tests were employed with Guilford's Consequences Test the principle criterion measure. Results of the experiment suggested that training can increase significantly, improvement in the production of remote or uncommon ideas. However, no significant differences were found between the experimental and control group in quantity of ideas produced. (48)

The University of Minnesota Studies

Most investigations of deliberate attempts to develop creative abilities have been done with post-high school or adult groups. Torrance has been engaged in a series of studies regarding the manifestation and development of creative thinking from kindergarten through graduate school. Approximately 1,400 first through sixth-grade children and 1,500 college students and adults have been used in the experiments. (54:363) Criterion measures have been adapted from the Guilford tests and others developed by Torrance and his associates. Developmental growth curves, for most of the abilities thought to be involved in creative thinking, have been plotted for males and females. Most of these curves indicated sustained growth from first through third grade, with declines taking place between third and fourth grade, followed by extended growth at least through sixth grade. A decline was fairly common between the sixth and seventh grades, after which a steady rise was noted extending into the late high school period. After this period, most curves indicated a leveling off period or one of slight decline. (79:84-103)

In 1960, Torrance and his associates reported on the results of a specific investigation of developing creative talent in the early school years, grades one through six. Two classes at each grade level (a total of 386) participated in the study. Experimental and control groups were randomly formed with the experimental groups being trained to use a set of principles (Osborn's) designed to assist them in developing a quantity of ideas and to use higher quality ideas in improving some product. There was a "consistent tendency for the trained subjects to produce more responses, more flexible records and more clever responses than the untrained ones." (81:30) Differences between the experimental and control groups were statistical significant in grades two, three, four and six.

The Hutchinson Study

In a study of 256 seventh-grade students, reported in 1963, Hutchinson sought to determine what learning and thinking processes were sought by students with typical teaching practices while learning subject matter and then with a modification of teaching methods used, determine if changes occur in student processes. The primary categories of learning and thinking processes used in this study were: routine, cognitive-memory, convergent thinking, divergent thinking and evaluative thinking.

Four experimental and one control group matched on the basis of sex and mental age were assigned by pairs to four teachers. Before and after tests of creativity and subject matter on a unit of transportation were administered to both types of groups.

Prior to the unit instruction of the experimental group, a four day in-service training program was held for the teachers and their experimental students. During the training session, major emphasis was placed on recognizing the individual student as a thinker rather than just a learner, and the contribution of the student to the learning situation. Brainstorming and other idea generating techniques were discussed, demonstrated and practiced. A suggested outline of content, process and teaching procedure was developed for the fifteen days of unit instruction.

An analysis of tape recordings, notes from classroom observers and results of tests produced the following conclusions:

1. Verbal responses in the cognitive memory classification tend to dominate typical seventh-grade social studies classes. By modifying the instructional procedures to consider the student as a thinker as well as a learner, a wider range of responses was elicted. In contrast to instruction in the control groups, instruction in the experimental groups was more nearly geared to the entire range of mental abilities.
2. Modification of instructional procedure produced gains in achievement of subject matter for the experimental groups over the control groups.
3. Gains on measures of creativity for the experimental groups was significantly greater on four of the item tests than the control groups.
4. When instruction was changed to view students as thinkers as well as learners, the number of correlations became

significantly greater between actual classroom responses and measures of creativity. (33)

Developing Creative Thinking in Industrial Arts

Since 1960 there have been two studies of creativity in the field of industrial arts. In 1961, Sommers (63) and in 1963, Anderson (2) reported on studies investigating the influence of several methods of developing creative thinking and problem solving abilities within regular college industrial arts courses.

Sommers' study specifically investigated the feasibility of improving creative thinking within a free hand drawing laboratory type course for freshmen at Stout State College. He hypothesized that:

> Specific teaching methods designed to increase certain creative thinking abilities will increase those abilities without negatively affecting other learning outcomes of an industrial arts laboratory course. (63:7)

Students were selected at random and assigned to two groups, control and experimental, in separate sections of the subject matter course. The control group treatment consisted of standard learning activities for the course. In the experimental group, creative learning activities, designed by Sommers, were substituted for some of the standard activi-- ties. Results were based on an analysis of the scores yielded by the pre- and post-tests of creative thinking and subject matter. The University of Minnesota Test of Imagination (Form DX) was used to measure gains in creative thinking and a locally constructed test of understanding of free hand drawing to evaluate gains in subject matter.

Using the analysis of covariance technique, Sommers reported significant differences between the experimental and control groups on measures of subject matter and on some of the creative thinking test measures. Gains were in favor of the experimental group during replications in two college quarters. On the measures of creativity gains were observed on the factor of fluency and ask-and-guess adequacy for both quarters. On the factors of flexibility and inventive level, gains were significant for the second quarter only. No significant differences were found between groups on measures of originality. (63:112-117)

Anderson's study differed somewhat from Sommers on several points. Anderson's investigation was an evaluation of two methods for improving creative problem-solving abilities in a general education college level industrial arts course with classwork quite different from Sommers free hand drawing course. The type of creative treatment, although based on the same rationale, was quite different. Anderson confined his treatment to a few minutes at the beginning of a class period one day a week whereas Sommers integrated his creative activities into his instructional program throughout the normal class period.

In Anderson's study distinctly different treatments were given to two experimental groups and one control group. One experimental group treatment consisted of presenting nine weekly brochures of written materials. The material emphasized various techniques for improvement of creative thinking. The second experimental group received the same brochures plus nine oral, group-type imagination exercises developed by Anderson and based on Osborn's brainstorming principles. The third, or control group, received neither of the above treatments but was given the same lecture and laboratory work presented to all students in the experiment.

Three replications of the experiment were conducted during the winter and spring terms,1961-62, at Mankato State College. Subjects were non-industrial arts majors who were divided into three groups on the basis of levels of intelligence and within each level randomly assigned to each treatment group in each replication.

Pre- and post-test scores on several of the Minnesota Tests of Creative Thinking provided a measure of the creativity treatment effects with subscores for fluency, flexibility, originality and elaboration factors. A final teacher-made test was used to evaluate subject matter attainment.

Results of a two-way analysis of covariance showed significant differences among treatment effects in increasing creative problem-solving ability favoring a combination of written materials with verbal practice in all three replications. In all three replications, the direction or order of adjusted mean scores associated with levels of intelligence and interacting with treatments were inconsistent. On the final subject matter test, no significant differences were found among means for the three treatment groups. (2:158-159)

IX. SUMMARY

In this chapter several meanings of creativity were explored. Four approaches to creativity identified by Mooney as the product, process, individual and environment were reflected in the various definitions discussed. Emphasis on the product was sharply contrasted with emphasis on the individual. Creativity in industrial arts was described as existing when students organize their past experiences in such a way that they achieve an unusual and useful solution to a problem they have. (46)

Two positions presented concerning the question of who is creative were: all individuals have the capacity to be creative, and only a select few individuals possess such ability. A compromise solution suggested by several writers was to view creativity as operating on different levels and somewhat specialized in different fields of endeavor.

Primary factors or attributes of creativity were identified by Guilford and Lowenfeld as sensitivity to problems, fluency, flexibility and originality. Other researchers using personality assessment techniques have provided descriptions of personality and motivational characteristics of the creative person. The multivariable approach has generally been used when measuring creative ability. A wide range of intellectual abilities or personality characteristics have provided the basis for the development of several tests of creativity and inventories of non-aptitude traits. The test batteries developed by Guilford have been among the most widely used or adapted by other researchers.

Along with other studies, those by Sommers and Anderson, in the field of industrial arts, have supported the contention that creative abilities can be developed through planned instructional activities in regular subject matter courses.

In Chapter III, literature related to the development of a series of creative and non-creative behavioral statements in industrial arts was reviewed.

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CHAPTER III

THE DEVELOPMENT OF AN OPERATIONAL DEFINITION OF CREATIVITY

I. INTRODUCTION

A concept as general and varied as creativity has numerous meanings for different persons. The range and extent of some of these meanings were discussed in Chapter I. In this study, creativity in industrial arts was defined by developing a series of behavioral statements characteristic of creative behavior in industrial arts. In contrast, a series of non-creative behavioral statements were also developed in order to sharpen the distinctions between these two concepts. Defining a concept in this manner,as Cureton suggested, can be considered as developing an operational definition of an abstract concept since no other meaning is given to such a concept other than described by the acts or behaviors. (13:641)

In this chapter other studies which have operationally defined educational goals and concepts are reviewed and analyzed in terms of methodology employed. Techniques and procedures employed in development of the operational definition in this study are presented, together with a review of the related literature on characteristics of creativity and implications of this research for the field of industrial arts.

II. GENERAL STUDIES THAT DEVELOPED OPERATIONAL DEFINITIONS OF EDUCATIONAL GOALS

Elementary and High School Studies

Two of the most extensive studies that employed a behavioral analysis of educational goals as an operational definition of educational objectives were the Will French and Associates study of Behavioral Goals of General Education in High School (17) and its forerunner, the Mid-Century Committee on Outcomes in Elementary Education study of Elementary School Objectives. (36)

The major purpose of each study was to identify the goals of education for the particular situations and "at the same time provide a very practical definition - in terms of behavior - of each of the stated goals." (36:14) Both studies were predicated on the assumption that more specific descriptive statements of behaviors were essential if educational programs were to be effective in achieving the stated goals or objectives and evaluating the achievement of these same goals.

In the study of Elementary School Objectives, a group of thirteen outstanding educators and specialists in their respective fields (identified as a Committee of Consultants) were asked to submit descriptions of desirable outcomes for elementary school education. Next, a committee of ten critics composed of classroom teachers and supervisors, evaluated the suggestions of the consultants and submitted additional descriptions of outcomes. A final survey committee made up of eleven administrators, teachers and researchers developed the outline or framework for the final report, interpretation and recommendations. (36:28-41)

The procedure followed in the study of Behavioral Goals of General Education in High School was basically the same as the elementary educational

study. Consultants working individually identified goals, developed tests of behavioral outcomes and described illustrative behaviors. A review was carried out by a committee of teachers, administrators, psychologists and curriculum specialists. The final lists of behaviors consisted of statements which were rated as important by at least three-fourths of the reviewers who evaluated them. (17:17-19)

The list of behavioral outcomes in the high school study was extensive; but arranged and presented in a very useful and understandable manner. A summary of the study was presented as a "Form for Evaluating General Education Programs in terms of Behavioral Outcomes." (17:218-229) Particularly significant to the current study were the lists of illustrative behaviors of several outcomes related to creativity.

Eight-Year Study Evaluation Project

Another study that proceeded to define operationally educational objectives in terms of implicit student behaviors was the evaluation project associated with the Eight-Year Study of the Progressive Education Association. (54) This study behaviorally defined an objective of creativeness and imagination in terms of levels of creativity*. The method used in this study involved the formation of a committee, four representatives of the thirty participating schools, for each major type of objective. The meaning of the objective was clarified by descriptions of student behavior typically found when this objective was being emphasized.

Taxonomy of Educational Objectives

In a comprehensive effort spearheaded largely by Benjamin Bloom and a committee of college and university examiners, a Taxonomy of

*A description of these levels is given in Chapter II, pp. 23-24.

Educational Objectives (10) was developed. The intended purpose was to develop a means that would provide for classification of the goals of our educational system. While the committee recognized the problem of classifying phenomena (educational objectives) which could not be observed or manipulated in the same manner as is done in some scientific fields, they assumed that "educational objectives stated in behavioral form have their counterparts in the behavior of individuals and that such behavior can be observed, described and classified." (10:5)

Industrial Arts Statements

As was related in Chapter I, the American Vocational Association's A Guide to Improving Industrial Arts Instruction (1) and Wilbur's book, Industrial Arts in General Education (72) have provided two of the more extensive listings of illustrative student behaviors. These listings present limited operational definitions of generally accepted objectives of industrial arts. However, neither of these sources provided insight and direction into the derivation of these behavioral statements, except to imply that such statements must be developed by the individual teacher.

Observations Based on These Studies

The primary purpose in all of these studies that developed operational definitions of educational objectives was to facilitate evaluation of these objectives. Standard evaluative instruments have generally emphasized content or subject matter and appriasal of educational objectives associated with this content. In order to appraise the many other outcomes of educational programs, researchers in these studies had to develop new instruments and techniques for assessing them. To make a valid evaluation, a detailed description or definition of the specific

objective to be measured was required. An operational definition of an objective which was characterized by descriptive statements of student behavior sought, provided the type of definitions these investigators sought to develop their evaluation instruments.

Methods and procedures employed in the various studies reviewed have varied, but several behavioral statements representative of an educational goal or objective were developed and written by some individual usually working independently of others. Second, these statements were an individual's interpretation of the meaning of a particular objective or his views of the type of behavior sought when emphasizing a particular objective. Third, initial statements of behavior were checked for validity. Generally, this was accomplished by having critics or reviewers also familiar with the field analyze the statements, offer suggestions for improvement and identify omissions. Finally, some degree of consensus or agreement on the statements was achieved, usually by a final committee of reviewers.

III. GENERAL PLAN FOR OPERATIONALLY DEFINING CREATIVITY IN THE FIELD OF INDUSTRIAL ARTS

While considerable research has been done in identifying the characteristics and nature of creative behavior in general and within such fields as science, engineering, architecture, mathematics and arts, no concentrated attempt has been made in the area of industrial arts. The most extensive statement to date has been "The Theoretical Model for Identifying the Relative Creative Abilities ofIndustrial Arts Students" by Jerome Moss and David Bjorkquist.* (46) The two studies by Sommers

*Complete statement is found in Appendix A.

(55) and Anderson (2), cited in Chapter I, indicated creative abilities can be developed in industrial arts courses; but neither identified creative behavior in industrial arts. The criteria in both of these studies was a general test of creativity.

In this study, in order to arrive at a tentative operational definition of creativity in industrial arts, the research on creativity in general was reviewed. Emphasis was directed to those studies and writings that dealt with the factors, attributes, traits and characteristics of individuals who behave in a creative manner. When descriptive statements or findings characterizing creative behavior were found, an attempt was made to translate these statements into a specific description of student behavior in industrial arts, that would be classified as creative or non-creative behavior. Major emphasis was placed on the development of creative behavioral statements, but in order to sharpen the distinctiveness of this type of behavior comparative non-creative statements were also developed where appropriate. Some support for these non-creative statements was found in the literature but many were developed as the antithesis of a creative statement.

In industrial arts with its many specialized areas, the degree to which these creative or non-creative student behavior statements could be made specific presented a problem. For example, if a statement was made too specific, it might only have meaning for teachers of drafting in one case and in another, only those who taught electronics. In this study specific statements of behavior for the field of industrial arts were developed but generalized within the field.

The behavioral statements that were developed primarily originated from five basic areas and were so classified in this chapter. Four of

these areas were the general characteristics of fluency, flexibility, problem sensitivity and originality that Guilford and others found to be attributes, factors or primary traits of creativity. Selection of these factors was supported in several ways. In addition to Guilford and his many studies, investigations by Lowenfeld (38), and Taylor (63) and to some extent those of MacKinnon (39), Barron (6) and Torrance (71) summarized in Chapter II have found these traits to be present in creative people they have studied. Tests of creativity usually yield scores on the factors of fluency or quantity of ideas, flexibility or range of different ideas, and original or new ideas.* A score for the factor of problem sensitivity generally has been isolated only in the Guilford (34) and Torrance (69) test batteries. (69:213-253)

In the two studies of creativity by Sommers (55) and Anderson (2), both investigators used tests from the Torrance battery that yielded scores for fluency, flexibility and originality factors. One reason for excluding the problem sensitivity factor in some test batteries was the difficulty encountered in development of objective measures of this factor. These four factors, which were prominent in general studies of creativity appeared to have significant implications and meaning for industrial arts.

The fifth area was a general category composed primarily of personality, motivational and other non-intellectural or non-aptitude characteristics. The work of Mooney(44), Taylor (63), Stein (57), MacKinnon (40), Barron (4) and others has emphasized this area or approach to the problem of identifying creative persons.

A description of the general meaning and nature of each of these five characteristics is presented with research evidences related to

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*See Guilford (33), Torrance (69:213-253), Maltzman (41), A.C. Spark Plug Company (65), D. Harris (35) and Mosing (45). Also cited in Chapter II.

the specific characteristics or traits, in the remaining portion of this chapter. Implications of this research for industrial arts are drawn. Finally, the creative and non-creative statements of student behavior that were extracted from these findings are presented with specific documentation where possible.

IV. FLUENCY AS A CHARACTERISTIC OF CREATIVITY

In his address before the American Psychological Association in 1950, Guilford hypothesized the existence of "a fluency factor, or . . .a number of fluency factors, in creative talent." (23:452) Subsequent studies by Guilford and associates have supported this general hypothesis. (33), (31) Blake Clark showed the need for fluency and its relationship to creativity when he stated: "Good decisions come from a choice of alternatives. The fertile innovator approaches his problem from every point of view and lets the thoughts come tumbling." (12:67-68) Before a suggestion or idea can be characterized as creative, it must have been produced. The free and easy production of a quantity of ideas appears to be a characteristic of creative ability and is often described by the term, fluency. The meaning of the term fluency, sub-divisions of this factor and its relation to general creativity will be explored in the following sections.

Fluency and General Creativity

Fluency or fluency of thinking has been described by Guilford as "the facility with which ideas can be generated." (24:157) and is indicated by the number of ideas an individual can produce in a specified amount of time. (27:5) In initial studies, three sub-factors of fluency

were identified by Guilford as word-fluency, associational-fluency and ideational-fluency. (33:22) Subsequent investigations revealed an additional factor called expressional-fluency. (26:383) (30:473)

These sub-factors are discussed in detail in the sections that follow. The test numbers, names and factor loadings were presented in table form at the beginning of the discussion for each factor. Only those tests with loadings of .30 or higher were included from the test battery that was used to define the factor.

Word Fluency. This factor was defined by those tests listed in Table 2.

TABLE 2

WORD FLUENCY TESTS[a]

Test Number	Name of Test	Loading
53	Sentence Gestalt ("Right" Score)	56*
28	Word Transformation	52*
15	Circle Square II	44*
40	Disarranged Words	38*
36	Mutilated Words	37*
14	Circle Square I	36*

*All tests so marked did not have a higher loading on another factor.

[a]Modified versions taken from Reports from the Psychological Laboratory, No. 8, (33:15-16)

Word fluency has not been a recent discovery. Thurstone identified this factor about twenty years ago as the ability to express words rapidly with each word meeting the same letter requirements. (24)

Four of the tests listed in Table 2 involved the manipulation of letters or words that met specific structural requirements. In the

Sentence Gestalt Test (No. 53), the task required the subject to separate words continuously run together, where in the Disarranged Words Test (No. 40), scrambled letters had to be assembled into words. Regrouping letters in a series of words, without changing word order, to form a new set of words was the task required in the Word Transformation Test (No. 28). In the Mutilated Words Test (No. 36) words composed of partial letters had to be identified. In all of these tests, the meaning of the word was of no importance. In fact, the subject did not have to know the meaning of the words he gave. (33:4-6, 15, 16) Guilford had not predicted the two Circle Square Tests (Nos. 14 and 15) would be associated with this factor. However, he indicated they "are somewhat consistent with this interpretation since the tasks they impose do not emphasize meaning but the manipulation of circles and squares identified with certain objects." (33:15, 16)

In a later study of verbal-fluency factors, Guilford and Christensen varied the degree of restriction (structural requirement) in some of the tests. One test required no restriction and just asked the examiner to list words. In three other tests every word listed had to contain one, two or three specified letters within each word. Results indicated the no restrictions test to be worthless and the other three fairly good measures, with the three letter restriction somewhat inferior to the other two. (31)

Associational Fluency. Tests that were used by Guilford to define this factor are those presented in Table 3.

Associational fluency required the production of a variety of things related in a specific way. In contrast to the factor of word fluency, several of the tests in Table 3 required the production of words that

TABLE 3

ASSOCIATIONAL FLUENCY TESTS[a]

Test Number	Name of Test	Loading
39	Controlled Associations	46*
27	Sentence Gestalt ("Error" Score, Reflected)	34
11	Number Associations (Uncommonness)	33*
28	Word Transformation	32

*All tests so marked did not have a higher loading on another factor.

[a]Modified versions taken from Reports from the Psychological Laboratory, No. 8. (33:15-16)

fulfilled specific requirements of meaning. In the Controlled Association Test (No. 39), the subject was asked to list a number of words that were synonyms for a given word. In the Sentence Gestalt Test (No. 27), individuals who separated the list of words run together, on the basis of meaning, tended to produce fewer wrong words than those who separated the words according to their superficial appearnace. In the Number Associations Test (No. 11), the examinee was given number stimulus and`asked to list as many words as possible associated with the number. Uncommonness was determined by the number of statistically infrequent responses. The Word Transformation Test (No. 28), was also related to associational fluency although its major factor loading was defined as word fluency. (33:16)

Several new tests developed by Guilford are included in experimental test batteries that have extended the varieties and types of relations and involve figural and symbolic content. (30:473) "Letter combinations that satisfy certain figural requirements, such as the activity of producing monograms or other artistic effects with words" (22:112) were examples of an extended view of associational fluency.

Ideational Fluency. Those tests listed in Table 4 were found to define ideational fluency.

TABLE 4

IDEATIONAL FLUENCY TESTS[a]

Test Number	Name of Test	Loading
6	Plot Titles (Low quality)	59*
8	Common Situations	55*
12	Consequences Test (Low quality)	55*
9	Brick Uses (Fluency)	54*
5	Impossibilities	39*
1	Sentence Analysis	31*

*All tests so marked did not have a higher loading on another factor.

[a]Modified versions taken from Reports from the Psychological Laboratory, No. 8. (33:15-16)

The result produced by tests of word fluency and associational fluency were words. The factor of ideational fluency differed on this point since "it is the ability to produce rapidly a succession of ideas meeting certain meaningful requirements." (22:113) Tests of this factor normally required the subject to produce as many ideas or alternate choices as possible within a specified time. The ideas produced ranged in complexity from a simple word to a complex title of a picture or phrase that conveyed unitary thoughts.

All of the tests presented in Table 4 were designed to elicit as many ideas as possible in a stated time. Generally, tests of this factor were scored in terms of the total number of responses that met the stated requirements. The two exceptions, Plot Titles (No. 6) and Consequences Tests (No. 12) both yielded two scores each that reflected the quality of the response. High quality or clever responses and low

quality or non-clever responses were obtained from the Plot Titles Test. Remote or far-reaching consequences and the number of the immediate or less remote consequences to certain hypothetical changes suggested for a particular situation were obtained from the Consequences Test. For the factor of ideational fluency only the number of low quality, non-clever or immediate, less remote consequence scales were used. Tests scored for only a quantity of relevant ideas, no quality score, were the Brick Uses (No. 9) and Common Situations Tests (No. 8). Different uses for the common brick were solicited in the former and the number of problems suggested by a specific everyday situation in the latter. Sentence Analysis (No. 1) by listing all facts or assumptions contained in the sentence and the Impossibilities Test (No.5) of listing things that are impossible were also examples of idea generation tasks with few restrictions placed on them. (33:4-6, 16)

Lowenfeld tested ideational fluency by trying "to find out the number of different ideas which a person may have when thinking of using one item." (38:539) No distinction was made by Lowenfeld between ideational fluency and associational fluency.

The optimum degree of restriction in the tasks measuring ideational fluency were investigated recently by Guilford. "Three levels of restriction were introduced in three similar tests involving the naming of objects where one, two or three class properties were specified." (21:39) Guilford gave the following example of this type of item:

> Have the examinees name objects that are solid, to satisfy only one property; to name objects that are both solid and manufactured, to satisfy two specified properties; and to name objects that are solid, manufactured and black, to satisfy three specified properties. (4:69)

Results indicated that two specified properties were somewhat better than one and much better than three for identifying individual differences in ideational fluency.

Expressional Fluency. The factor of expressional fluency was not originally identified in Guilford's initial "Factor-Analytic Study of Creative Thinking Abilities." (33) In a later study reported in 1957, Guilford and Christensen identified this factor as the ability to put ideas into words. To date, measures have been confined to verbal tests that require the subject to put words together into connected discourse. (31:40) Guilford suggested, "The best tests of expressive fluency require examinees to produce rapidly either phrases or sentences containing two or four words. Another good test requires the writing of sentences, each of which contains four specified words." (21:69) The identification of this new factor indicated ability to generate or have ideas (ideational fluency) is different from the ability to express them or put them into words (expressional fluency).

How broad this factor of expressional fluency is has not been determined. To date, work has been limited to tasks, such as sentence writing. The concept of expression was not new to fields dealing with materials and processes, such as the arts and industrial arts. The free and easy expression of early school youth as characterized by spontaneity and freedom in their drawings is a form of expressive creativity described by Taylor. (64:55) A musical, graphic or product idea alone, without expression falls short of a total creative production. Further indications of the evolvement of a broader meaning for expressional fluency has been provided by the significant relationship found

between this factor and "ratings by psychologists of the creative performance of military officers." (26:383)

Other Views on Fluency

Lowenfeld suggested that "the practicing of fluency in art education is common in every classroom in which materials are used for various purposes." (38:539) He further indicated that as children become more fluent in the use of their materials (i.e., crayons, paper, paints, clay, etc.) they will be able to relate their expressional desires and be more creative in their expressions. (38:539) This was a much broader view than Guilford's which has, to date, been primarily related to verbal capabilities.

The need for fluency in everyday problem solving situations was indicated by Wilson when he suggested that "a satisfactory solution to a problem is most easily found when one is choosing from a large number of ideas." (73:21) A cautioning note was added by Taylor to the sheer quantity output of verbal ideas. He raised doubt that persons capable of producing a voluminous number of ideas were able to select the one or two most fruitful ideas for a particular purpose. (61:213) It has been reported that Clement Attlee has said of Winston Churchill "that no matter what problem came up, Churchill always seemed to have about ten ideas. The trouble was. . . he did not know which was the good one." (24:158)

Several studies revealed relationships between fluency factors and other non-aptitude personality traits. Merrifield reported on a study carried out by Guilford and associates in which he was in direct charge. Significant intercorrelations were found between impulsiveness and ideation fluency (r = .22) and expressional fluency (r = .25). Also

related to ideational fluency was self-confidence (r = .20) and appreciation of originality (r = .16). The factor of expressional fluency was found to correlate with meditative thinking (r = .21) and aesthetic expression (r = .16). Correlations between associational fluency and tolerance of ambiguity and adventure were .15 and .13 respectively. Word fluency was positively related to need for freedom (r = .12) and negatively (r = .14) related to cultural conformity. (43:57-74)

Fluency and Implications for Industrial Arts

The factors of ideational fluency appeared to possess the greatest implication for industrial arts. The other fluency factors, as defined at present, would seem to have important implications for English composition and creative writing courses. With a broader interpretation of associational and expressional fluency factors, as Lowenfeld suggested,* these factors could also provide considerable meaning in the field of industrial arts.

The ability to produce ideas or alternative choices in large quantity within a specified unit of time was interpreted as having particular meaning when attempting to solve a problem. Once a problem situation has been analyzed and defined by the problem solver, he will more likely find a satisfactory solution to his problem when choosing from a number of alternative solutions. Individuals who are able to generate a large number of possible ideas or solutions to problems can often solve the problem in a short period of time.

An industrial arts program that emphasizes the problem solving approach where students are constantly challenged to identify and suggest alternative solutions to problems could provide an effective means

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*For a more complete discussion see page 68.

of developing idea fluency and other associated characteristics. Wilson has suggested that, "individual and group activities, which have as their aim getting as many ideas as possible, are probably helpful in encouraging . . . ideational fluency." (73:21) In industrial arts classes, activities where students are required to suggest alternative solutions to a particular technical problem are necessary. Sketching and designing activities requiring the student to produce numerous design ideas for a particular product* would utilize and develop idea and expressional fluency factors. Even with a strict project-centered approach to industrial arts (where students make individual projects out of materials) students could be encouraged to suggest alternative ways of fabricating or making a particular project. Many idea solicitation activities could effectively follow the brainstorming approach as developed by Osborn. (47:151-193) For example, in a quantity production unit a group or entire class could meet and brainstorm ideas for a possible product suitable for quantity production. Later, similar sessions could be held in order to identify alternatives for technical and organizational problems.

An integral aspect of encouragement of ideational and other types of fluent behavior is the concept of suspended judgment. In the initial idea production stages, no attempt to evaluate ideas should be made. The primary deterrent to idea fluency has been shown by Osborn to reside in early evaluation and judgment of the merits of a particular suggestion or idea. (47:166) Evidences of idea fluency are often exhibited by students in industrial arts classes, but too frequently the early application of an evaluative criteria or judgment of the ideas worth, usually by the teacher, is made. With extended experience along these

*Sommers' study has shown the possibilities that exist with this type of approach that he calls "sketch storming." (55:81, 82)

lines, the student will often apply considerable evaluation and judgment before ever making a suggestion or presenting an idea.

In the following section the general findings concerning fluency factors and sub-factors and the implications of these findings for industrial arts have been translated into a series of descriptive behavioral statements indicative of creative and non-creative behavior in industrial arts.

Creative and Non-Creative Behavioral Statements Related to Fluency

The behavioral statements listed below provided the initial operational definition or description of what is creative or non-creative behavior in the field of industrial arts, as related to the factor of fluency. For purposes of classification only, these statements were arranged and listed under four categories: (a) those related to many ideas, (b) those related to the stimulation of ideas, (c) those that contrasted productivity versus quality and (d) those related to the personality trait of impulsiveness.

Primary emphasis was placed on the development of creative behavioral statements. However, whenever possible, non-creative behavioral statements were developed to show the difference between creative and non-creative behavior.

Since these statements were eventually going to be incorporated into an inventory of creative and non-creative behavior that would attempt to assess the degree teachers indicate encouragement of such behavior, each statement was prefaced by the phrase - encourage students to/who - behave in a described manner. In order to convert these statements into student behavioral outcomes the phrase - students will -

should be substituted for the above phrase. For example, an inventory item would be stated as: encourage students to try out many possible solutions for problems. As a student behavioral outcome this same item would be stated as: students will try out many possible solutions for problems.

Many Ideas.

1.	Encourage students to sketch three or more tentative design ideas before making a specific project.	C *
2.	Encourage students to sketch or suggest one good design idea before making a project.	N
3.	Encourage students to suggest several possible ways of fabricating an article.	C
4.	Encourage students to recognize that a construction problem has a limited number of possible solutions.	N
5.	Encourage students to express all the ideas they might have about a possible solution to a problem.	C
6.	Encourage students to carefully evaluate each idea or suggestion before presenting it. (44:2)	N
7.	Encourage students who seem to have many ideas about how to solve a problem. (56:44)	C
8.	Encourage students to suggest their best idea for solving a problem.	N
9.	Encourage students who are quick with suggestions. (44:2)	C
10.	Encourage students to think through their suggestions before making them. (44:2)	N
11.	Encourage students to offer a few good ideas rather than suggesting many ideas.	N
12.	Encourage students to think of many ideas about how to get something done. (56:45)	C
13.	Encourage students to suggest only ideas and solutions that they think have merit.	N

*Note C indicates a creative behavioral statement and N indicates a non-creative behavioral statement.

14. Encourage students to suggest many alternate uses for fastening devices such as a: nail, screw, staple, cotter-key, etc. (34:12) C

15. Encourage students to devise many solutions to a problem with specified properties, for example: design a container that will hold a liquid and can be folded up or collapsed. (21:69) C

16. Encourage students to produce ideas in quantity rather than quality. (25:141, 147) C

17. Encourage students who make more suggestions than they can immediately use. (44:2) C

18. Encourage students to try out many possible solutions for problems. (16:168) C

19. Encourage students to be sure an idea is workable before suggesting it. N

20. Encourage students to consult numerous sources when searching for design ideas. C

21. Encourage students to use existing designs and plans for projects. N

22. Encourage students to sketch on paper as many tentative problem solutions as possible before executing a particular solution. C

23. Encourage students to use their first solution to a design or fabrication problem. N

24. Encourage students to stick with one project design idea once selected. N

<u>Productivity Vs. Quality</u>

25. Encourage students to make many projects. (16:168), (62:7, 8) C

26. Encourage students to make a few high quality projects instead of numerous low quality ones. (16:168) N

27. Encourage students to produce a large quantity of different projects and not be concerned with their quality. (62:7, 8) C

28. Encourage students to strive for quality and perfection in the laboratory work they do. (16:168) C

29. Encourage students to be satisfied only with their highest quality of work. (16:168) N

30. Encourage students to be unconcerned with perfection when making a project. (16:168) C

31. Encourage students to strive for perfection when making any project. (16:168) N

Impulsiveness

32. Encourage students who impetuously or hastily decide to act on something. (69:65), (50:35), (43:66) C

33. Encourage students to act on a sudden impulse. (69:65), (69:35), (43:66) C

34. Encourage students to think things through carefully before acting. N

V. FLEXIBILITY AS A CHARACTERISTIC OF CREATIVITY

Charles Kettering has been reported to have said, "a person with engineering or scientific training had one-half the probability of making an invention compared with others." (49:423) He also suggested the inventor is someone who does not regard his education very seriously. By this, Kettering implied that individuals who have the ability to shift from one hypothesis to another are more likely to be creative than those who accept their education and knowledge as the final authority. (49:423) The continued application with slight modification of proven solutions does not always provide the necessary breakthrough to solve a complex or difficult problem. The ability to shift to a completely different approach to a problem is a divergent thinking ability described by Guilford as flexibility of thinking. The meaning of this factor of creativity and its sub-factors will be explored in the following section.

Flexibility and General Creativity

In initial and subsequent studies by Guilford, two sub-factors of flexibility have been found consistently. (44) (32) These factors were identified as a spontaneous and adaptive flexibility. When an individual's thinking was flexible for no particular reason, it was called spontaneous flexibility. However, in the case of adaptive flexibility, the individual would fail to solve the problem if he were not flexible. These factors were further distinguished from each other in that the former was identified in verbal tests and the latter mostly in non-verbal tests.

Spontaneous Flexibility. This factor appeared to represent the ability to produce a range of radically different ideas when there is no particular need to be flexible. Those tests listed in Table 5 were used by Guilford to identify this factor. (33:18)

TABLE 5

SPONTANEOUS FLEXIBILITY TESTS[a]

Test Number	Name of Test	Loading
10	Brick Uses (Flexibility)	43*
22	Unusual Uses	39*
13	Consequences Test (Remote Consequences)	33*
8	Common Situations	33
18	Implied Uses	30*

*All tests so marked did not have a higher loading on another factor.

[a]Modified versions taken from Reports from the Psychological Laboratory, No. 8. (33:15-16)

In all of the above tests the individual was not required to produce a particular response to be successful. The requirement for obtaining high test scores on this factor was to change set or direction when no indication to do so was given and the greater frequency of changes the higher the score. The Brick Uses Test (No. 10) (sometimes called Other Uses of Objects Test) has consistently been one of the better tests of this ability together with idea fluency where the score

was the number of items listed. When scored for flexible thinking, the number of times the examinee changed categories of uses was recorded. For instance, all responses for other uses of a brick might be in one category that would involve building things. This was not classified as flexible thinking. Examples of shifting categories were found by Guilford in responses such as: paper weight, red powder, drive a nail, throw at a cat or door stop. (26:383) Shifting from one of these or other categories to another category indicated spontaneous flexibility.

The Unusual Uses Test (No. 22) was very similar since six other uses for common objects such as a newspaper or wire coat hanger were requested and scored in the same manner. The Remote Consequences Test (No. 13) and the Common Situations Test (No. 8) were both scored for a shift in response categories. The Implied Uses Test (No. 18) was a verbal test and elicited secondary meaning responses to a given word. For example, the word green in commonly associated with color. However, it can also imply young, unripe, envious, jealous and inexperienced. The number of correct other uses given to such words was scored as flexible thinking. (33) (34:12-17)

The essence of this ability was the tendency of going from class to class of uses and the disposition to avoid repeating one's self. Guilford has suggested that staying in one class longer than most "is a form of rigidity in thinking." (27:6) In a later study Guilford hypothesized the existence of two types of rigidity in thinking--perseverance and persistence. Results indicated the existence of two factors with the hypothesized bipolarities. As an outcome of this study, a "revised definition of spontaneous flexibility which described it as the ability or disposition to produce a diversity of ideas, with freedom

from inertia and restraint." (21:70) was formulated. The quality of ridigity had its virtues in a necessary systematical approach to a task but when a variety of responses was needed, it restricted the range of possibilities.

Adaptive Flexibility. This factor was defined by the tests listed below in Table 6.

TABLE 6

ADAPTIVE FLEXIBILITY TESTS[a]

Test Number	Name of Test	Loading
16	Match Problems	.37*
17	Sign Changes	.32*
20	Associations I	-.11
5	Impossibilities	-.12
26	Social Institutions (Indirect Implications)	-.16
10	Brick Uses (Flexibility)	-.17
31	Object Synthesis	-.20
23	F-Test	-.22
22	Unusual Uses	-.24

*All tests so marked did not have a higher loading on another factor.

[a]Modified versions taken from Reports from the Psychological Laboratory, No. 8. (33:15-16)

The two tests with significant positive loadings on this factor required the ability to change set to meet new requirements imposed by changing problems. The Match Problems Test (No. 16) required the examinee to remove a certain number of matches and leave a certain number of squares as shown in Illustration 1. The instructions were to take away two matches and leave two squares.

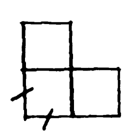

Illustration 1

The correct choices are indicated by the slashed (/) lines. These test items were so constructed that they were unsolvable if the examinee self-imposed unnecessary restrictions to the problem, i.e. that the squares be the same size or have a common side. The Sign Changes Test (No. 17) presented a series of numerical operations that required the subject to substitute one kind of mathematical operational sign for another before performing the operation. An example of this type of problem is given in Illustration 2. The instructions were: In the following, substitute - for + and x for -.

$$5 - 6 = 30$$
$$6 + 3 = \underline{\quad}$$
$$2 - 4 + \underline{\quad}$$

Illustration 2

Answers for the second and third items should be 3 and 8, respectively. (34:15)

The remaining portion of the test batteries defined the negative side of the factor. These tests were composed of open-end type items and problems that imposed relatively little restriction on the responses.

Other Views on Flexibility

When discussing spontaneous flexibility, Guilford suggested that, since a high score on tests of this factor are achieved by the examinee's own initiative, "it is possible that this is a temperamental trait or a motivational trait rather than an ability." (22:114)

Lowenfeld accepted a broader view of flexibility than Guilford and maintained that it was part and parcel of any creative process. By way of illustration he stated that:

> Not only must the creator continuously adapt his expression to the medium which he uses but he must also flexibly take continuous advantage in shifting his ideas and responses from the results he obtains during the creative process. (38:539)

Lowenfeld implied in this quotation the production of a creative product and the individual must recognize and take advantage of developments and accidents that occur while producing his product.

Flexibility and Implications for Industrial Arts

It appeared that both factors of flexibility had some implications for industrial arts. In design and sketching activities where students are designing a particular product, the wide variation sometimes seen between various tentative solutions suggested by a particular student provides evidence of spontaneous flexibility. For example, one student might suggest the use of several different materials and sketch design shapes quite different from each other while another student sticks with one material and modifies one basic shape only slightly from one sketch to the next. The latter type of students, who are inflexible and cannot adapt to new situations, Lowenfeld suggests "express themselves in stereotyped patterns and won't adapt flexibly according to a changing situation but continue to use the same pattern regardless of their ever-changing experience. (38:539)

When discussing art education for young children and the type of materials that should be used, Lowenfeld stated, "that neither flexibility nor fluency is promoted by predetermined patterns in workbooks or coloring books." (38:539) Certainly a similar statement could be made about the required projects with all details worked out, teacher-made templets or patterns and a handy supply of project books which in some cases constitutes the activity phase of an industrial arts program. Instead, activities should be developed that encourage flexible uses of materials and take advantage of the constantly shifting mind of the student.

Many of the preceding comments also hold true for the factor of adaptive flexibility. However, this divergent thinking factor is more obviously essential to solve problems or achieve goals requiring an unusual or out of the ordinary procedure or solution. This type of problem requires new definitions and reinterpretations of traditional ideas. Habitual methods and habits prevent many individuals from striking out in new and different directions while other individuals easily shift set and leave the bounds of previous experience. In industrial arts a ready made situation exists where problems in product design, fabrication and material processing could be devised that would require the student to break out of a rut and strike out in new directions to achieve satisfactory solutions. With the development of such a problem approach, the constantly shifting mind of the student would be challenged and his flexible thinking abilities activated and developed.

In the succeeding section, characteristics of flexible thinking have been translated into a series of descriptive behavioral statements indicative of creative and non-creative behavior in the field of industrial arts.

Creative and Non-Creative Behavioral Statements Related to Flexibility

The behavioral statements listed below provided the initial operational definition or description of what is creative or non-creative behavior in industrial arts as related to the factor of flexibility of thinking. For purposes of classification only, these statements were arranged and listed under three categories: (a) those related to alternate use of objects, (b) those related to different ideas, and (c) those related to the personality traits of perseverance and persistence.*

Alternate Uses

35. Encourage students to improvise if they do not have the correct tool for the job. (28:73) C

36. Encourage students to use tools for purposes other than their intended use. C

37. Encourage students to use tools only for their designed purpose. N

38. Encourage students to use an everyday object for a different purpose. (25:141, 140) C

39. Encourage students to suggest unusual or different combinations of materials. C

40. Encourage students to combine only compatible materials when making a project. N

41. Encourage students to suggest the use of materials in an unconventional manner. C

42. Encourage students to use materials only for the purpose they were intended. N

Different Ideas

43. Encourage students to apply the initial solution they think of to solve a problem. (44:6) N

44. Encourage students who produce a diversity of different ideas when only one is called for. C

45. Encourage students to strive for wide variations between possible solutions to a specific design problem. (25:141, 147) C

46. Encourage students to take a basic idea for the solution of a design problem and then vary it in different ways. N

47. Encourage students to look for widely differing ways of performing shop operations. C

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*For a more complete description of the intended use and interpretation of this initial phase of the development of behavioral items refer to paragraphs 3 and 4, pages 72 and 73.

48. Encourage students to perform shop operations only in the manner suggested by the teacher or text. N

49. Encourage students to suggest alternate operational plans of procedure when planning a project. C

Perseverance & Persistence

50. Encourage students to strike out in a different direction when having difficulty with several similar solutions. (28:73) C

51. Encourage students to proceed first with the initial solution to a problem when another become evident during the process. N

52. Encourage students to jump from one activity to another sometimes before completion. (21:69) C

53. Encourage students to keep at a task, once selected. (21:69) N

54. Encourage students to shift to a different activity if they become disinterested in the one they are working on. (21:69) C

55. Encourage students to carry all projects through to completion. (21:69) N

56. Encourage students to shift to another problem when a solution doesn't appear likely. C

57. Encourage students to never give up trying to solve a problem. (21:69) N

58. Encourage students to resist repeating or doing things a second time. (21:71) C

59. Encourage students to repeat technical operations until they have mastered them. (21:71) N

60. Encourage students to develop competence by doing things repeatedly. (21:71) N

61. Encourage students who "dislike doing the same things the same way all the time." (44:3) C

VI. PROBLEM SENSITIVITY AS A CHARACTERISTIC OF CREATIVITY

One of the earliest hypotheses made by Guilford was "that the unusually creative person has a high degree of sensitivity to problems." (26:387) Initially, Guilford believed there probably were individual differences on the ability or trait to sense and recognize problems.

Problem Sensitivity and General Creativity

Factor analysis studies have repeatedly supported the existence of a problem sensitivity factor by identifying an ability in several tests that required the individual to notice defects or deficiencies in such things as: automobiles, toasters, telephones, social customs or typical solutions to other problems. Several tests used to isolate this factor are listed in Table 7.

TABLE 7

PROBLEM SENSITIVITY TESTS[a]

Test Number	Name of Test	Loading
25	Social Institutions (Direct Implications)	.70*
24	Apparatus Test	.59*

*All tests so marked did not have a higher loading on another factor.

[a]Modified versions taken from Reports from the Psychological Laboratory, No. 8. (33:15-16)

Both of these tests listed above were similar because each test required the ability to see defects, needs, deficiencies and recognition of practical problems. In the Social Institutions Test (No. 25) the examinee was asked to suggest two improvements for each of twelve social institutions. One item was to suggest two improvements on the

institution of marriage. Total number of responses, number of direct responses and number of indirect responses were scores yielded on this test. The number of direct responses was used as a score of problem sensitivity. In the Apparatus Test (No. 24) improvements were requested for sixteen implements or appliances such as the telephone, iron, toaster and automobile. Scores yielded were in terms of the number of relevant responses. Since both of these tests employed similar tasks, Guilford suggested the need for further investigation to explore the generality of this factor. (33:18-19) (34:18)

Recently, Guilford has indicated that this ability to notice defects and deficiencies seemed "to fit better in the general category of evaluative factors than it does in that of divergent production." (26:387) Evaluation factors were related to decisions concerning the goodness, suitability or effectiveness of the results of thinking. After ideas have been suggested, decisions or discoveries made, or after products are developed, judgmental steps that consider such questions as: will it work, is it correct, or is it the best that we can do, are necessary.

Dissatisfaction with things as they are is also a matter of evaluation. Individuals often show their dissatisfaction with present affairs by asking such things as: why don't they find something that will overcome that, or why doesn't someone build something that will do such-and-such, or isn't there a better way? "The un-creative, in contrast are often willing to settle for half-way measures and tolerably successful solutions to problems." (26:387)

Other Views on Problem Sensitivity

Sometimes the view has been expressed that a general over-sensitiveness to the environment is the key to recognizing problems, or those who readily see problems are just naturally curious. Undoubtedly, this type of ability serves an important function in as far as general creative ability is concerned. But, beyond this as Guilford suggested, the ability to identify, anticipate and sense problems might be considerably more specific than these general abilities. (33:19) While Lowenfeld also identified problem sensitivity as a criterion of creativity, he described the ability in rather broad terms and yet showed the specificity of the trait in the field of art. Promoting or motivating sensitivity in art, Lowenfeld described as follows:

> The refinement of sensibilities to the end that students learn to use their eyes not only for seeing but for observing, their ears not only for hearing but for listening, and their hands not only for touching but for feeling. (38:539)

The above statement was indicative of a general view of sensitivity or awareness of one's environment. The specific view in the field of art was described as a sensitive reaction to different materials and media. Lowenfeld elaborated that:

> Sensitivity to media means to identify with them, to learn the behavior of materials and media to such an extent that we can almost predict what will result when two colors merge, how wood will appear when it is all polished up, showing its best grain. (38:539)

Sensitivity and recognition of these types of problems that might be found in the form of expression or treatment, or in the use of techniques or materials involve figural properties of things. The relationship between the abilities needed to identify figural type problems and those represented in verbal tests is unknown. (22:116) It appeared that in

fields where tangible products and materials were handled, both types of problem sensitivities would be important. However, it remains for these abilities in the figural area to be identified and defined carefully in terms of the specific field where such content is found.

Problem Sensitivity and Implications for Industrial Arts

The ability to recognize, sense and anticipate problems is a particularly important trait in a field such as industrial arts, where students constantly encounter problem situations. Before a creative solution to a problem can be found, one must be aware that a problem exists. In industrial arts classes, the student is sometimes given an opportunity to identify and express his awareness of problems he encounters while working in a laboratory. Sensitivity to problems could be improved if a genuine attempt was made to have students identify and select problems to work on that were significant and real to the student. An area of greatest opportunity for students to develop problem sensitivity abilities would appear to involve the day-to-day, hour-by-hour problem situations encountered by a student actively engaged in working with tools and materials in a laboratory. Recognition and anticipation of problems they might encounter in the future while working on a specific product, such as material selection and utilization, sequence of operations, most appropriate fabrication techniques and functional requirements of a specific design are examples of areas where students have an opportunity to utilize problem sensitivity abilities.

In general, greater emphasis has been placed on the development of abilities associated with problem sensitivity than those associated with other factors of creativity. Seldom, however, are the unconscious assumptions, so frequently held about the accepted use of materials, tools and processes questioned. As a result, students are encouraged to be curious and raise questions only within a vague, limited and specified area. In order to tap and develop fully these abilities, instructional activities must be designed that will constantly encourage students to question basic assumptions often taken for granted in designing, developing and fabricating products.

In the section that follows, characteristics of problem sensitivity have been translated into a series of descriptive behavioral statements indicative of creative and non-creative behavior in the field of industrial arts.

Creative and Non-Creative Behavioral Statements Related to Problem Sensitivity

The initial operational definition or description of what is creative behavior in the field of industrial arts as related to the factor of problem sensitivity was provided by the behavioral statements listed below. For purposes of classification only, these statements were arranged and listed under three categories: (a) recognition and anticipation, (b) questioning and curiosity, and (c) improving things.*

Recognition and Anticipation

62. Encourage students who always look for problems. C

63. Encourage students to exercise caution in looking for problems, since more than enough will usually come up anyway. N

64. Encourage students who recognize problems and difficulties in almost any situation. C

65. Encourage students to accept things as they are instead of looking for problems. (8:159) N

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*For a more complete description of the intended use and interpretation of this initial phase of the development of behavioral items refer to paragraphs 3 and 4, pages 72 and 73.

66. Encourage students to quickly recognize difficulties they might encounter in constructing a project. C

67. Encourage students to recognize in advance problems that may come up when constructing a project.(25:141,148) C

68. Encourage students to consult with their instructor to find out possible difficulties they might encounter while making a project. N

69. Encourage students to recognize how one operation might affect the success of a later operation. (25:141,146) C

70. Encourage students to warn other students of various difficulties or problems they might encounter while working on a particular project. C

71. Encourage students to let someone else make a project first so they can find out the problems and difficulties they encountered. N

72. Encourage students who say I don't think that will work because: C

73. Encourage students to explore several possible courses of action before selecting the most effective. (25:141, 146) C

74. Encourage students to avoid tackling a problem that seems difficult. N

Questioning and Curiosity

75. Encourage students to be curious about things. (21:72) C

76. Encourage students to accept things as they are.(8:159) N

77. Encourage students to question the obvious. (50:53) C

78. Encourage students to accept the obvious. N

79. Encourage students to be impressed more with what they don't know than what they do know. (44:2) C

80. Encourage students to be impressed with the knowledge they possess. (44:2) N

81. Encourage students to ask questions about things that seem obvious to others. (44:2) C

82. Encourage students to find out how things fit together. (44:6) C

83. Encourage students to be concerned more about the individual ideas or parts rather than how they fit together. (44:6) N

84. Encourage students who question the advisability of following a stated plan of procedure when constructing a project. (62:13) C

85. Encourage students to follow closely a prescribed way of constructing an article. (62:13) N

86. Encourage students to outline a plan of procedure for making a project and not deviate from it. N

87. Encourage students to arrange in a workable sequence their plan of procedure for making a project. (25:141, 147) C

88. Encourage students to follow a sequential operational plan of porcedure diligently. N

89. Encourage students to question and challenge instructions. (11:408, 10, 11) C

90. Encourage students to follow all instructions without question. (11:408, 10, 11) N

<u>Improving Things</u>

91. Encourage students to suggest ways they might improve a project if they were to make it again. C

92. Encourage students to accept their final solution to a problem as the best solution possible. N

93. Encourage students to suggest how a particular hand tool might be improved. C

94. Encourage students to suggest different ways of handling student responsibilities for laboratory cleanliness. C

95. Encourage students to suggest how the laboratory could be improved. C

96. Encourage students to remember that the physical arrangement and condition of the laboratory is the responsibility of the school board and the instructor. N

VII. ORIGINALITY AS A CHARACTERISTIC OF CREATIVITY

Of all the factors of creativity, originality has been more frequently associated with creativity than any other single factor. Often originality is viewed as synonymous with creativity. (34:5)

A composite meaning of originality based upon Guilford's interpretation and that of other researchers (15:24) would characterize it as the production of unusual, uncommon, novel, farfetched, remote or clever responses. However, the major point of debate and disagreement in the field of creativity has been over the meaning of originality and novelty. Some have contended that an idea or product is not original unless no one has ever thought of it or produced it before. But as Guilford pointed out, there is no way to determine the previous existence of an idea. A modified view suggested that an idea or product is novel if it is new to the individual who produced it. Still difficulty arose, because it would be necessary to determine an individual's entire experiential background. Another criterion of an original idea was that it must be socially useful. This view has provided little assistance because it involves the values held by a society in a way that makes it difficult for science to deal with them. (26:382)

The final approach to originality and novelty used by Guilford was to "resort to empirical signs of novelty in terms of the statistical infrequency of a response among members of a certain population that is culturally relatively homogeneous" (26:382) as an index of originality.

Originality and General Creativity

The single factor of originality has appeared to be more general than some of the other factors in the sense that a wide variety of different types of tests employing varied tasks have been used repeatedly to identify this factor. Individual tests used in the initial study by Guilford to measure this factor are presented in Table 8. Many of these same tests have been used in subsequent studies by Guilford, Torrance, Getzels and Jackson, and Taylor.

TABLE 8

ORIGINALITY TESTS[a]

Test Number	Name of Test	Loading
7	Plot Titles (Cleverness)	.55*
19	Quick Responses	.49*
13	Consequences Test (Remote Consequences)	.42*
4	Figure Concepts (Uncommonness)	.32*
5	Impossibilities	.31
22	Unusual Uses	.31
8	Common Situations	.31
39	Controlled Associations	.30
20	Associations I	.30
37	Street Gestalt Completion Test	-.12
30	Picture Gestalt (Empirically Keyed)	-.14
35	Punched Holes	-.16
29	Gestalt Transformation	-.25

*All tests so marked did not have a higher loading on another factor.

[a]Modified versions taken from Reports from the Psychological Laboratory, No. 8. (33:15-16)

Tests used to measure the factor of originality were based on three alternative principles or approaches to measurement in this area. One approach used was to design tests that would yield scores of "uncommonness of responses as measured by weighting the responses of an individual according to the statistical infrequency of those responses in the group as a whole." (74:309) The Quick Responses (No. 19) and the Figure Concept Tests (No. 4) were scored in this manner.

Another approach to measurement was the development of specially prepared association tests that required "the production of remote, unusual, or unconventional associations" (74:309) as responses. Tests using this approach were: Unusual Uses, when scored for uncommonness;* Consequences Test, when indirect responses were used;** and the Associations Test I where the subject must write a related word on a line between two words, such as indian__________ money. (34:17)

The final approach was to measure the cleverness of responses. The Plot Titles Test which required the examinee to list as many appropriate titles as possible for each plot of several stories given to him was the only test used to measure cleverness. Responses were weighted by judges according to cleverness ratings based on titles suggested for the short story plots. (34:12)

The remaining three tests with positive loading were not predicted to assess originality and possessed higher loadings on other factors.

Evidence of the bipolarity of originality was indicated by the four tests, with small negative loadings, shown in Table 8, page 92. All of these tests required responses that, in order to be scored as correct, tended to be keyed on an arbitrary and conventional basis. As a result, the examinee who responded in an unusual or unconventional manner was penalized for his original thinking on such tests. (33:17)

The generality of the factor of originality was noted by Wilson and others when they pointed out that the three test approaches to

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*For a more complete description of this test see page 76.

**For a more complete description of this test see page 67.

measuring originality all "tend to have in common a single factor. . . which can be justifiably called originality." (74:309) He further stated, "Inasmuch as tests representing all three methods of measuring originality have loadings on this factor, we may have some confidence in its generality." (74:309)

Other Views on Originality

In both the Guilford and Lowenfeld studies, originality was considered one of the keys in distinguishing the more creative persons from the less or non-creative individuals. Initially all of the Guilford tests of this factor were of the verbal type, where Lowenfeld tested this factor by measuring "uncommonness of verbal and sensory responses." (38:539)

Relationships existing between originality and certain non-aptitude traits have been suggested by several writers. In a study of Interrelationships Between Certain Abilities and Certain Traits of Motivation and Temperment (43) Merrifield found small significant relationships between seven non-aptitude traits and a composite measure of originality. The significant correlations obtained are shown in Table 9.

Four of the traits had been predicted to be related to originality, two positive (Aesthetic Expression and Tolerance of Ambiguity) and the two negative traits. Individuals who scored high on the originality test battery tended to be more interested in aesthetic expression, mediatative and divergent thinking, more tolerant of ambiguity, and have less need for meticulousness and discipline. The expected negative relationship between originality and cultural conformity was not obtained at a significant correlation although it was always negative in all sample groups.

However, the type of conformity measured was classified as general and individual moral conformity. Thus, the popular notion that creative people are likely to be moral non-conformists was not supported.

TABLE 9

CORRELATIONS BETWEEN ORIGINALTIY AND NON-APTITUDE TRAITS[a]

Non-Aptitude Trait	Originality Correlation
Aesthetic Expression	.26
Meditative Thinking	.25
Divergent Adaptive Thinking	.16
Self-Confidence	.13
Tolerance of Ambiguity	.12
Need for Discipline	-.17
Meticulousness	-.14

[a]Merrifield, P. R., and others, "Interrelationships Between Certain Abilities and Certain Traits of Motivation and Temperament," The Journal of General Psychology, July, 1961, page 67.

Other writers have looked at conformity in a broader context than moral conformity and have indicated the negative effect it can have on originality or creativity in general. In spite of encouraging individuals to respond in an original way, Lowenfeld suggested that, "conformity and regimentation are a danger both in our classrooms and in our society." (38:539) "Conformity in certain instances," he furhter stated, "may be a social necessity, yet to foster it in education means the suppression of the 'uncommonness of responses'." (38:539) Mooney indicated that the creative person tended to move toward self realization and differentiation which included reaching beyond conformity. In so doing, he dislikes doing the same things the same way all the time or will try things that have not occurred to others to try. He also feels that something is missing in the average and ordinary situations and will dare to be different in things that really matter to him. (44:3) Expressive conformity and personal constriction, Barron indicated, can be seen in individuals who are stereotyped and unoriginal in their approach to problems. (5:139)

Another trait found to be related to originality was independent judgment. When summarizing some of his work at the Institute of Personality Assessment and Research, Frank Barron indicated that individuals who regularly performed in an original way on their tests were "also independent in judgment when put under pressure to conform to a group opinion which [was] in conflict with their own." (8:160)

Originality and Implications for Industrial Arts

If originality is characterized by the production of unusual, uncommon, novel and remotely associated ideas, then industrial arts activities can play a significant role in assisting students to develop these kinds of ideas. In a program which emphasizes active student participation, individuals should constantly be provided with stimuli that encourage idea production. If students are required to design and develop their own project ideas, the opportunity for original ideas to be expressed is presented.

Instructional activities can be devised where students are given specific encouragement "to give uncommon or unusual responses, to look for a different or new way of doing something." (73:21) Sommers has shown the feasibility of this approach in an industrial arts free hand drawing class. Through "sketchstorming"* activities such as: developing

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*A term suggested by Sommers to describe a brainstorming activity where the idea is presented in the form of a sketch.

a new alphabet, developing other uses for a wire coat hanger and a tin pie pan, Sommers found that students could develop abilities to produce more uncommon and unusual ideas while at the same time acquiring knowledge and skill in free hand drawing. (55)

Many other similar types of activities could be developed in industrial arts with the specific purpose of producing unusual and uncommon ideas or responses. However, even without specific structured activities, teachers can encourage students to: explore new ideas regardless of practical use, suggest radical ideas or solutions to problems, forget how a similar problem was solved before, suggest different ways of joining materials, tackle a complex job, try out a silly or crack-pot idea, and make decisions independent of others. This type of described behavior can be encouraged regardless of the specific instructional activity students might be engaged in.

These behaviors along with others are characterized in the operational definition that follows.

Creative and Non-Creative Behavioral Statements Related to Originality

The initial operational definition or description of what is creative behavior in the field of industrial arts as related to the factor of originality was provided by the behavioral statements listed below. For purposes of classification only, these statements were arranged and listed under six categories: (a) new, uncommon or unusual ideas, (b) silly or wild ideas, (c) complex situations, (d) different methods or short cuts, (e) independence and independent judgment, and (f) conformity or non-conformity.*

Uncommon or Unusual Ideas

97.	Encourage students to produce unusual responses to specific situations. (25:141, 147)	C
98.	Encourage students who suggest the accepted way of doing things.	N
99.	Encourage students to stick to the tried and true way of doing things.	N
100.	Encourage students to look for new and novel ways of doing things. (11:408, 411), (56:44,45)	C
101.	Encourage students to explore new ideas, whether or not they have any practical use. (70:I-10, 27)**	C
102.	Encourage students to experiment with an idea that may have no practical meaning for anyone else. (70:I-10, 27)	C
103.	Encourage students to propose entirely new approaches to a problem. (11:408, 411)	C
104.	Encourage students to solve problems using solutions that have proved to be successful. (25:141, 147)	N
105.	Encourage students who suggest a radical idea or solution to a problem. (56:44)	C
106.	Encourage students to recall how a particular problem was solved before. (25:141, 147)	N
107.	Encourage students who approach a problem in a different way from the rest of the group or class. (11:408, 411)	C
108.	Encourage students to get their design ideas from accepted sources of good design.	N
109.	Encourage students to select projects according to the operations involved.	N

*For a more complete description of the intended use and interpretation of this initial phase of the development of behavioral items refer to paragraphs 3 and 4, pages 72 and 73.

**Note (I-10, 27) refers to items numbered 10 & 27 in the appendix of Torrance's Preliminary Manual for Personal-Social Motivation Inventory.

110. Encourage students to explore and experiment with clever or uncommon project design ideas they have. (25:141, 147) C

111. Encourage students to select projects to make from a list of suggested projects. N

112. Encourage students to suggest new ways of joining materials. C

Silly or Wild Ideas

113. Encourage students who suggest wild or silly ideas. (52:204) C

114. Encourage students to keep their ridiculous and silly ideas to themselves. (52:204), (50:58) N

115. Encourage students to express "crack-pot" ideas. (44:2) C

116. Encourage students to express only sensible ideas. (44:2) N

117. Encourage students to try out a wild or silly idea. (50:58) C

Complex Situations

118. Encourage students to tackle a problem that might be too complex for them. (9:482, 483) C

119. Encourage students to select projects that won't be too complex or difficult for them to make. (9:482,483) N

120. Encourage students who desire to work on a highly complex project. (9:482, 483) C

121. Encourage students who seem to come up with a complex solution to even simple problems. (27:6) C

122. Encourage students to tackle a job that possibly involves many unknown difficulties. (70:I-49) C

Different Methods or Short Cuts

123. Encourage students to develop short cut methods of performing a technical operation. (11:409, 411) C

Independence and Independent Judgment

124. Encourage students to make decisions independent of others. (9:482, 483), (8:160) C

125. Encourage students to consult others before making a decision. (9:482, 483), (8:160) N

126. Encourage students to rely heavily on their own experience. (44:3) C

127. Encourage students to rely upon the greater experience of others when confronted with a problem. (44:3) N

128. Encourage students to figure out problems for themselves instead of finding out what others have done. (70:I-44) C

129. Encourage students who try to direct their own learning. (69:114) C

130. Encourage students to learn on their own. (69:114) C

131. Encourage students to plan their learning experience only after consultation with their teacher. (69:114, 168) N

132. Encourage students to fool around with new ideas even if they turn out later to be a total waste of time. (8:156) C

133. Encourage students to accept as the best theory the one that has the best practical applications. (8:156) N

Conformity-Nonconformity

134. Encourage students to be different in things that have meaning to them. (44:3) C

135. Encourage students to be like other students. (44:3) N

136. Encourage students to disagree with the instructor. (21:71) C

137. Encourage students to accept readily the suggestions of the instructor. (21:71) N

138. Encourage students to be submissive or compliant with respect to authority. N

139. Encourage students to resist doing what other students have done. (21:71) C

140. Encourage students to try something which has not occurred to others to try. (44:3) C

141. Encourage students to observe and do as others do. (44:3) N

142. Encourage students to disagree with suggestions made by other students. (21:71) C

143. Encourage students to accept readily suggestions of other students. (21:71) N

144. Encourage students to make concessions to avoid unpleasantness. (5:139) N

VIII. NON-APTITUDE TRAITS AS CHARACTERISTICS OF CREATIVITY

In the four preceeding sections of this chapter the intellectual traits of fluency, flexibility, problem sensitivity and originality were discussed in terms of their contributions as factors of general creativity and implications for industrial arts. When analyzing the research related to these factors, reference was made to the relationships or influence of certain non-aptitude traits (personality, motivation and temperament) upon some of these intellectual factors. In some cases where the relationship and influence was found to be particularly strong, behavioral statements indicative of the particular non-aptitude trait were developed and included along with those derived from the intellectual factors. However, research has shown the existence of many other non-aptitude traits that appear to have very little relationship to or influence upon the intellectual factors that Guilford has identified. In this section, those non-aptitude traits that have not been presented in connection with the intellectual factors of fluency, flexibility, problem sensitivity and originality were discussed.

Non-Aptitude Traits and General Creativity

Until recently, little attention has been given to assessing the non-aptitude or personality traits of creative people as well as identifying intellectual attributes. Since the early 1950's, when Guilford and his associates launched their attack on the intellectual phase, other psychologists have undertaken extensive research of the creative person from other directions such as biographic information and personality factors contributory to creative productivity. Probably the most comprehensive summaries of the progress and accomplishments of work in this area have been reported in the 1955, 1957 and 1959 University of Utah Research Conferences on the Identification of Creative Scientific Talent edited by Calvin Taylor and in the 1960 publication by Stein and Heinze Creativity and the Individual Summaries of Selected Literature in Psychology and Psychiatry. (58) Among others, Barron (9), MacKinnon (39), Merrifield (43), Mooney (44), Rees and Goldman (51), Stein (59), Drevdahl (15) and Torrance (70) have described certain personality and motivational attributes of individuals evaluated as creative. In general, findings of these studies indicated that those individuals judged as creative tend to be more impulsive, self-confident, willing to take risks, independent, non-conforming, tolerant of ambiguity, concerned with ideas and things other than people, and unwilling to give up. On the other hand, they are less meticulous, less conforming and have a tendency toward neurotic behavior.

One of the recurring characteristics found in creative people was an inclination toward self-confidence, particularly in respect to their own ideas. Gerry and others, in an attitude survey of U.S. Air

Force officers, found creative individuals have a "sense of confidence in their creative and intellectual abilities." (18:272) In a study of scientific careers, Super and Bachrach characterized the natural scientist as self-confident with an "absence of marked feeling of inferiority." (60:135) As a result of a recent survey of personality studies of highly creative individuals, Torrance compiled a list of eighty-four characteristics found in one or more studies that differentiated highly creative persons from less creative ones. Along with the characteristic of self-confidence, he listed other related traits as "doesn't fear being thought different, self-sufficient, willing to take risks and self-awareness." (69:66-67) Several other writers supported some of these associated traits. Mooney developed an extensive listing of <u>Indices of Creative Behavior</u>. He classified one category as self-orientation and described it as openness to self, environment and life, for the reception and extension of experience. (44:1) Openness to self, Mooney further described as having "a very vivid sense of his own being, [awareness] of his own vitality and a recognition that his own internal feelings and ideas can stimulate him as much as outside events." (44:1)

An extension of the general trait of self-confindence appeared to be a willingness to take risks. Guilford pointed out the interrelatedness of originality, self-confidence and taking risks when he stated that, "Originality yields success and hence self-confidence, and self-confidence leads the individual to attempt to solve problems where others would give up" (26:390) or be afraid to try. At the 1965 Utah Conference, both McClelland (42:96-101) and Barron (3:222,227) indicated the possibility of creative individuals not only being willing to take a risk but actually enjoying or receiving satisfaction from the risk taking situation. Again at this same conference in 1959, Getzels in collaboration with Jackson, reporting on their study of highly intelligent and creative adolescents concluded that "the creative adolescent seemed to possess the ability to free himself from the usual, to 'diverge' from the customary." He stated further, "He seemed to enjoy the risks and uncertainty of the unknown." (19:56) In a Personal-Social Motivation Inventory developed by Torrance in 1963, he included a creative motivation scale. Within this scale were several items reflecting self-confidence and risk-taking traits. This type of creative behavior is indicated by the following illustrative item:

> When I feel something deeply I feel impelled to express it, I am willing to risk suffering for the sake of possible growth and I make a point to be open and direct in what I say, even though I may be criticized for it. (70)

In another direction, considerable evidence was found that creative individuals tend to prefer experiencing things directly. Torrance suggested they are "unwilling to accept anything on mere say-so [and are] receptive to external stimuli." (69:66-67) In his study of creative thinking of children in early school years, Torrance found that in tests of creativity which permitted manipulation of objects, the degree of this manipulation was significantly related to both the quantity and quality of responses and that boys engaged in more manipulation of objects than girls. (68:62) Mooney extended this concept into his Indices of Creative Behavior. He classified one section as direct and spontaneous experiencing and included items that indicated the following types of creative behavior:

> He likes to feel things and perceive things directly.
> He likes his experiences to have a sensuous quality as well as an intellectual quality.
> He has retained a spirit of play.

> He feels more sure of himself in experiences where the sensuous and intellectual qualities harmonize in support of a common perception. (44:1)

In another section categorized as management of materials, Mooney included items which suggested that the creative individual "enjoys playing with the materials he uses in his work, is sensitive to the qualities and limitation of his materials and likes to know his materials so well they become a part of him." (44:5)

Several authors suggested creative individuals differed in terms of their relationships and feelings toward others. However, there seemed to be some disagreement whether they are more sensitive and responsive to other individuals and their feelings or more concerned with their own individual state of affairs. Mooney indicated the creative individual is sensitive to the way other people feel, is open and direct in his dealings with them and likes to help other people in the discovery of themselves. In terms of his dealing with other people, he accepts each person as a unique and valuable individual, is sensitive to the effects which people have on one another, desires to treat others as he would treat himself but will not let others run over him in things of real value to him. (44:89)

On the other hand, Drevdahl suggested that creative individuals were "more concerned with ideas and things than with people." (15:25) Torrance indicated that they were inclined to pay so little attention to what [other] people are saying that. . . they often do not hear them." (70) Stein found that the more creative subjects in his study were more autonomous individuals and saw themselves as more different from their colleagues than did lesser creative subjects. (57:179)

In terms of interpersonal involvement in human relations, Knapp while summarizing the Personality Committee Report at the 1955 Utah Conference indicated:

> The thing that shows up again and again is that they [engineers and scientists] don't like to get into warm, close, human relations, they're not very good at comaraderie, they don't like competitive sports, body contact, etc. They like impersonal things like nature walks and sailing. (37:239)

Extending this view to school children, Torrance found that children who were rated high on measures of creativity appeared to become alienated from other children and teachers and tended to exhibit behavior that required sanction by their peers. (68:220)

In general, it appeared that while creative individuals may be sensitive and responsive to the feeling of others, they tend to avoid personal involvement with others and value their own individuality highly.

Another motivational aspect of creative individuals appeared to be that they are often able to concentrate their effort for extended periods of time and in the face of difficulty. Parnes in a study of the effects of extended effort with creative problem solving tasks reported "that extended effort in producing ideas on a creative thinking problem tends to reward problem solvers with a greater proportion of good ideas among the latter ideas [produced]." (48:121) "Unwillingness to give up, preoccupation with an idea or problem and going beyond assigned tasks" (66:12) were similar characteristics Torrance listed as non-test indicators of creative behavior. More specific examples of creative behavior that reflected concentration of effort was provided by Mooney. In his Indices of Creative Behavior, he characterized the creative individual as being consumed by his work, enjoying periods of hard work, sticking to a baffling problem over an extended period of time, being able to bring to his work a concentration of his whole personality and while working on one task, he is often imaginatively planning the next job he wants to do. (44:4)

It could be concluded then that creative individuals expend considerable effort on tasks they become involved with and this effort often results in more productive and creative results.

Non-Aptitude Traits and Implications for Industrial Arts

"The challenge for all education" as Torrance has characterized it, is:

> To help the highly creative child cultivate those personality characteristics which apparently are essential to his creativity and to help him avoid or reduce the sanction of his peers [and others] without sacrificing his creativity. (68:220)

While Torrance speaks only of the highly creative, the challenge is broader than that if it is accepted that all individuals have the potential to be creative.

Examination of the theory of self-concept and particularly the characteristic of self-confidence reveals that the confidence an individual has in himself and his abilities is usually a result of past experiences and the degree of success he has had in the past. Industrial arts programs that are comprehensive and provide experiences that tap a wide range of different kinds of abilities and talents can help students with these abilities achieve genuine success where the opportunities for success in other phases of the curriculum have been meager. Successful experiences in industrial arts programs are possible for individuals with a wider range and type of abilities than often are required for success in many typical curricular areas. Students

who perhaps have seldom achieved success have such an opportunity in industrial arts programs and as a result develop increased confidence in their abilities and an improved concept of self.

The very heart of any industrial arts program is based on providing direct experiences for students with materials, processes and problems encountered when working with these materials. Since creative individuals prefer to experience things first-hand and are receptive and motivated by external stimuli, industrial arts programs can play an important role in meeting these needs.

With a range of possibilities available in many industrial arts programs for individual identity and development, as well as interaction with others, students can be encouraged to be responsive and sensitive to the feeling and needs of others while at the same time developing individual identity.

Finally, industrial arts programs can, through the extensive range of experiences and problems available, provide students with the type of motivation that will involve and challenge them to the degree that they concentrate and extend their efforts to solve a particularly baffling problem, at times in a creative manner.

In the section that follows, non-aptitude characteristics of general creativity have been translated into a series of descriptive behavioral statements indicative of creative and non-creative behavior in the field of industrial arts.

Creative and Non-Creative Behavioral Statements Related to Non-Aptitude Traits of Creativity

The preliminary operational definition or description of the nature of creative behavior in the field of industrial arts as related to non-

aptitude traits of creativity was provided by the following behavioral statements. For the purposes of grouping, these statements were listed under three categories: (a) self-confidence and risk taking, (b) direct experiencing, and (c) concentration of effort.*

Self-Confidence and Taking Risks

145.	Encourage students to keep in check their own feelings and ideas. (44:1)	N
146.	Encourage students to defend their own ideas in the face of criticism. (27:6, 7), (62:9), (11:408)	C
147.	Encourage students to accept criticism and change their ideas accordingly.	N
148.	Encourage students to express in some manner what is usually held back. (6 :76), (70)	C
149.	Encourage students to laugh at their own blunders. (44:5)	C
150.	Encourage students to criticize themselves for their own foolishness or ineptitude. (44:5)	C
151.	Encourage students to reject a proven solution to a problem and take a chance that they will find another solution. (21:73, 74), (3:222 & 227), (19:56), (69:72-76)	C
152.	Encourage students to eliminate the risk of being wrong by checking with the instructor.	N
153.	Encourage students to risk making a mistake by trying to make something they are not sure will be a success.	C
154.	Encourage students to avoid making mistakes by making projects that have been made before.	N
155.	Encourage students to trust their feelings to lead them through an experience. (44:6)	C
156.	Encourage students to depend on specific facts instead of feelings or hunches to guide them to a solution. (44:6)	N

*For a more complete description of the intended use and interpretation of this initial phase of the development of behavioral items refer to paragraphs 3 and 4, pages 72 and 73.

157. Encourage students to try out a hunch just to see what will happen. (69:71), (44:6) C

158. Encourage students to rely on what they know to be true instead of hunches. (44:6) N

159. Encourage students to work on problems where the outcome is unpredictable. (69:71) C

160. Encourage students who like to handle and touch everything in the laboratory. (44:1) C

161. Encourage students to feel, handle and manipulate all kinds of materials and objects. (68:62, 63) C

162. Encourage students to look at the materials and equipment in the laboratory but not to touch things unless told to do so. (44:1) N

163. Encourage students to feel, smell and taste, where possible the various materials they use in the laboratory. (44:1) C

164. Encourage students to play with the materials available in the laboratory. (44:5) C

165. Encourage students to leave the materials alone in the laboratory until they are needed. (44:5) N

166. Encourage students who seem to have a spirit of play. (44:1) C

167. Encourage students to grow up and not play around anymore. (44:1) N

Concentration of Effort

168. Encourage students to plan the task they will do next, while working at a current task. (44:4) C

169. Encourage students to concentrate on the present operation and plan the next step when they get to it. (44:4) N

170. Encourage students to meditate and mull over problems or possible solutions to problems. (44:5) C

171. Encourage students to solve a problem as quickly as possible and not to meditate on it too much as it will only confuse them. (44:5) N

172. Encourage students who like to day dream. (44:20) C

IX. SUMMARY

In this chapter, several studies were reviewed that developed operational definitions of educational objectives. Specific emphasis was placed on the characteristics of an operational definition and procedures employed in developing such a definition. In general, it was concluded that an abstract concept such as creativity can be operationally defined when no other meaning is given to such a concept other than the acts or behaviors summarized by the word creativity.

Most of the studies included in this review of educational objectives and their operational definition were large cooperative ventures employing many individuals and cooperating agencies. General methodology common to most of the studies included identification of the goals and development of behavioral statements or outcomes related to each goal. This work was usually carried out by a committee directly associated with the project and consultants in special areas where needed. General acceptance and revision of the behavioral statements was accomplished by having a committee of reviewers or critics composed of a cross-section of individuals evaluate the statements and suggest revisions or additions.

A general review of the literature on creativity revealed five major areas that provided guidelines for developing an operational definition of creativity in the field of industrial arts. Four of these areas consisted of the intellectual factors or attributes of creativity identified by Guilford and Lowenfeld as sensitivity to problems, fluency, flexibility and originality. The fifth area was composed of non-aptitude traits such as personality and motivational characteristics related to creativity. Research findings in each of these areas were presented and specific implications for industrial arts drawn. Related to each of the five areas, creative and non-creative behavioral statements were developed and when combined, formed the initial operational definition of creativity in industrial arts.

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CHAPTER IV

DESIGN AND INSTRUMENTATION OF STUDY

The purpose of this study was to develop an operational definition of creative and non-creative behavior in industrial arts and to test differences between industrial arts teachers in Michigan and their indicated encouragement of such behavior. The differences hypothesized to exist between various categories of industrial arts teachers are presented in the null (H_o) and alternate (H_1) form in this chapter. Since the Chi-square median test was used as a test of significance, the hypotheses are stated in terms of differences between medians of various sample sub-groups and categories.

I. NULL AND ALTERNATE HYPOTHESES

<u>Major Hypotheses</u>

1. H_o: There is no difference between the median (Mdn) creative score for (1) junior high school industrial arts teachers and the median (Mdn) creative score for (2) high school industrial arts teachers. (H_o: $Mdn_1 = Mdn_2$)

   H_1: The median creative score for (1) junior high school industrial arts teachers is greater than the median creative score for (2) high school industrial arts teachers. (H_1: $Mdn_1 > Mdn_2$)*

2. H_o: There is no difference between the median non-creative score for (1) junior high school industrial arts teachers and the median non-creative score for (2) high school industrial arts teachers. (H_o: $Mdn_1 = Mdn_2$)

   H_1: $Mdn_1 < Mdn_2$

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*Note hereafter, alternate hypotheses (H_1) will be stated in symbolic form only.

3. H_o: There is no difference between the median creative score for (1) multiple area industrial arts teachers and the median creative score for (2) limited area industrial arts teachers. (H_o: $Mdn_1 = Mdn_2$)

   H_1: $Mdn_1 > Mdn_2$

4. H_o: There is no difference between the median non-creative score for (1) multiple area industrial arts teachers and the median non-creative score for (2) limited area industrial arts teachers. (H_o: $Mdn_1 = Mdn_2$)

   H_1: $Mdn_1 < Mdn_2$

5. H_o: There is no difference between the median creative score for (1) industrial arts teachers who rank the self-realization objective (B) number one and the median creative score for those (2) teachers who rank the skill development objective (A) or (3) interpreting industry objective (C) as number one. (H_o: $Mdn_1 = Mdn_{2,3}$)

   H_1: $Mdn_1 > Mdn_{2,3}$

6. H_o: There is no difference between the median non-creative score for (1) industrial arts teachers who rank the self-realization objective (B) number one and the median non-creative score for those (2) teachers who rank the skill development objective (A) or (3) interpreting industry objective (C) as number one. (H_o: $Mdn_1 = Mdn_{2,3}$)

   H_1: $Mdn_1 < Mdn_{2,3}$

7. H_o: There is no difference between the median creative score for (1) industrial arts teachers with masters degrees and the median creative score for (2) industrial arts teachers with bachelors degrees only. (H_o: $Mdn_1 = Mdn_2$)

   H_1: $Mdn_1 > Mdn_2$

8. H_o: There is no difference between the median non-creative score for (1) industrial arts teachers with masters degrees and the median non-creative score for (2) industrial arts teachers with bachelors degrees only. (H_o: $Mdn_1 = Mdn_2$)

   H_1: $Mdn_1 < Mdn_2$

9. H_o: There is no difference between the median creative score for (1) industrial arts teachers with one to six years teaching experience or (2) teachers with seven to fifteen years teaching experience or (3) teachers with sixteen or more years teaching experience. (H_o: $Mdn_1 = Mdn_2 = Mdn_3$)

H_1: $Mdn_1 \neq Mdn_2 \neq Mdn_3$

10. H_o: There is no difference between the median non-creative score for (1) industrial arts teachers with one to six years teaching experience or (2) teachers with seven to fifteen years teaching experience or (3) teachers with sixteen or more years teaching experience. (H_o: $Mdn_1 = Mdn_2 = Mdn_3$)

H_1: $Mdn_1 \neq Mdn_2 \neq Mdn_3$

<u>Sub-Hypotheses Related to Major Hypotheses 1-4</u>

11. H_o: There is no difference between the median creative score for (1) junior high school multiple area industrial arts teachers and the median creative score for (2) junior high school limited area teachers. (H_o: $Mdn_1 = Mdn_2$)

H_1: $Mdn_1 > Mdn_2$

12. H_o: There is no difference between the median non-creative score for (1) junior high school multiple area industrial arts teachers and the median non-creative score for (2) junior high school limited area teachers. (H_o: $Mdn_1 = Mdn_2$)

H_1: $Mdn_1 < Mdn_2$

13. H_o: There is no difference between the median creative score for (1) senior high school multiple area industrial arts teachers and the median creative score for (2) high school limited area teachers. (H_o: $Mdn_1 = Mdn_2$)

H_1: $Mdn_1 > Mdn_2$

14. H_o: There is no difference between the median non-creative score for (1) senior high school multiple area industrial arts teachers and the median non-creative score for (2) senior high school limited area teachers. (H_o: $Mdn_1 = Mdn_2$)

H_1: $Mdn_1 < Mdn_2$

15. H_o: There is no difference between the median creative score for (1) junior high school multiple area industrial arts teachers and the median creative score for (2) senior high school multiple area teachers. (H_o: $Mdn_1 = Mdn_2$)

H_1: $Mdn_1 > Mdn_2$

16. H_o: There is no difference between the median non-creative score for (1) junior high school multiple area industrial arts teachers and the median non-creative score for (2) senior high school multiple area teachers. (H_o: $Mdn_1 = Mdn_2$)

H_1: $Mdn_1 < Mdn_2$

17. H_o: There is no difference between the median creative score for (1) junior high school limited area industrial arts teachers and the median creative score for (2) senior high school limited area teachers. (H_o: $Mdn_1 = Mdn_2$)

H_1: $Mdn_1 > Mdn_2$

18. H_o: There is no difference between the median non-creative score for (1) junior high school limited area industrial arts teachers and the median non-creative score for (2) senior high school limited area teachers. (H_o: $Mdn_1 = Mdn_2$)

H_1: $Mdn_1 < Mdn_2$

While these differences were hypothesized in respect to the sum of the creative scale items and the sum of the non-creative items, the same differences were predicted in respect to individual items that constitute the two scales.

II. INITIAL INSTRUMENT DEVELOPMENT

The instrument employed in this study was developed to determine the extent to which industrial arts teachers indicate they encourage their students to exhibit creative or non-creative behavior and to test the differences hypothesized to exist between various categories of industrial arts teachers. Development of the initial instrument involved three stages: (a) creative and non-creative behavioral statements were selected, (b) three statements of industrial arts objectives were developed so hypotheses five and six could be tested, and (c) items to obtain general background information about the respondent were developed. A detailed discussion of these three stages follows.

Creative and Non-Creative Behavioral Statements

The initial pool of creative and non-creative behavioral items was assembled by combining all the behavioral statements developed and listed in Chapter III that were related to the five major sections of characteristics and attributes of creativity. In addition to these 172 items, nineteen additional behavioral statements were developed relating to the three objective statements presented on pages 127, 128 and 129. All but eight of these additional items were classified by the writer as a creative or non-creative behavioral statement. A total of 191 behavioral statements made up the preliminary creative or non-creative behavior inventory for industrial arts.*

Judges' Classification of Items. In order to obtain a degree of consensus on whether the behavioral statements developed by the writer were indicative of creative or non-creative behavior in industrial arts, a jury of six judges and one alternate was selected.

The following criteria were established in order to identify and select these judges:

1. He was an industrial arts educator (secondary school or college level).
2. He was familiar with research and writings of psychologists, sociologists and educators concerning characteristics and attributes of creative individuals and the development of creative ability.
3. He has spoken or written concerning creativity in industrial arts or is constantly attempting to encourage his students to behave in a creative manner.

*See Appendix B.

On the basis of these criteria the following six judges and one alternate were selected.

Mr. Arthur Anderson
Teacher, Livonia Public Schools
Livonia, Michigan

Dr. Donald N. Anderson
Head, Department of Industrial Education
Mankato State College
Mankato, Minnesota

Dr. John Lindbeck
Associate Professor of Industrial Education
Western Michigan University
Kalamazoo, Michigan

Dr. Jerome Moss, Jr.
Associate Professor of Industrial Education
University of Minnesota
Minneapolis, Minnesota

Dr. Wesley Sommers
Head, Industrial Technology Department
Stout State College
Menomonie, Wisconsin

Dr. Robert Tinkham
Associate Professor, Industrial Education
University of Illinois
Urbana, Illinois

Dr. George Ferns (Alternate)
Assistant Professor, Industrial Education
Michigan State University
East Lansing, Michigan

Prior to sending the inventory, all judges were contacted and agreed to participate in the study. The Preliminary Creative or Non-Creative Inventory* was sent to all seven judges on September 21,

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*The entire inventory and directions for responding to it is found in Appendix B.

1963.* These judges were asked to classify each statement in one of three ways.**

1. Creative behavioral statement
2. Non-creative behavioral statement
3. Neither creative or non-creative or an unclear statement.

A random arrangement of all behavioral statements in the inventory was achieved by listing all the statements developed in Chapter III plus those related to the three objective statements in numerical order. These statements were then arranged according to the sequence in which the number for each statement appeared in a table of random numbers. (4:1-11)

In order to avoid structuring responses no definition of creativity or other descriptive information about creativity in industrial arts was given to the judges. It was assumed that judges would read into the term creativity whatever meaning they chose and this meaning would be reflected in their classification of statements. Sprecher used basically the same technique in A Study of Engineer's Criteria for Creativity. (6) He emphasized "that differences among expert judges regarding the meaning of the term creativity is meaningful variability indicative of the kinds of ideas connoted." (6:141) He also suggested "that if creativity means different things to different people, this variability

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*A schedule of all data collection procedures is included in Appendix C.

**The categories of fluency, flexibility, problem sensitivity and non-aptitude characteristics were only used in the initial classification of statements. The list of statements submitted to the judges were not classified in any way and they were asked to classify them as creative, non-creative or neither creative or non-creative only.

should be explored before attempts to define it are undertaken." (6:141) By employing such a technique, a broader operational definition of creativity in industrial arts might evolve than would have been possible otherwise.

Judges' Results. The selection of the final scales of creative and non-creative behavioral items was dependent upon the ratings of the judges. Prior to submitting the inventory to the judges, item acceptance criterion was established as follows. In order to accept a behavioral statement for inclusion in either the creative or non-creative scale, each statement had to have been rated in the same way by at least five of the six judges and agree with the writer's original rating. In other words, out of seven ratings, including the author's, only one disagreement was permitted for an item to be retained in either scale.

Of the 191 items in the Preliminary Creative or Non-Creative Behavior Inventory, the writer had classified 107 items as creative, seventy-six items as non-creative and eight items as neither creative or non-creative. In Table 10, the number of items on which all six, five of six, and four of six judges agreed with the original classification is presented. The entire number of item classifications agreed upon by more than half of the judges was presented, even though these items did not meet the stricter acceptance criterion.*

Applying the item acceptance criteria of five or more judges classifying the item in the same way, sixty creative and twenty-two non-creative items were available for use in the final creative and non-creative scale.

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*For a more complete tabulation of all judges' responses and identification of specific items see Appendix B_2.

TABLE 10

ITEM CLASSIFICATION BY NUMBER OF JUDGES IN AGREEMENT WITH ORIGINAL CLASSIFICATION

Number of Judges	Creative Items	Non-Creative Items	Neither C or N-C	Totals
All 6	35	10	0	45
5 of 6	25	12	1	38
4 of 6	14	18	3	35
Totals	74	40	4	118

Objectives of Industrial Arts and Behavioral Statements

Hypotheses 5 and 6 predicted differences would exist between the number one ranking given to one of three industrial arts objective statements by teachers and their indicated encouragement of creative or non-creative behavior. In order to test these hypotheses, three objective statements were developed along with several behavioral statements indicative of these objectives. The three objectives were titled (a) skill development, (b) self-realization and (c) interpretation of industry. These three areas are not to be considered the only areas from which objectives of industrial arts evolve. However, they do represent three rather distinctive positions held by many industrial arts teachers concerning the primary purpose of industrial arts.

In the next three sections, the objectives are stated, followed by descriptive behavioral statements related to each of these objectives.

Skill Development, Objective, and Behavioral Statements.

A. To develop the students ability to perform skillfully hand or machine operations with tools and materials and to increase their knowledge of the working qualities, characteristics and problems encountered while working with tools and materials.

173. *Encourage students to increase their speed, accuracy and efficiency when performing hand or machine tool processes. X**

174. Encourage students to perfect a limited number of tool skills to as high a level as possible. N

175. Encourage students to concentrate their work in an area that is closely related to a particular job classification. X

176. Encourage students to develop a high degree of performance and perfection with one technical operation before performing other operations. N

177. Encourage students to try out construction operations on scrap material before using them on a project. N

Note: Non-creative fluency item number 29 and problem sensitivity item number 86 were also considered a part of this scale.

Self-Realization Objective and Behavioral Statements.

B. To help students understand their capabilities and limitations, likes and dislikes, strengths and weaknesses and therefore gain a better understanding of themselves and their potentiality.

178. Encourage students to value their own growth and development. C

179. Encourage students to openly recognize their own limitations and imperfections. C

180. Encourage students to recognize and develop the strength and abilities they possess. C

181. Encourage students who look for problems to work on that challenge all their capacities. C

182. Encourage students to express their individual likes and dislikes about an activity or area of work. C

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*Numerical order follows the last non-aptitude item in Chapter III, page 121.

**"X" indicates neither a creative or non-creative item, "C" indicates a creative item, and "N" indicates a non-creative item.

183. Encourage students to work with a material or engage in an activity where they have had little or no previous experience. C

184. Encourage students to critically analyze and evaluate themselves. C

Interpreting Industry Objective and Behavioral Statements.

C. To develop the students ability to interpret and understand industry and the role it plays in our industrial society.

185. Encourage students to select a national industrial corporation, find out all they can about it, and make a report to the class. X

186. Encourage students to relate and compare the techniques and processes used in industrial arts laboratories with those employed in industry. X

187. Encourage students to visit local manufacturing concerns on their own. X

188. Encourage students to become familiar with the many different industrial enterprises within their own community. X

189. Encourage students to select and execute quantity production projects in the laboratory. X

190. Encourage students to set up and operate a student business such as a toy repair service. C

191. Encourage students to understand the organization and management of industry. X

The behavioral statements or items related to the objectives were not classified by the judges as related or not related to a particular objective. Since these items were developed for the final instrument for the purpose of establishing rapport with the respondent, a validity check was unnecessary.

Scaling

In developing the instrument it was recognized that individuals would differ considerably in the degree of encouragement they indicate for a particular behavioral statement. To obtain a measure of the indicated degree of encouragement of specific items and to provide alternative choices to the respondent a means of scaling the responses was devised.

A four level scale was developed for use with all behavioral statements. The four levels of NEVER, SOMETIMES, USUALLY, and ALWAYS were chosen to represent the different degrees of encouragement of a specific behavioral statement. A four level scale was chosen instead of a three or five position scale, so it could also be dichotomized at the mid-point if necessary. As a dichotomized scale, responses of NEVER and SOMETIMES were combined together as indicative of non-encouragement of the described behavior and USUALLY and ALWAYS combined to indicate encouragement of that particular item.

Arbitrary values were assigned to each of the scaled responses. A weight of four was assigned to ALWAYS, three to USUALLY, two to SOMETIMES and one to a response of NEVER. It was recognized that the values assigned to the response categories were made arbitrarily and that equal intervals cannot be assumed to exist between the four divisions of the scale. Instead, an ordinal or ranking scale was created.

General Information Items

It was necessary to obtain information that would facilitate the classification of respondents into various categories other than their industrial arts objective orientation in order to test the other hypothesized effects. Information necessary to categorize industrial arts teachers on the basis of educational experience, major field of study, length of teaching experience, certification (vocational or industrial arts), and field currently teaching in (vocational or industrial arts) was obtained by direct questions in part one, "Basic Data" of the Industrial Arts Activity Questionnaire found in Appendix E.

As the preceding type of information was rather easily obtained, no further discussion is necessary. However, the classification of industrial arts teachers as junior high or senior high school teachers and whether they taught in a multiple area laboratory or limited area laboratory was crucial to this study and will be described in more detail.

Junior or Senior High School Teachers. Since teachers who taught industrial arts at both the junior and senior high school level were not a part of this study, initial sampling procedures were devised to eliminate those teachers from the total population before drawing the sample.* It was almost impossible to determine before sampling those teachers teaching at the junior or senior high school level only. Therefore, the following item was devised to accomplish this classification and also to check on the elimination of teachers teaching on both levels.

Check all grades in which you are currently teaching industrial arts.

* ( ) 6th grade and below
* ( ) 7th grade
* ( ) 8th grade
* ( ) 9th grade
\# ( ) 10th grade
\# ( ) 11th grade
\# ( ) 12th grade
\# ( ) Other grade

For the purpose of this study a junior high school teacher of industrial arts was defined as one teaching at the ninth grade level

*Sampling procedures are discussed in greater detail on page 140.

and below or any combination of grades nine and below. A respondent checking any starred (*) grade or combination was classified as a junior high school industrial arts teacher. A senior high school industrial arts teacher was defined as one teaching at the tenth grade level and above. Also included were those at the ninth grade level if also teaching in grades above ninth grade. A respondent checking any number symbol (#) grade was classified as a senior high school industrial arts teacher.

Individuals who indicated they were currently teaching in grades above and below the ninth grade level were classified as junior-senior high school teachers and eliminated from the analysis.

<u>Multiple or Limited Area Laboratories</u>. Determination of the type of laboratory in which an industrial arts teacher was teaching was necessary to test several of the hypotheses. Since the possibility of visiting all schools and making such a classification was impossible, a compromise plan was used where the individual respondent supplied some basic information about his laboratory and the actual classification was done through the use of the same criterion. The item that follows was used to gather information from the respondent to determine the type of laboratory in which he was teaching.

> Check all technical areas in which <u>you give instruction</u> in the laboratory or shop where you do <u>most</u> of your teaching.

2 ( ) Woodworking	1 ( ) Leather
2 ( ) Metalworking	1 ( ) Ceramics
2 ( ) Graphic Arts	1 ( ) Textiles
1 ( ) Auto and power mechanics	1 ( ) Photography
1 ( ) Electricity or electronics	1 ( ) Jewelry
1 ( ) Drafting	1 ( ) Other areas
1 ( ) Materials testing	1 ( ) ____________
1 ( ) Plastics	1 ( ) ____________

From responses made to this question, multiple and limited area laboratory classifications were determined largely by the number of technical areas the respondent indicated in which instruction was given. To equalize the differences in comprehensiveness and breadth between some of the areas, a weighting system was devised. All areas were given a value of one except woodworking, metalworking and graphic arts which received a value of two. For the purposes of this study then, a limited area laboratory industrial arts teacher was classified as one who achieved a score of one to three, and a multiple area laboratory teacher, one who scored four or above.

III. PRE-TESTING AND FINAL INSTRUMENT DEVELOPMENT

A small pilot study was conducted to pre-test the questionnaire so revisions could be made and procedures for tabulating and analyzing the data checked.

Procedures

A group of ten industrial arts teachers located within a twenty mile radius of Lansing, Michigan were selected as individuals who could provide frank constructive criticism and suggestions for improving such an instrument. Through telephone contacts made with these individuals, the following seven teachers were selected and agreed to participate in the pilot study.

Dale Hansen
Waverly Senior High School
Lansing, Michigan

Erwin Korroch
Pattengill Junior High School
Lansing, Michigan

Lloyd Mox
Williamston Senior High School
Williamston, Michigan

Dale Pattengill
Perry Junior-Senior High School
Perry, Michigan

Edward Remick
Otto Junior High School
Lansing, Michigan

Louis Shepard
Mason High School
Mason, Michigan

Charles Wilson
Holt High School
Holt, Michigan

The pilot study was conducted during the week of December 10, 1963. A letter explaining the purpose of the pilot study and outlining the procedure to be followed was personally delivered to each teacher. Included was a copy of the proposed introductory letter, the preliminary draft of the questionnaire inventory and a reaction-suggestion sheet which requested answers to specific questions and provided space for general comments about the questionnaire.* Specifically, these individuals were requested to:

1. Read the proposed introductory or cover letter.
2. Complete Parts I, General Information; II, Industrial Arts Student Behavior Inventory; and III, Industrial Arts Objective Emphasis Sections of the questionnaire.
3. Answer the questions on the reaction-suggestion sheet.

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*Copies of the pilot study introductory letter, proposed cover letter, pilot study questionnaire and reaction-suggestion sheet are found in Appendix D.

In addition, they were encouraged to write directly on the questionnaire any questions or comments concerning the directions, format, clarity of items or identify anything that was confusing.

When the materials were delivered to the teachers in the pilot study, arrangements were made to pick up all materials within three to five days and have a thirty minute interview with each individual. The purpose of this interview was to provide an opportunity to obtain clarification on some of the individual reactions, comments and suggestions and also to acquire a verbal expression.

Results of Pilot Study*

The time required for individuals to respond to the questionnaire in the pilot study ranged from twenty to seventy-five minutes, with an average time of forty-four minutes. The mode time was thirty-five minutes with three respondents indicating this amount of time.

In response to the motivational aspect of the proposed cover letter, five teachers indicated they would have been motivated to respond to the questionnaire. One individual gave no response and the other respondent stated that "I would have responded as [I] did, with or without the introductory letter." The introductory letter explained the purpose of the study adequately for six of the respondents. One teacher who did not agree suggested including information about how the data were to be analyzed.

In response to the question of whether a large number of responses to such a questionnaire would help educators and the public gain a better understanding of industrial arts and program accomplishments, the opinion

*Information presented in this section was obtained from an analysis of responses to the questions on the Reaction and Suggestion Sheet found in Appendix D.

was varied. Four respondents indicated they thought it would be helpful, but one of these qualified his response by adding, "if the information is placed in front of the public." The two individuals who responded negatively to this question expressed the same concern. The teacher who did not respond to this question indicated in the interview that it would depend on how the results were disseminated.

The directions provided for responding to all three parts of the questionnaire were clear and sufficient for six of the seven teachers with one teacher not responding.

In response to specific questions concerning Part II, Industrial Arts Student Behavior Inventory and the 99 items contained in it, opinion was varied. All six persons who responded felt that the statements were meaningful. Three of the six indicated some difficulty when attempting to determine the degree of emphasis or encouragement they give to each described behavior in their classroom. This section was believed to be too long by four of the seven respondents.

Five individuals indicated they would have answered this questionnaire if they had received it in the mail. One of the other two respondents wrote, "yes and no [but] might lose interest in Part II."

As a result of the written responses to the reaction-suggestion sheet and verbal comments made during the interview, two conclusions were drawn. First, the introductory or cover letter, and the directions and instructions appeared to be clear and adequate. Second, evidence seemed to indicate a need for shortening the questionnaire, particularly the behavioral inventory section. In order to check the possibility of shortening the inventory, a preliminary analysis was made of responses to the behavioral statements.

The inventory was shortened first by eliminating some of the twenty-one items related to the three objective statements in Part III. Each objective scale was reduced from seven items to the five items that in general, produced the highest score for those teachers who ranked the corresponding objective related to those items numbered one. The final composition of each objective scale is shown in Table 11 by individual item number.

TABLE 11

RETAINED AND DROPPED ITEMS FOR OBJECTIVE SCALES A, B,C, AS A RESULT OF PILOT STUDY

Objective A		Objective B		Objective C	
Retained	Dropped	Retained	Dropped	Retained	Dropped
22[a]	19	1	69	20	58
29	71	34	79	56	85
52		36		63	
70				80	
72				83	

[a]Item numbers refer to the items as numbered on the pilot study questionnaire in Appendix D.

With the elimination of the six objective related items shown in Table 11, the only remaining means of shortening the questionnaire was to exclude some of the creative and non-creative behavioral statements. Initial identification of possible items for elimination was accomplished by listing all those items in the inventory that the pilot study respondents indicated were not clear, caused difficulty, or they were unable to answer. Thirty-two items identified in this manner are listed by number in Table 12. Each item was analyzed in terms of response pattern, judges' classification, strength of documentation and

TABLE 12

TROUBLESOME CREATIVE AND NON-CREATIVE ITEMS IDENTIFIED BY PILOT STUDY AND THOSE RETAINED AND DROPPED

Item Number[a]	Item Number	Item Number	Item Number
7 C[b]	26 C	57 C *	81 N
9 N	28 C	60 C *	84 C *
10 C *[c]	31 C *	61 C	87 C *
11 N *	39 C *	65 C *	91 C
13 C	41 C *	70 N	93 C *
16 C	42 C *	73 C *	94 C
17 C *	48 C *	74 C *	97 C *
21 N *	55 C *	75 C *	98 C *

[a]Item numbers refer to the items as numbered on the pilot study questionnaire in Appendix D_3.

[b]Items marked with a "C" represent a creative item, those marked with a "N" represent a non-creative item.

[c]Items marked with an asterick (*) were eliminated.

duplication of the same concept in other items. Since judges' rating and strength of item documentation did not appear to account for items causing difficulty, the other factors of response pattern and concept duplication were used to eliminate troublesome items. If an item was based on a concept or idea quite similar to that of other items not causing problems in the inventory, it was eliminated. Also, if the response pattern to an item was rather uniform and the item did not discriminate between individuals, it was usually dropped from the inventory. Those items marked with an asterick (*) in Table 12 were eliminated from the inventory.

Employing the criteria outlined, nineteen creative and two non-creative items or a total of twenty-one items were deleted from the thirty-two troublesome items in the pilot study.

Final Instrument*

The final instrument used for data collection in this study resulted from revisions made to the pilot study questionnaire which were based on the reaction of the respondents and other suggestions received. Parts I (Basic Data) and III (Industrial Arts Objective Emphasis) of the questionnaire were slightly modified by minor changes in wording and rearrangement of items. Since the major problem with the questionnaire was its lengthiness, Part II (Student Activity and Behavior Inventory) was shortened from ninety-nine to seventy-four items. A total of twenty-seven items were deleted including both objective related items and those associated with creativity and non-creativity. Two check items, numbers 30 and 60, were added to determine whether individuals took the time to read the items or just marked them indiscriminantly. The final breakdown and classification of items is shown in Table 13.

TABLE 13

CLASSIFICATION OF ITEMS IN PART II OF THE QUESTIONNAIRE

Classification of Items	Number of Items
Creative behavioral statements	40
Non-creative behavioral statements	20
Items for objective scale A	5
Items for objective scale B	5
Items for objective scale C	5
Check items	2
Total	77
Less three dual-purpose items	- 3
Total number of items in inventory	74

*A copy of the questionnaire, cover letter and follow-up letter are in Appendix E.

The three dual purpose items shown in Table 13 were item numbers 70, a non-creative and Objective A item and items 34 and 77 which were creative and Objective B items.

To condense the final questionnaire into a four page single folded sheet the copy was set in 12-point Bookmen's Type by the vari-type process and printed by the photo-offset method.

IV. ADMINISTRATION OF THE INSTRUMENT

The Sample

The sample used in this study was randomly selected from the entire population of industrial arts and vocational industrial teachers in Michigan that had been stratified to include only those school districts having separate junior and senior high school facilities.

The listing from which the sample was drawn was the Michigan Department of Public Instruction Register of Certificated Personnel for Majors and Minors and Assignment Classification IX Industrial Arts and Industrial Education, 1962-63 school year. The listing was by school districts and provided the individual teachers name, age, type of certification, degrees, graduating institution, semester hours, major and minor, type of assignment and length of experience in current and other school districts.

A total of 509 school districts were included in the listing with each having at least one teacher with an assignment in the industrial arts or vocational industrial teaching areas. In order to stratify the final sample in terms of junior high school teaching only and senior high school teaching only, school districts were eliminated if they did not meet at least one of the following criteria.

a. One secondary school (7-12) with at least two teachers classified as IX* and with an enrollment that exceeded 450 students.

b. One secondary school (7-12) with three or more teachers classified as IX.

c. Two or more secondary schools (J.H.S.-S.H.S.) with two or more teachers classified as IX and a combined enrollment that exceeded 600 for those districts that had only two schools.

Information concerning the number of secondary schools within a school district and the enrollments of these schools was obtained from the 1963-64 Michigan Education Directory (3). A total of 1,589 industrial arts and vocational industrial teachers were identified as teaching in school districts meeting the above criteria. From this list a 300 teacher sample was drawn randomly by assigning each teacher a number and including them in the sample in the order their assigned number appeared in a Table of Random Numbers (4). Teachers who were known to be currently teaching reimbursed vocational industrial classes and those who did not have at least a bachelors degree were excluded from the sample and another number drawn until a total of 300 eligible numbers appeared. Prior to mailing the questionnaire the sample was reduced to 297 from the knowledge that three Detroit city teachers had recently retired or were deceased.

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*See underlined section on previous page.

Mailing and Follow-Up Procedures

The first mailing of the cover letter, questionnaire and return self-addressed envelope took place during a five day period beginning January 8, 1964. A total of 297 questionnaires were mailed. Three follow-ups were conducted using a postal card, a letter with an additional questionnaire and a final postal card.*

Identification of Respondents

All questionnaires were coded. Two purposes were achieved by this practice: (a) follow-up procedures were confined only to those individuals who had not responded and (b) information already available on each member of the sample from the Michigan Department of Public Instruction Register of Certificated Personnel could be combined with additional information obtained on the questionnaire.

Returns

A total of 244 individuals or 82 percent of those sent questionnaires returned them. School officials and postal authorities returned eleven letters indicating that these individuals were no longer at the designated address or had retired. Excluding these individuals, 244 out of 286 or 85 percent respondents returned the questionnaire. Of the 244 questionnaires returned eight were incomplete and therefore disregarded. The remaining 236 questionnaires or 80 percent were used in the analysis. The percent of return was considered sufficiently high

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*A schedule of follow-up procedures is found in Appendix C, and a copy of all letters and postal cards used are found in Appendix E.

and representative of the entire population sample that no additional investigation of non-respondents was conducted. However, the remote possibility of a biasing factor existing among the non-respondents was recognized.

The effectiveness of stratification procedures employed to eliminate from the sample industrial arts teachers that taught at both junior and senior high school levels is shown in Table 14.

TABLE 14

RESPONDENTS AND THEIR LEVEL OF TEACHING

Teaching Level	Number of Respondents	Percent
Junior high school	75	31.8
Senior high school	140	59.3
Junior and senior high school	16	6.8
Unidentified	5	2.1
Totals	236	100.0

Only 21 respondents could not be classified as separate junior or senior high school industrial arts teachers. Seventy-five teachers were classified as junior high school teachers and 140 as senior high school teachers exclusively.

Scoring and Coding

The entire questionnaire was pre-coded so the data could be scored, coded and punched on data cards to utilize data processing and computer techniques for data analysis. All printed item numbers on the questionnaire corresponded to column numbers on data cards. Two data cards were punched for each observation. The first contained all control variables or information in Parts I and III of the questionnaire. All responses to the activity and behavior inventory, Part II, were punched on the second card. Columns 77, 78 and 79 on both cards were used to identify each respondent by number and column 80 was used for card one and card two designations.

V. STATISTICAL ANALYSIS

The statistical method employed in testing the null and alternate hypotheses was the Chi-square median test.(5:111) Because the data were obtained from an ordinal scale and normality of distribution was not assumed, a non-parametric test was chosen. The median test was appropriate since it can be employed to determine whether it is likely that two independent groups have been drawn from populations with a common median. (5:111)

Individual item analysis of hypothesized differences were tested by Chi-square 2 x 2 contingency tables and responses were dichotomized as encouragement or non-encouragement of a particular item.

In all Chi-square tests the .05 level of significance was used. Therefore, the null hypothesis was accepted if the computed value of Chi-square did not exceed the .05 level of significance. If the null hypothesis was rejected, the alternate hypothesis was accepted in the case of a two-tail test and inspected for proper direction of difference before accepting it in the case of a directional alternative hypothesis or one-tail test.

To test individual item relationships with each other and with both the creative and non-creative scales, inter-item and between scale correlations were computed, using the Product-Moment Correlation Coefficient. (1:142-154) Another measure of internal consistency of the two scales and an estimate of reliability was calculated by Hoyt's "Estimate of Test Reliability for Unrestricted Item Scoring Methods." (2)

Where inferential statistics were not appropriate, descriptive statistics were employed to analyze the data and provide additional understanding.

VI. SUMMARY

The null and alternate hypotheses, development and testing of the instrument, administration of the instrument, sample and returns, and the statistical design have been discussed. Major hypothesized differences were that: junior high school teachers, multiple area teachers, teachers with masters degrees and teachers who selected the objective of self-realization (B) would have a higher median score on the creative scale of the inventory than high school teachers, limited area teachers, teachers with bachelors degrees, and teachers who selected skill development (A) and interpretation of industry (C) objectives. The reverse was hypothesized for the non-creative scale. The same differences were hypothesized to exist in respect to individual items that constituted the two scales.

From the initial pool of creative, non-creative and objective behavioral items, six judges unanimously agreed that forty-five of these items were indicative of creative or non-creative behavior in industrial arts. An additional thirty-eight items were agreed upon by five of the six judges. As a result of a pilot study the final inventory was shortened to include forty creative items, twenty non-creative items, twelve items with each item related to one of the three objective scales and two check items for a total of seventy-four items.

The final instrument contained three major parts. In Part I, Basic Data, or background information about the respondent was solicited, Part II, Industrial Arts Student Activity and Behavior Inventory, contained the seventy-four behavioral statements and in Part III, Industrial Arts Objective Emphasis, respondents were asked to rank in order according to degree of emphasis three different stated objectives of industrial arts.

The questionnaire was administered to a random sample of 297 junior or senior high school industrial arts teachers in the State of Michigan. Usable returns were received from 236 or 80 percent of the total sample.

Statistical tests employed to test the hypotheses and analyze the data were Hoyt's analysis of variance test of reliability, the chi-square median test, chi-square 2x2 contingency tables, and Product-Moment Correlation Coefficients. The latter were obtained to identify inter-item and scale relationships. The .05 level of significance was accepted for all tests of statistical significance.

In Chapter V, the analysis of the data obtained from the questionnaire is presented.

VII. BIBLIOGRAPHY

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CHAPTER V

ANALYSIS OF THE DATA CONCERNING THE SAMPLE

I. INTRODUCTION

The "Industrial Arts Activity Questionnaire" was sent to 297 Michigan Industrial Arts teachers in January of 1964. The statistical analyses were conducted on 236 usable responses. Descriptive statistics were computed to define status characteristics of the sample and inferential statistics were employed to test hypotheses and determine extent of differences between various sub-groups of the sample. This chapter contains a summary of these investigations.

II. RELATIONSHIPS BETWEEN INDIVIDUAL BEHAVIORAL ITEMS AND THE CREATIVE AND NON-CREATIVE SCALES

To check the internal-consistency of the inventory, inter-item correlations were computed between all seventy-four inventory items and the total creative and non-creative scales. Only those respondents who had responded to all items on the inventory were included in this analysis. A total of 186 responses were analyzed. In Table 15, the correlations between individual creative items and both the creative and non-creative scales are shown. Table 16 presents correlations between non-creative items and both the creative and non-creative scales. All item numbers correspond to those on the final "Industrial Arts Activity Questionnaire" found in Appendix E.

TABLE 15

RELATIONSHIP OF INDIVIDUAL CREATIVE ITEMS TO ENTIRE CREATIVE AND NON-CREATIVE SCALES

Creative Item Number	Correlation with Creative Scale	Correlation with Non-Creative Scale
2	.43	-.03
3	.31	-.22
4	.34	-.19
7	.32	.01
8	.49	-.18
11	.50	-.18
14	.30	.09
18	.54	-.19
19	.54	-.30
20	.35	-.01
21	.45	-.14
23	.34	-.13
25	.37	-.21
26	.34	-.09
27	.41	-.15
28	.37	-.11
32	.51	-.16
33	.59	-.17
34	.59	-.33
36	.56	-.11
37	.48	-.16
38	.51	-.12
39	.36	-.07
40	.56	-.08
42	.52	-.23
44	.40	-.09
45	.32	-.10
47	.55	-.34
48	.38	-.08
49	.43	-.08
51	.57	-.23
57	.50	-.20
58	.29	-.17
59	.44	.05
63	.31	-.08
66	.49	-.14
68	.53	-.17
69	.63	-.19
71	.58	-.20
72	.50	-.18

All forty of the individual creative behavioral items were found to correlate positively with the entire creative behavioral scale. The correlations were all greater than .188 which is the .01 level of significance with 185 degrees of freedom. These correlation coefficients ranged from .29 to .63 with the median correlation computed at 46.5

The relationship between the individual creative items and the sum of the non-creative scale was generally found to be in the negative direction. Negative correlations ranging from -01 to -.34 were found for thirty-seven items. Three items, numbers 7, 14 and 59 had low non-significant positive correlations with the non-creative scale.

In Table 16 the same type of analysis for the non-creative behavioral items is presented.

TABLE 16

RELATIONSHIP OF INDIVIDUAL NON-CREATIVE ITEMS TO ENTIRE NON-CREATIVE AND CREATIVE SCALES

Non-Creative Item Number	Correlation with Non-Creative Scale	Correlation with Creative Scale
5	.07	.28
6	.41	-.21
9	.21	-.22
10	.42	-.06
12	.41	-.03
13	.51	-.13
15	.32	.05
22	.38	-.19
29	.54	-.34
35	.26	-.04
41	.47	-.14
52	.45	-.33
53	.57	-.29
54	.46	-.28
55	.44	-.20
62	.47	-.24
65	.42	-.02
70	.31	-.06
73	.45	.01
74	.46	-.22

With the exception of item number 5, positive, significant correlations at the .01 level were found between the other nineteen non-creative behavioral items and the entire non-creative scale. These correlations ranged from .07 for item number 5 to .57 with the median correlation computed at .43. Again with the exception of item number 5, negative or small positive non-significant correlations were found between the other non-creative behavioral items and the entire creative scale. For seventeen items these negative correlations ranged from -.02 to -.34. Items 15 and 73 had correlations of .05 and .01 respectively. Response patterns to item 5 - encourage students to think through their suggestions before making them - produced a significant positive correlation of .28 with the creative scale and a non-significant correlation of .07 with the non-creative scale. Since this item was classified as a non-creative item, these relationships were opposite of those found and predicted in respect to all the other items.

With the exception of item 5, significant positive correlations were found between all items and the creative or non-creative scale to which they were assigned and negative correlations or small insignificant positive correlations between all items and the non-assigned scale.

The complete correlation matrix for all items constituting the creative scale is found in Appendix F_1. Since the majority of these items originated from four factors or attributes of creativity, identified as fluency, flexibility, problem sensitivity and originality, correlation matrices for each of these factors were extracted and are presented in Appendix F_2 and F_3. Average inter-item correlations for each item assigned to the sub-scales of fluency, flexibility, problem sensitivity and originality were generally higher than the inter-item correlations between these same items and the entire scale of creative items. For the factors of fluency, originality and problem sensitivity, only one item in each of these sub-scales produced an inter-item correlation that was less than the inter-item correlation between that same item and the rest of the creative scale items. The flexibility factor appeared to be least internally consistent since only two of the five items assigned to this factor produced inter-item correlations within this factor that were higher than those inter-item correlations between these same items and the entire scale of creative items. No attempt was made to identify various factors of creativity in industrial arts other than the development of individual behavioral items that theoretically were related to the four factors mentioned above and other identified characteristics of creative individuals. Therefore, creativity in industrial arts was considered to consist of the total collective behavior as described by the individual creative items.

III. RELATIONSHIP BETWEEN ENTIRE CREATIVE AND NON-CREATIVE SCALES BY TOTAL GROUP AND VARIOUS SUB-GROUPS

In Table 17 is presented the mean and standard deviation of both the creative and non-creative scales for the total group and various sub-groups together with the correlation between the two scales for all groups. Only individuals who responded to all items on the inventory were used in this analysis.

TABLE 17

RELATIONSHIP OF RESPONSES TO CREATIVE AND NON-CREATIVE SCALES BY VARIOUS GROUPINGS

Sub-Group	N	$\bar{X}_c$	SD_c	$\bar{X}_{nc}$	SD_{nc}	r between X_c & X_{nc}	Level of Significance
Jr. High School	62	110.48	16.41	41.85	6.52	-.35	.01
Sr. High School	92	111.09	12.26	44.09	6.02	-.21	.05
Limited Area	86	109.07	13.70	44.27	6.49	-.27	.01
Multiple Area	80	112.06	14.32	42.56	5.64	-.39	.01
Jr. High School Limited Area	20	104.80	16.10	43.05	6.56	-.49	.02
Jr. High School Multiple Area	40	114.10	15.88	41.63	6.39	-.35	.05
Sr. High School Limited Area	63	110.44	12.84	44.52	6.38	-.19	*
Sr. High School Multiple Area	28	112.61	11.17	42.79	4.88	-.25	*
Objective A-Skill	62	107.19	14.70	43.89	6.82	-.34	.01
Objective B-Self-Realization	77	112.47	13.10	42.38	6.31	-.29	.01
Objective C-Industry	17	110.88	12.30	42.59	5.36	-.12	*
Total Group	186	109.67	13.77	43.34	6.27	-.30	.01

N denotes size of group, $\bar{X}_c$ and SD_c the mean and standard deviation respectively of the creative scale and $\bar{X}_{nc}$ and SD_{nc} are the same designation for the non-creative scale. An asterick (*) indicates a correlation that is not significant at the .10 level or higher.

When combining all sub-sample groups together a correlation coefficient of -.30 was computed between responses to the entire creative and non-creative scales that was significant at the .01 level with 185 degrees of freedom. Correlations for the eleven sub-groups ranged from -.12 to -.49 on the same variables.

These negative correlations between both the creative and non-creative behavioral scales for the total sample and the various sub-groupings indicated that a person who scores high on one of the scales tends to score lower on the other scale. Since the magnitude of this negative relationship was fairly stable in the sub-groups as well as the total sample, the variables used to categorize the sub-groups were considered as non-biasing variables on the interrelatedness of the creative and non-creative scales.

IV. RELIABILITY ESTIMATES

Since individual items in the inventory were not scored as right or wrong, Hoyt's estimate of test reliability for raw score data (r_{tt}) was used. (1:756-8) The form for this test is illustrated in Figure 1.

Source	d.f.	S. Sq.	M. Sq.
Betw. Indiv.	n-1	$\frac{Exc^2}{k} - \frac{(Exr)^2}{nk}$	A'
Betw. Items	k-1	$\frac{Exr^2}{n} - \frac{(Exr)^2}{nk}$	B'
Residual	(n-1) (k-1)	Tot. S.Sq.-(Indiv. + Item S. Sq.)	C'
Total	nk-1	$\sum\sum {}_i x^2 - \frac{(Exr)^2}{nk}$	

Reliability: $r_{tt} = \frac{A' - C'}{A'}$ SEmeasurement = $\sqrt{KC}$

FIGURE 1
HOYT'S TEST FOR RELIABILITY OF TOTAL SCORE

Creative Scale Reliability

A creative scale reliability score of .899 with a $SE_{measurement}$ of 4.41 was computed using the Hoyt technique. Summation and computations are given below.

Source	d.f.	S. Sq.	M. Sq.
Betw. Indiv.	185	890	4.81
Betw. Items	39	1300	33.20
Residual	7215	3510	0.486
Total	7439	5700	----

r_{tt} = 4.81 - 0.486/4.81 = .899

$SE_{measurement} = \sqrt{40 \times 0.486} = 4.41$

Non-Creative Scale Reliability

A non-creative scale reliability score of .744 with a $SE_{measurement}$ of 3.22 was computed using the Hoyt technique. Summation and computations are given below.

Source	d.f.	S. Sq.	M. Sq.
Betw. Indiv.	185	375	2.03
Betw. Items	19	609	32.0
Residual	3515	1820	0.519
Total	3719	2810	---

r_{tt} = 2.03 - 0.519/2.03 = .744

$SE_{measurement} = \sqrt{20 \times 0.519} = 3.22$

The internal consistency of the individual items, the reported reliability coefficient of the creative and non-creative behavioral scales and the negative relationship that existed between the two scales suggested the feasibility of analyzing and testing hypotheses independently on both scales.*

In the following section the hypotheses were tested and conclusions presented.

V. HYPOTHESIZED RELATIONSHIPS BETWEEN THE INDICATED ENCOURAGEMENT OF CREATIVE OR NON-CREATIVE BEHAVIOR AND VARIOUS CATEGORIZED GROUPINGS OF INDUSTRIAL ARTS TEACHERS

For this analysis, 236 observations or respondents were used. Various sub-groups or categories of teachers were formed by eliminating observations on the basis of certain variables, or status factors. In any sub-group of observations, individuals who failed to respond to three or more scale items were eliminated from the analysis. A total of 186 complete observations plus 36 observations with one or two incomplete responses or a total of 222 observations were available for analysis. The 36 incomplete observations used were adjusted and analyzed as complete responses by computing a mean score on each scale for each incomplete observation. This mean score was added to the total score on each scale as many times as the observation or respondent had failed to respond to a creative or non-creative scale item. As a result of this correction, the size of the various sub-groups differed slightly from the size indicated for these groups in the analysis made of the relationship between the creative and non-creative scale presented on page 153.

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*A complete analysis was also made on a combined scale of 40 creative and 20 non-creative items by using a reverse scoring technique for the non-creative items. With a r_{tt} of .82 this scale produced similiar results as the separate creative scale.

This adjustment was considered necessary in order to increase the size of some of the groups so the individual cell frequencies would be sufficiently large enough for the Chi-square median test.

In each sub-group formed, a median score was computed for both the creative and non-creative scales. Differences were hypothesized to exist between two or more categories within each sub-group and the number of individuals in each of these categories who scored above or below the combined median for the creative scale or the combined median for the non-creative scale. The Chi-square median test was used to test the significance of the hypothesized differences.

Individual items which constituted the creative and non-creative scales were also tested for the same hypothesized differences. The scaled responses to each item were dichotomized as encouraging the item or not encouraging the item. A response of (1) never or (2) sometimes was considered as non-encouragement and a response of (3) usually or (4) always as encouragement of a particular item. The Chi-square 2x2 or 3x2 contingency table test was used to test the significance of hypothesized differences.

<u>The Indicated Encouragement of Creative or Non-Creative Behavior and Level of Teaching</u> (Hypotheses 1 and 2)

The two categories of teaching levels analyzed were industrial arts teachers at the junior high school level and those at the senior high school level.*

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*The methods used to define these two categories were discussed in detail on pages 132 and 133 of Chapter IV.

Creative Scale. (Hypothesis 1) A combined median creative score of 110* was computed for this combined group of 186 junior or senior high school teachers of industrial arts. Table 18 records the number of junior or senior high school teachers who scored either above or at and below the combined median of the creative scale.

TABLE 18

NUMBER OF TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN ON THE CREATIVE SCALE AND TEACHING AT THE JUNIOR OR SENIOR HIGH SCHOOL LEVEL

Teaching Level	At or Below $Mdn._c$ Score	Above $Mdn._c$ Score	Totals
J.H.S. (1)	39	33	72
S.H.S. (2)	59	55	114
Totals	98	88	186

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. Chi-square was computed and found to be .103. The null hypothesis was accepted and the alternate hypothsis H_1: $Mdn_1 > Mdn_2$ rejected since the value of Chi-square did not exceed the table value of 2.71**necessary to meet the .05 level of significance. It was concluded that the median creative score for junior high school industrial arts teachers was not higher than the median creative score for senior high school teachers.

*All groups were actually dishotomized as those scores which exceeded the median and those which did not.

**This value is the .05 level for a one tail test of significance with one degree of freedom and was obtained from a Table of Critical Values of Chi-square in Siegel's Non-Parametric Statistics. (2:249)

Individual items that constituted the creative scale were tested on the same variable by a Chi-square 2x2 contingency table test. All items where the computed value of Chi-square exceeded the table value of 2.71 were listed in Table 19 and the direction of the difference indicated.

TABLE 19

CREATIVE ITEMS WHERE INDICATED ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN JUNIOR OR SENIOR HIGH SCHOOL TEACHERS

Item No.	Chi-Square Value	Predicted Direction J.H.S > S.H.S	Direction Not Predicted J.H.S. < S.H.S.
4	3.203	x	
39	4.572		x
44	4.174		x
48	4.077		x
49	9.155		x

Only item number 4 produced a significant value of Chi-square in the predicted direction. It was concluded that a significantly greater proportion of junior high school teachers indicated they encouraged students to sketch three or more tentative design ideas before making a specific project than senior high school teachers. The other items, numbered 39, 44, 48, 49 produced significant values of Chi-square but not in the direction predicted. Therefore, it was concluded that a smaller proportion of junior than senior high school teachers indicated they encouraged students to: (39) develop short cut methods of performing a technical operation, (44) make decisions independent of others, (48) improvise if they do not have the correct tool for the job and (49) tackle a job that possibly involves many unknown difficulties.

Non-Creative Scale. (Hypothesis 2) A combined median non-creative score of 43 was computed for the combined group of 186 junior or senior high school teachers. Table 20 records the number of teachers who scored either above or at and below the combined median of the non-creative scale.

TABLE 20

NUMBER OF JUNIOR OR SENIOR HIGH TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE NON-CREATIVE SCALE

Teaching Level	At or Below $Mdn._{nc}$ Score	Above $Mdn._{nc}$ Score	Totals
J.H.S.(1)	43	29	72
S.H.S.(2)	58	56	114
Totals	101	85	186

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. The value of Chi-square computed was 1.391. The null hypothesis was accepted and the alternate hypothesis H_1: $Mdn_1 < Mdn_2$ rejected since the value of Chi-square did not exceed the table value of 2.71 necessary to meet the .05 level of significance. It was concluded that the median non-creative score for junior high school industrial arts teachers was not less than the median non-creative score for senior high school teachers.

Individual items that constituted the non-creative scale were tested on the same variable. All items where the computed value of Chi-square exceeded the table value of 2.71 were listed in Table 21 and the direction of difference indicated.

TABLE 21

NON-CREATIVE ITEMS WHERE ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN JUNIOR OR SENIOR HIGH SCHOOL TEACHERS

Item No.	Chi-Square Value	Predicted Direction J.H.S. $<$ S.H.S.	Direction Not Predicted J.H.S $>$ S.H.S.
12	5.177	x	
15	4.327	x	
35	4.104	x	
73	3.565	x	

All items in Table 21 produced a significant value of Chi-square in the predicted direction. It was concluded that a significantly smaller proportion of junior than senior high school teachers indicated they encourage students to: (12) exercise caution in looking for problems, since more than enough will usually come up anyway, (15) rely upon the greater experience of others when confronted with a problem, (35) proceed first with the initial solution to a problem when another becomes evident during the process, and (73) accept their final solution to a problem as the best solution possible.

<u>The Indicated Encouragement of Creative or Non-Creative Behavior and Multiple or Limited Area Teaching</u> (Hypotheses 3 and 4)

The two categories of multiple area and limited area industrial arts teaching are described and defined on pages 132 and 133.

<u>Creative Scale</u>. (Hypothesis 3) A combined median creative score of 110 was computed for the combined group of 183 multiple or limited area teachers of industrial arts. Table 22 records the number of these teachers who scored either above or at and below the combined median of the creative scale.

TABLE 22

NUMBER OF MULTIPLE OR LIMITED AREA TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE CREATIVE SCALE

Area Designation	At or Below $Mdn._c$ Score	Above $Mdn._c$ Score	Totals
Multiple Area (1)	39	47	86
Limited Area (2)	56	41	97
Totals	95	88	183

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. The value of Chi-square computed was 2.800. The null hypothesis was rejected since the computed value of Chi-square exceeded the table value of 2.71 at the .05 level of significance. The alternate hypothesis H_1: $Mdn_1 > Mdn_2$ was accepted since the difference was in the direction predicted. It was concluded that the median creative score for multiple area industrial arts teachers was significantly higher than the median creative score for limited area teachers.

Individual items that constituted the creative scale were tested on the same variable. All items where the computed value of Chi-square exceeded the table value of 2.71 were listed in Table 23 and the direction of difference indicated.

With the exception of item 71 all items in Table 23 produced a significant value of Chi-square in the predicted direction. It was concluded that a significantly greater proportion of multiple area teachers than limited area teachers indicated they encourage students:

11. who approach a problem in a different way from the rest of the group or class.
37. to meditate and mull over problems or possible solutions to problems.

42. to propose entirely new approaches to a problem.
51. ~~to suggest un~~usual or different combinations of materials.
57. to suggest alternate operational plans of procedure when planning a project.
58. to work with a material or engage in an activity where they have had little or no previous experience.
63. to feel, smell and taste, where possible, the various materials they use in the laboratory.
66. to suggest new ways of joining materials.
69. to try something which has not occurred to others to try.

TABLE 23

CREATIVE ITEMS WHERE INDICATED ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN MULTIPLE OR LIMITED AREA TEACHING

Item No.	Chi-Square Value	Predicted Direction Multi. > Limited	Direction Not Predicted Multi. < Limited
11	7.198	x	
37	3.428	x	
42	3.348	x	
51	5.623	x	
57	3.117	x	
58	8.420	x	
63	4.170	x	
66	3.789	x	
69	3.688	x	
71	3.562		x

Non-Creative Scale. (Hypothesis 4) A combined median non-creative score of 43 was computed for the combined group of 183 multiple or limited area teachers. In Table 24 the number of those teachers who scored either above or at and below this combined median is shown.

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. The value of Chi-square computed was 7.932. The null hypothesis was rejected since the value of Chi-square exceeded the table value of 2.71 at the .05 level of significance. The alternate hypothesis H_1: $Mdn_1 < Mdn_2$ was accepted since the difference was in the direction predicted. It was concluded that the median non-creative score for multiple area industrial arts teachers is lower than the median non-creative score for limited area industrial arts teachers.

TABLE 24

NUMBER OF MULTIPLE OR LIMITED AREA TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE NON-CREATIVE SCALE

Area Designation	At or Below $Mdn._{nc}$ Score	Above $Mdn._{nc}$ Score	Totals
Multiple Area (1)	56	30	86
Limited Area (2)	43	54	97
Totals	99	84	183

Individual items that constituted the non-creative scale were tested on the same variable. All items where the computed value of Chi-square exceeded the table value of 2.71 were listed in Table 25 and the direction of difference indicated.

TABLE 25

NON-CREATIVE ITEMS WHERE ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN MULTIPLE OR LIMITED AREA TEACHERS

Item No.	Chi-Square Value	Predicted Direction Multi. $<$ Limited	Direction Not Predicted Multi $>$ Limited
12	3.016	x	
29	5.995	x	
74	3.502	x	

All items in Table 25 produced a significant value of Chi-square in the predicted direction. It was concluded that a significantly smaller proportion of multiple area teachers than limited area teachers indicate they encourage students to: (12) exercise caution in looking for problems, since more than enough will usually come up anyway, (29) stick to the tried and true way of doing things and (74) follow all instructions without question.

The Indicated Encouragement of Creative or Non-Creative Behavior and First Choice of Three Industrial Arts Objectives (Hypotheses 5 and 6)

The three objectives statements are given on pages 127 to 129 and are categorized as Objective A Skill Development, Objective B Self-Realization, and Objective C Interpreting Industry.* On the questionnaire each individual was asked to rank these three objectives according to the degree of emphasis in their industrial arts classes. Relationships between number one rankings and indicated encouragement of creative or non-creative behavior were analyzed.

Creative Scale. (Hypothesis 5) A combined median creative score of 110 was computed for the combined group of 174 teachers of industrial arts who ranked either Objectives A, B, or C as number one. In Table 26 the number of these teachers who scored either above or at and below the combined median by first objective ranking is recorded.

By combining Objective A and C groups together for comparison with the Objective B group a 2x2 table was formed so the null hypothesis H_0: $Mdn_1 = Mdn_{2,3}$ could be tested. The value of Chi-square computed was 1.160. Since the computed value was less than the table value of 2.71 at the .05 level of significance, the null hypothesis was accepted

*Hereafter in this chapter these objectives will be identified as Objective A, B, or C.

and the alternate hypothesis H_1: $Mdn_1 > Mdn_{2,3}$ was rejected. It was concluded that the median creative score for industrial arts teachers who ranked the self-realization Objective B first was not higher than the median creative score for teachers who ranked Objective A or C first.

TABLE 26

NUMBER OF TEACHERS RANKING OBJECTIVE A, B, OR C AS NUMBER ONE SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE CREATIVE SCALE

1st Objective Choice	At or Below Mdn_c Score	Above Mdn_{nc} Score	Totals
Objective B (1)	44	44	88
Objective A (2)	41 > 50	27 > 36	68 > 86
Objective C (3)	9	9	18
Totals	94	80	174

Individual items that constituted the creative scale were tested on the same variable. All items where the computed value of Chi-square exceeded the table value of 2.71 were listed in Table 27 and the direction of difference indicated.

TABLE 27

CREATIVE ITEMS WHERE ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN TEACHERS WHO RANKED OBJECTIVE A, B, OR C AS NUMBER ONE

Item No.	Chi-Square Value	Obj. B > Obj. A, C	Obj. B < Obj. A, C
48	3.341	x	
57	3.292	x	

Items numbered 48 and 57 in Table 27 produced a significant Chi-square value in the direction predicted. It was concluded that a significantly greater proportion of teachers who ranked the self-realization objective as number one indicated they encourage students to: (48) improvise if they do not have the correct tool for the job, (57) suggest alternate operational plans of procedure when planning a project than teachers who ranked the skill development Objective A or the interpreting industry Objective C as number one.

Non-Creative Scale. (Hypothesis 6) A combined median non-creative score of 43 was computed for the combined group of 174 teachers who ranked either Objective A, B, or C as number one. In Table 28 the number of these teachers who scored either above or at and below this combined median by first objective ranking is recorded.

TABLE 28

NUMBER OF TEACHERS RANKING OBJECTIVES A, B, OR C AS NUMBER ONE SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE NON-CREATIVE SCALE

1st Objective Choice	At or Below $Mdn._{nc}$ Score	Above $Mdn._{nc}$ Score	Totals
Objective B (1)	54	34	88
Objective A (2)	31	37	68
Objective C (3)	10	8	18
(A + C)	41	45	86
Totals	95	79	174

By combining Objective A and C groups together for comparison with the Objective B group a 2x2 table was formed so the null hypothesis H_o: $Mdn_1 = Mdn_{2,3}$ could be tested. The value of Chi-square computed was 3.288. The null hypothesis was rejected since the computed value of Chi-square exceeded the table value of 2.71 at the .05 level of significance. The alternate hypothesis H_1: $Mdn_1 < Mdn_{2,3}$ was in the direction predicted. It was concluded that the median non-creative score for industrial arts teachers who ranked the self-realization Objective B first was significantly lower than the median non-creative score for teachers who ranked Objectives A and C first.

Individual items that constituted the non-creative scale were tested on the same variable. All items where the computed value of Chi-square exceeded the table value of 2.71 were listed in Table 29 and the direction of difference indicated.

TABLE 29

NON-CREATIVE ITEMS WHERE ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN TEACHERS WHO RANKED OBJECTIVE A, B, OR C AS NUMBER ONE

Item No.	Chi-Square Value	Obj. B < Obj. A or C	Obj. B > Obj. A or C
22	3.457	x	
70	5.791	x	
74	3.050	x	

Items numbered 22, 70 and 74 in Table 29 produced a significant Chi-square value in the direction predicted. It was concluded that a significantly smaller proportion of teachers who ranked the self-realization Objective B as number one indicated they encourage students to: (22) accept the obvious answer, (70) apply the initial solution they think of to solve a problem or (74) follow all instructions without question than teachers who rank the skill development Objective A or the interpreting industry Objective C as number one.

The Indicated Encouragement of Creative and Non-Creative Behavior and Degree Held (Hypotheses 7 and 8)

Comparisons were made on both the creative and non-creative scales between teachers holding Bachelor's Degrees and those holding Master's Degrees.

Creative Scale. (Hypothesis 7) A combined median creative score of 110 was computed for the combined group of 186 industrial arts teachers holding Bachelor's or Master's Degrees. In Table 30 the number of these teachers who scored either above or at and below the combined medium on the creative scale is recorded.

TABLE 30

NUMBER OF TEACHERS HOLDING BACHELOR'S OR MASTER'S DEGREES SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE CREATIVE SCALE

Degree Held		At or Below $Mdn._c$ Score	Above $Mdn._c$ Score	Totals
Master's	(1)	41	46	87
Bachelor's	(2)	57	42	99
Totals		98	88	186

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. The value of Chi-square computed was 2.028. Since the computed value was less than the table value of 2.71 at the .05 level of significance, the null hypothesis was accepted and the alternate hypothesis H_1: $Mdn_1 > Mdn_2$ was rejected. It was concluded that the median creative score for industrial arts teachers holding Master's Degrees was not higher than the median creative score for teachers holding Bachelor's Degrees.

Individual items that constituted the creative scale were tested on the same variable. All items where the computed value of Chi-square exceeded the table value of 2.71 were listed in Table 31 and the direction of difference indicated.

TABLE 31

CREATIVE ITEMS WHERE ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN TEACHERS HOLDING BACHELOR'S OR MASTER'S DEGREES

Item No.	Chi-Square Value	Predicted Direction Master's > Bachelor's	Direction Not Predicted Master's < Bachelor's
3	3.442	x	
14	6.516	x	
21	3.168		x
25	3.544	x	
37	5.754	x	
44	3.696		x
48	3.528	x	

With the exception of items numbered 21 and 44 all items in Table 31 produced a significant value of Chi-square in the predicted direction. It was concluded that a significantly greater proportion of teachers holding Master's Degrees than teachers with Bachelor's Degrees indicated they encouraged students:

3. to reject a proven solution to a problem and take a chance that they will find another solution.
14. who always look for problems.
25. to question the obvious.
37. to meditate and mull over problems or possible solutions to problems.
48. to improvise if they do not have the correct tool for the job.

Non-Creative Scale.(Hypothsis 8) A combined median non-creative score of 43 was computed for the combined group of 186 industrial arts teachers holding Bachelor's or Master's Degrees. In Table 32 the number of these teachers who scored either above or at and below the combined median on the creative scale is recorded.

TABLE 32

NUMBER OF TEACHERS HOLDING BACHELOR'S OR MASTER'S DEGREES SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE NON-CREATIVE SCALE

Degree Held	At or Below $Mdn._{nc}$ Score	Above $Mdn._{nc}$ Score	Totals
Master's (1)	51	36	87
Bachelor's (2)	50	49	99
Totals	101	85	186

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. The value of Chi-square computed was 1.229. Since the computed value was less than the table value of 2.71 at the .05 level of significance, the null hypothesis was accepted and the alternate hypothesis H_1: $Mdn_1 < Mdn_2$ was rejected. It was concluded that the median non-creative score for industrial arts teachers holding Master's Degrees was not lower than the median non-creative score for teachers holding Bachelor's Degrees.

Individual items that constituted the non-creative scale were tested on the same variable. Inspection of the Chi-square values for individual items, revealed no items where there were significant differences between the proportion of teachers holding Master's Degrees who indicated they encouraged that particular behavioral statement and Bachelor's Degrees teachers.

The Indicated Encouragement of Creative and Non-Creative Behavior and Length of Teaching Experience (Hypotheses 9 and 10)

The length of teaching experience was dichotomized in three categories: (1) 1-6 years, (2) 7-15 years, and (3) 16 or more years. Comparisons were made on both the creative and non-creative scales between teachers in each of these categories.

Creative Scale. (Hypothesis 9) A combined median creative score of 110 was computed for the combined group of 183 industrial arts teachers with varying years of teaching experience. In Table 33 the number of teachers in different categories of experience who scored either above or at and below the combined median on the creative scale is recorded.

TABLE 33

NUMBER OF TEACHERS WITH 1-6, 7-15, AND 16 OR MORE YEARS TEACHING EXPERIENCE ABOVE OR BELOW THE COMBINED MEDIAN OF THE CREATIVE SCALE

Years Experience		At or Below $Mdn._c$ Score	Above $Mdn._c$ Score	Totals
1-6 years	(1)	52	54	106
7-15 years	(2)	27	22	49
16 plus years	(3)	19	9	28
Totals		98	85	183

The null hypothesis H_o: $Mdn._1 = Mdn_2 = Mdn_3$ was tested. Chi-square was computed and found to be 3.212. Since the computed value was less than the table value of 5.99 at the .05 level of significance, the null hypothesis was accepted and the alternate hypothesis H_1: $Mdn_1 \neq Mdn_2 \neq Mdn_3$ was rejected. It was concluded that there was no significant difference between the median creative scores of teachers with 1-6, 7-15, and 16 or more years teaching experience.

Individual items that constituted the creative scale were tested on the same variable. A two tail test of significance was employed since no specific direction of difference was hypothesized. Therefore, all items where the computed value of Chi-square exceeded the table value of 5.99 were listed in Table 34.

TABLE 34

CREATIVE ITEMS WHERE ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN TEACHERS WITH 1-6, 7-15, AND 16 OR MORE YEARS TEACHING EXPERIENCE

Item No.	Chi-Square Value	1-6 Years	7-15 Years	16+ Years
39	8.004	3	2	1[a]
42	7.707	2	1	3

[a]The numbers 1, 2, or 3 under the three teaching experience categories indicates the ranking position of each experience category with respect to encouragement of each item.

For item 39 it was concluded that a significantly greater proportion of teachers with 16 or more years experience indicated they encourage students to develop short cut methods of performing a technical operation than teachers with less than 16 years of experience. For item 42 it was concluded that a significantly greater proportion of teachers with 7 to 15 years experience indicated they encourage students to propose entirely new approaches to a problem than teachers with less than 7 or more than 15 years experience.

Non-Creative Scale. (Hypothesis 10) A combined median non-creative score of 43 was computed for the combined group of 183 industrial arts teachers with varying years of teaching experience. In Table 35 the number of teachers in different categories of experience who scored either above or at and below the combined median on the non-creative scale is recorded.

TABLE 35

NUMBER OF TEACHERS WITH 1-6, 7-15, AND 16 OR MORE YEARS TEACHING EXPERIENCE SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE NON-CREATIVE SCALE

Years Experience	At or Below $Mdn._{nc}$ Score	Above $Mdn._{nc}$ Score	Totals
1-6 years (1)	62	42	106
7-15 years (2)	24	25	49
16 plus years (3)	12	16	28
Totals	98	85	184

The null hypothesis H_o: $Mdn_1 = Mdn_2 = Mdn_3$ was tested. Chi-square was computed and found to be 2.739. Since the computed value was less than the table value of 5.99 at the .05 level of significance, the null hypothesis was accepted and the alternate hypothesis H_1: $Mdn_1 \neq Mdn_2 \neq Mdn_3$ was rejected. It was concluded that there was no significant difference between the median non-creative score of teachers with 1-6, 7-15, and 16 or more years teaching experience.

Individual items that constituted the non-creative scale were tested on the same variable. A two tail test of significance was used since no specific direction of difference was hypothesized. All items where the computed value of Chi-square exceeded the table value of 5.99 were listed in Table 36.

TABLE 36

NON-CREATIVE ITEMS WHERE ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN TEACHERS WITH 1-6, 7-15, AND 16 OR MORE YEARS TEACHING EXPERIENCE

Item No.	Chi-Square Value	1-6 Years	7-15 Years	16+ Years
12	7.338	2	3	1[a]
15	11.310	3	1	2
29	8.190	3	2	1
52	9.782	3	2	1
73	6.072	2	3	1

[a]The numbers 1, 2, or 3 under the three teaching experience categories indicates the ranking position of each experience category with respect to encouragement of each item.

For item number 15 it was concluded that a significantly greater proportion of teachers with 7-15 years of teaching experience indicated they encouraged students to rely upon the greater experience of others when confronted with a problem than teachers with less than 7 and more than 15 years experience. For the other four items it was concluded that a significantly greater proportion of teachers with 16 or more years experience than teachers with less experience indicated they encourage students to:

12. exercise caution in looking for problems, since more than enough will usually come up anyway.
29. stick to the tried and true way of doing things.
52. use existing designs and plans for proejcts.
73. accept their final solution to a problem as the best solution possible.

<u>The Indicated Encouragement of Creative or Non-Creative Behavior and Junior High School Multiple or Junior High School Limited Area Teaching</u> (Hypotheses 11 and 12)

By holding the level of teaching constant to the junior high school the relationship between multiple or limited area teaching and the indicated encouragement of creative or non-creative behavior was analyzed more completely on this level of teaching.

Creative Scale. (Hypothesis 11) A combined median creative score of 108 was computed for the combined groups of 69 junior high school multiple or limited area teachers of industrial arts. In Table 37 the number of these teachers who scored either above or at and below the combined median on the creative scale is recorded.

TABLE 37

NUMBER OF J.H.S. MULTIPLE OR LIMITED AREA TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE CREATIVE SCALE

Teaching Category		At or Below $Mdn._c$ Score	Above $Mdn._c$ Score	Totals
J.H.S. Multiple	(1)	19	27	46
J.H.S. Limited	(2)	16	7	23
Totals		35	34	69

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. Chi-square was computed and found to be 4.900. The null hypothesis was rejected since the computed value of Chi-square exceeded the table value of 2.71 at the .05 level of significance. The alternate hypothesis H_1: $Mdn_1 > Mdn_2$ was accepted since the difference was in the direction predicted. It was concluded that the median creative score for junior high school multiple area industrial arts teachers was significantly higher than the median creative score for junior high school limited area teachers.

Individual creative scale items were tested on the same variable. All items where the computed value of Chi-square exceeded the table value of 2.71 were listed in Table 38 and the direction of difference indicated.

TABLE 38

CREATIVE ITEMS WHERE INDICATED ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN J.H.S. MULTIPLE OR LIMITED AREA TEACHING

Item No.	Chi-Square Value	Predicted Direction J.H.S. Multi. $>$ J.H.S. Limited	Direction Not Predicted J.H.S. Multi. $<$ J.H.S. Limited
2	4.481	x	
4	5.741	x	
8	6.845	x	
11	4.600	x	
25	3.946	x	
42	3.526	x	
48	4.182	x	
51	2.772	x	
57	4.182	x	
58	4.394	x	
66	4.924	x	
68	4.246	x	
69	3.261	x	

All items in Table 38 produced a significant value of Chi-square in the predicted direction. It was concluded that a significantly higher proportion of junior high school multiple area teachers than junior high school limited area teachers indicated they encourage students:

2. to think of many ideas about how to get something done.
4. to sketch three or more tentative design ideas before making a specific project.
8. to explore and experiment with clever or uncommon project design ideas they have.
11. who approach a problem in a different way from the rest of the group or class.
25. to question the obvious.
42. to propose entirely new approaches to a problem.
48. to improvise if they do not have the correct tool for the job.
51. to suggest unusual or different combinations of materials.
57. to suggest alternate operational plans of procedure when planning a project.
58. to work with a material or engage in an activity where they have had little or no previous experience.
66. to suggest new ways of joining materials.
68. to suggest how a particular hand tool might be improved.
69. to try something which has not occurred to others to try.

Non-Creative Scale. (Hypothesis 12) A combined median non-creative score of 43 was computed for the combined group of 69 junior high school multiple or limited area teachers of industrial arts. In Table 39 the number of these teachers who scored either above or at and below the combined median on the non-creative scale is recorded.

TABLE 39

NUMBER OF J.H.S. MULTIPLE OR LIMITED AREA TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE NON-CREATIVE SCALE

Teaching Categories		At or Below $Mdn._{nc}$ Score	Above $Mdn._{nc}$ Score	Totals
J.H.S. Multiple	(1)	30	16	46
J.H.S. Limited	(2)	10	13	23
Totals		40	29	69

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. Chi-square was computed and found to be 2.974. The null hypothesis was rejected since the computed value of Chi-square exceeded the table value of 2.71 at the .05 level of significance. The alternate hypothesis H_1: $Mdn_1 < Mdn_2$ was accepted since the difference was in the direction predicted. It was concluded that the median non-creative score for junior high school multiple area industrial arts teachers was significantly lower than the median non-creative score for junior high school limited area teachers.

Individual non-creative scale items were tested on the same variable. Items numbered 22 and 41 produced a computed Chi-square value of 3.261 and 2.914 respectively. Each of these values exceeded the table value of 2.71 but only item 22 produced a difference in the predicted direction. It was concluded that a significantly smaller proportion of junior high school multiple area teachers indicated they encourage students to (22) accept the obvious answer than junior high school limited area teachers.

The Indicated Encouragement of Creative or Non-Creative Behavior and Senior High School Multiple or Senior High School Limited Area Teaching (Hypotheses 13 and 14)

With the level of teaching experience held constant at the senior high school level the relationship between multiple or limited area teaching and the indicated encouragement of creative or non-creative behavior was analyzed more completely for this level of teaching.

Creative Scale. (Hypothesis 13) A combined median creative score of 110 was computed for the combined group of 113 senior high school multiple or limited area teachers of industrial arts. In Table 40 the number of those teachers who scored either above or at and below the combined median on the creative scale is recorded.

TABLE 40

NUMBER OF S.H.S. MULTIPLE OR LIMITED AREA TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE CREATIVE SCALE

Teaching Category	At or Below $Mdn._c$ Score	Above $Mdn._c$ Score	Totals
S.H.S. Multiple (1)	19	20	39
S.H.S. Limited (2)	39	35	74
Totals	58	55	113

The null hypothesis H_0: $Mdn_1 = Mdn_2$ was tested. Chi-square was computed and found to be .162. The null hypothesis was accepted since the computed value of Chi-square was less than the table value of 2.71 at the .05 level of significance and the alternate hypothesis H_1: $Mdn_1 > Mdn_2$ was rejected. It was concluded that the median creative score for senior high school multiple area industrial arts teachers was not significantly higher than the median creative score for senior high school limited area teachers.

Individual creative scale items were tested on the same variable. All items where the computed value of Chi-square exceeded the table value of 2.71 were listed in Table 41 and the direction of difference indicated.

TABLE 41

CREATIVE ITEMS WHERE INDICATED ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN S.H.S. MULTIPLE AND LIMITED AREA TEACHING

Item No.	Chi-Square Value	Direction Predicted S.H.S. Multi. > S.H.S. Limited	Direction Not Predicted S.H.S. Multi. < S.H.S. Limited
11	3.954	x	
58	3.954	x	
71	4.493		x
72	2.918		x

Items 71 and 72 in Table 41 produced significant values of Chi-square but the difference was not in the direction predicted. Only items 11 and 58 fulfilled both requirements of value and direction. Therefore, it was concluded that a significantly higher proportion of senior high school multiple area teachers than senior high school limited area teachers indicated they encourage students: (11) who approach a problem in a different way from the rest of the group or class and (50) to work with a material or engage in an activity where they have had little or no previous experience.

Non-Creative Scale. (Hypothesis 14) A combined median non-creative score of 43 was computed for the combined group of 113 senior high school multiple or limited area industrial arts teachers. In Table 42 the number of these teachers who scored either above or at and below the combined median on the non-creative scale is recorded.

TABLE 42

NUMBER OF S.H.S. MULTIPLE OR LIMITED AREA TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE NON-CREATIVE SCALE

Teaching Category	At or Below $Mdn._{nc}$ Score	Above $Mdn._{nc}$ Score	Totals
S.H.S. Multiple (1)	25	14	39
S.H.S. Limited (2)	33	41	74
Totals	58	55	113

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. Chi-square was computed and found to be 3.891. The null hypothesis was rejected since the computed value of Chi-square exceeded the table value of 2.71 at the .05 level of significance. The alternate hypothesis H_1: $Mdn_1 < Mdn_2$ was accepted since the difference was in the direction predicted. It was concluded that the median non-creative score for senior high school multiple area industrial arts teachers was significantly lower than the median non-creative score for senior high school limited area teachers.

Individual non-creative scale items were tested on the same variable. Items numbered 12 and 29 produced computed Chi-square values of 3.490 and 2.918 respectively. Each of these values exceeded the table value of 2.71 and the difference was in the predicted direction. It was concluded that a significantly smaller proportion of senior high school multiple area teachers than senior high school limited area teachers indicated they encourage students to: (12) exercise caution in looking for problems, since more than enough will usually come up anyway and (29) stick to the tried and true way of doing things.

The Indicated Encouragement of Creative or Non-Creative Behavior and Junior High School Multiple or Senior High School Multiple Area Teaching (Hypotheses 15 and 16)

With the type of laboratory teaching held constant to multiple area teaching, the relationship between junior or senior high school level of teaching and the indicated encouragement of creative or non-creative behavior was analyzed more completely for this type of laboratory.

Creative Scale. (Hypothesis 15) A combined median creative score of 111 was computed for the combined group of 86 junior and senior high school multiple area industrial arts teachers. In Table 43 the number of these teachers who scored either above or at and below the combined median and the creative scale is recorded.

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. Chi-square was computed and found to be .422. The null hypothesis was accepted since the computed value of Chi-square was less than the table value of 2.71 at the .05 level of significance and the alternate hypothesis H_1: $Mdn_1 > Mdn_2$ was rejected. It was concluded that the median creative score for junior high school multiple area teachers was not significantly higher than the median creative score for senior high school multiple area teachers.

TABLE 43

NUMBER OF JUNIOR OR SENIOR HIGH SCHOOL MULTIPLE AREA TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE CREATIVE SCALE

Teaching Category	At or Below $Mdn._c$ Score	Above $Mdn._c$ Score	Totals
J.H.S. Multiple (1)	22	25	47
S.H.S. Multiple (2)	21	18	39
Totals	43	43	86

Individual creative scale items were tested on the same variable. Items numbered 4, 39, and 49 produced a computed Chi-square value of 9.079, 3.607, and 4.970 respectively. Each of these values exceeded the table value of 2.71 but only in item 4 was the difference in the same direction as predicted. Therefore, it was concluded that a significantly greater proportion of junior high school multiple area teachers indicated they encourage students to (4) sketch three or more tentative design ideas before making a specific project, than senior high school multiple area teachers.

Non-Creative Scale. (Hypothesis 16) A combined median non-creative score of 42 was computed for the combined group of 86 junior and senior high school multiple area industrial arts teachers. In Table 44 the number of these teachers who scored either above or at and below the combined median on the creative scale is recorded.

TABLE 44

NUMBER OF JUNIOR OR SENIOR HIGH SCHOOL MULTIPLE AREA TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE NON-CREATIVE SCALE

Teaching Category	At or Below $Mdn._{nc}$ Score	Above $Mdn._{nc}$ Score	Totals
J.H.S. Multiple (1)	25	22	47
S.H.S. Multiple (2)	20	19	39
Totals	45	41	86

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. Chi-square was computed and found to be .031. The null hypothesis was accepted since the computed value of Chi-square was less than the table value of 2.71 at the .05 level of significance and the alternate hypothesis H_1: $Mdn_1 < Mdn_2$ was rejected. It was concluded that the median non-creative score for junior high school multiple area teachers was not significantly lower than the median non-creative score for senior high school multiple area teachers.

Individual non-creative scale items were tested on the same variable. Only item 35 produced a value of Chi-square which exceeded the table value of 2.71. The computed value for item 35 was 3.073 and the difference was in the predicted direction. Therefore, it was concluded that a significantly smaller proportion of junior high school multiple area teachers indicated they encourage students to (35) proceed first with the initial solution to a problem when another becomes evident during the process, than senior high school multiple area teachers.

The Indicated Encouragement of Creative or Non-Creative Behavior and Junior High School Limited or Senior High School Limited Area Teaching (Hypotheses 17 and 18)

With the type of laboratory teaching held constant to limited area teaching, the relationship between junior or senior high school level of teaching and the indicated encouragement of creative or non-creative behavior was analyzed more completely for this type of laboratory.

Creative Scale. (Hypothesis 17) A combined median creative score of 109 was computed for the combined group of 97 junior and senior high school limited area industrial arts teachers. In Table 45 the number of these teachers who scored either above or at and below the combined median on the creative scale is recorded.

TABLE 45

NUMBER OF JUNIOR OR SENIOR HIGH SCHOOL LIMITED AREA TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE CREATIVE SCALE

Teaching Category	At or Below Mdn. $_c$ Score	Above Mdn.$_c$ Score	Totals
J.H.S. Limited (1)	16	7	23
S.H.S. Limited (2)	33	41	74
Totals	49	48	97

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. Chi-square was computed and found to be 4.377. The null hypothesis was rejected since the computed value of Chi-square exceeded the table value of 2.70 at the .05 level of significance. The alternate hypothesis H1: $Mdn_1 > Mdn_2$ was also rejected since inspection of Table 45 revealed that Mdn_1 was not greater than Mdn_2 but actually less than Mdn_2. Since the computed value of Chi-square also exceeded the table value of 3.84 at the .05 level of significance for a two-tail test, it was concluded that the median creative score for junior high school limited area teachers was significantly lower than the median creative score for senior high school limited area teachers.

Individual creative scale items were tested on the same variable. All items where the computed value of Chi-square exceeded the table value of 2.71 were listed in Table 46 and the direction of difference indicated.

TABLE 46

CREATIVE ITEMS WHERE INDICATED ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN J.H.S. AND S.H.S. LIMITED AREA TEACHERS

Item No.	Chi-Square Value	Direction Predicted J.H.S. Limited > S.H.S. Limited	Direction Not Predicted J.H.S. Limited < S.H.S. Limited
8	3.342		x
23	3.342	x	
25	3.714		x
48	7.845		x
49	3.439		x

Only item 23 in Table 46 produced a significant value of Chi-square in the direction predicted. Differences onall the other items were in the opposite direction from what was predicted. It was concluded that a significantly higher proportion of junior high school limited area teachers indicated they encourage students who (23) make more suggestions than they can immediately use, than senior high school limited area teachers.

Non-Creative Scale. (Hypothesis 18)

A combined median non-creative score of 44 was computed for the combined group of 97 junior and senior high school limited area industrial arts teachers. In Table 47 the number of these teachers who scored either above or at and below the combined median on the creative scale is recorded.

TABLE 47

NUMBER OF JUNIOR OR SENIOR HIGH SCHOOL LIMITED AREA TEACHERS SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE NON-CREATIVE SCALE

Teaching Category	At or Below $Mdn._{nc}$ Score	Above $Mdn._{nc}$ Score	Totals
J.H.S. Limited (1)	11	12	23
S.H.S. Limited (2)	40	34	74
Totals	50	46	97

The null hypothesis H_o: $Mdn_1 = Mdn_2$ was tested. Chi-square was computed and found to be .273. The null hypothesis was accepted since the computed value of Chi-square was less than the table value of 2.71 at the .05 level of significance and the alternate hypothesis H_1: $Mdn_1 < Mdn_2$ rejected. It was concluded that the median non-creative score for junior high school limited area teachers was not significantly lower than the median non-creative score for senior high school limited area teachers.

Individual non-creative scale items were tested on the same variable. Items numbered 12, 15, and 41 produced computed Chi-square values of 5.778, 3.638, and 3.791 respectively. Each of these values exceeded the table value of 2.71 and the difference was in the predicted direction. It was concluded that a significantly smaller proportion of junior high school limited area teachers than senior high school limited area teachers indicated they encourage students to:

12. exercise caution in looking for problems, since more than enough will usually come up anyway.
15. rely upon the greater experience of others when confronted with a problem.
41. express only sensible ideas.

VI. NON-HYPOTHESIZED RELATIONSHIPS BETWEEN THE INDICATED ENCOURAGEMENT OF CREATIVE OR NON-CREATIVE BEHAVIOR BY VARIOUS CATEGORIES OF INDUSTRIAL ARTS TEACHERS

In addition to the hypothesized differences that were tested in the previous section, several other factors where possible relationships might be found between these factors and the indicated encouragement of creative or non-creative behavior were also analyzed.

The Indicated Encouragement of Creative or Non-Creative Behavior and Signature of the Questionnaire

The questionnaire sent to all respondents was not visibly coded or marked in any way that would normally be apparent to the respondent. Provision was made for individuals to sign the return but this was plainly marked as optional. Of the 186 returns analyzed 125 respondents signed their questionnaires and 61 preferred to not identify themselves. The analysis made of this factor and the relationships between it and indicated encouragement of creative or non-creative behavior was carried out in the same way as the hypotheses were tested.

Creative Scale. A combined median creative score of 110 was computed for the combined group of 186 industrial arts teachers who either signed or did not sign their questionnaire. In Table 48 the number of these teachers who scored either above or at and below the combined median on the creative scale is recorded.

TABLE 48

NUMBER OF TEACHERS SIGNING OR NOT SIGNING THE QUESTIONNAIRE SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE CREATIVE SCALE

Signed or Not Signed		At or Below $Mdn._c$ Score	Above $Mdn._c$ Score	Totals
Did not sign	(1)	42	19	61
Did sign	(2)	56	69	125
Totals		98	88	186

Chi-square was computed and found to be 9.514 according to the table of Chi-square values for a two-tail test with one degree of freedom, the probability of obtaining a value this large by chance was less than .01 but greater than the .001 levels of significance. From a review of the frequencies in Table 48 it was concluded that the median creative score was significantly higher for industrial arts teachers who signed their questionnaires than teachers who did not sign their questionnaires.

Individual creative items were tested on the same variable. All items where the computed value of Chi-square exceeded the table value of 3.84 for the .05 level of significance for a two-tail test with one degree of freedom were listed in Table 49 and the direction of difference indicated.

All items in Table 49 produced a significant value of Chi-square in the same direction. It was concluded that a significantly greater proportion of industrial arts teachers who signed their questionnaire than teachers who did not sign their questionnaire indicated they encourage students:

TABLE 49

CREATIVE ITEMS WHERE INDICATED ENCOURAGEMENT DIFFERED SIGNIFICANTLY BETWEEN TEACHERS WHO SIGNED OR DID NOT SIGN THEIR QUESTIONNAIRES

Item No.	Chi-Square Value	Direction Signed > Not Signed	Direction Signed < Not Given
2	4.804	x	
3	5.667	x	
4	9.514	x	
8	8.396	x	
14	3.845	x	
18	6.791	x	
19	5.817	x	
34	7.247	x	
37	6.592	x	
39	4.156	x	
69	10.832	x	

2. to think of many ideas about how to get something done.
3. to reject a proven solution to a problem and take a chance that they will find another solution.
4. to sketch three or more tentative design ideas before making a specific project.
8. to explore and experiment with clever or uncommon project design ideas they have.
14. who always look for problems.
18. to explore several possible courses of action before selecting the most effective.
19. to try out a wild or silly idea.
34. who suggest a radical idea or solution to a problem.
37. to meditate and mull over problems or possible solutions to problems.
39. to develop short cut methods of performing a technical operation.
69. to try something which has not occurred to others to try.

<u>Non-Creative Scale.</u> A combined median non-creative score of 43 was computed for the combined group of 186 industrial arts teachers who either signed or did not sign their questionnaire. In Table 50 the number of these teachers who scored either above or at and below the combined median on the non-creative scale is recorded.

TABLE 50

NUMBER OF TEACHERS SIGNING OR NOT SIGNING THE QUESTIONNAIRE SCORING ABOVE OR BELOW THE COMBINED MEDIAN OF THE NON-CREATIVE SCALE

Signed or Not Signed	At or Below $Mdn._{nc}$ Score	Above $Mdn._{nc}$ Score	Totals
Not signed	26	35	61
Signed	75	50	125
Totals	101	85	186

Chi-square was computed and found to be 4.988. According to the table of Chi-square values, for a two-tail test with one degree of freedom, the probability of obtaining a value this large by chance was less than .05 but greater than the .02 level of significance. By inspection of the frequencies in the individual cells it was concluded that the median non-creative score was significantly higher for industrial arts teachers who did not sign their questionnaires than teachers who signed their questionnaires.

Individual non-creative items were tested on the same variable. Only item number 55 which produced a computed value of 7.101 exceeded the table value of 3.84 for a two-tail test with one degree of freedom. It was concluded that a significantly greater proportion of industrial arts teachers who did not sign their questionnaires indicated they encourage students to (55) outline a plan of procedure for making a project and not deviate from it, than teachers who signed their questionnaires.

VII. INDICATED INDUSTRIAL ARTS OBJECTIVE EMPHASIS AND INSTITUTIONS GRATING BACHELORS DEGREES

Respondents to the inventory were asked to rank three objective statements according to the degree of emphasis given each in their industrial arts classes. Complete objective statements were given on pages 127-129 and are categorized as objectives (A) skill development, (B) self-realization and (C) interpreting industry. The rank given to these objectives would be determined largely by the individual teacher's philosophy or belief about the primary purpose of industrial arts. If it is assumed that the teacher's belief or philosophy of industrial arts is primarily developed during their undergraduate preparation, then the relationship between the undergraduate bachelors degree granting institution and the objectives ranked number one should be investigated.

In Table 51 the number one objective choice for 172 teachers is summarized according to the eight industrial arts bachelors degree granting institutions in Michigan and a composite grouping of all out-of-state institutions.

The skill development objective (A) was ranked number one by 67 or 38 percent of the 172 teachers who ranked these objectives. The self-realization objective (B) was ranked first by 87 or 50.6 percent while 18 or 10.5 percent of the total group chose the interpreting industry objective (C) as number one.

Because of the small number of teachers in the sample from Ferris Institute and the University of Michigan these two institutions were excluded from the following analysis made between institutions and the objective ranked number one.

TABLE 51

NUMBER AND PERCENT OF TEACHERS RANKING: (A) SKILL DEVELOPMENT, (B) SELF-REALIZATION OR (C) INTERPRETING INDUSTRY OBJECTIVES NUMBER ONE AND THEIR BACHELORS DEGREE GRANTING INSTITUTION

Bachelors Degree	Obj. A		Obj. B		Obj. C		Total
Institution	Freq.	%	Freq.	%	Freq.	%	Cum. Freq.
Central Mich. Univ.	10	45.5	10	45.5	2	9.1	22
Eastern Mich. Univ.	11	50.0	9	40.9	2	9.1	22
Ferris Institute	0	0.0	0	0.0	0	0.0	0
Michigan State Univ.	8	32.0	13	52.0	4	16.0	25
Northern Mich. Univ.	6	37.5	6	37.5	4	25.0	16
Univ. of Michigan	0	0.0	0	0.0	0	0.0	0
Wayne State Univ.	10	43.5	10	43.5	3	13.0	23
Western Mich. Univ.	17	48.6	17	48.6	1	2.9	35
Out-of-State	5	20.0	18	72.0	2	8.0	25
Totals	67	38.9	87	50.6	18	10.5	172

The two institutions with the highest percentage of graduates ranking the skill development Objective A as number one were Eastern Michigan University with 50 percent and Western Michigan University with 48.6 percent. The lowest percentage of graduates ranking this same objective number one were those from out-of-state institutions 20 percent and Michigan State University 32 percent.

The highest percentages of graduates who ranked the self-realization Objective B as number one received their degree from out-of-state institutions or Michigan State University. Percentages of 72 and 52 respectively were identified for these two categories. The lowest percentage of graduates ranking this same objective number one were those from Northern Michigan University, 37.5 percent, and Eastern Michigan University, 40.9 percent.

Because of the small total number of teachers (18) who ranked the interpreting industry Objective C as number one, the identification of high and low percentage groupings according to individual institutions would be meaningless.

VIII. SUMMARY

The statistical analysis was conducted on 236 usable responses from the original sample of 297 Michigan industrial arts teachers. Inter-item correlations were computed between all seventy-four inventory items and the total creative and non-creative scales. Position significant correlations were found between each individual creative behavioral item and the entire forty creative scale items. Negative or low non-significant positive correlations were found between these same items and the entire non-creative scale. Positive significant correlations were found between nineteen of the twenty individual non-creative behavioral items and the entire non-creative scale. Negative or low non-significant positive correlations were found between these same items and the entire creative scale. From this analysis, it was concluded that the creative and non-creative scales were internally consistent to the degree that hypothesized differences were tested on each scale.

Inter-item correlations between individual items assigned to the factors of fluency, originality and problem sensitivity were generally higher than between other items and thus supported their factor assignment. The individual items assigned to the factor of flexibility were least internally consistent.

Reliability coefficients of r_{tt} = .90 for the creative scale and r_{tt} = .74 for the non-creative scale were computed using Hoyt's analysis of variance technique for unrestricted scoring methods and provided another measure of internal consistency.

Hypothesized relationships between the indicated encouragement of creative or non-creative behavior and various categorized groupings of industrial arts teachers were tested. Hypothesized differences between these sub-groupings of teachers and their scores on the entire scales of creative and non-creative items were tested with the Chi-square median test of significance. Individual items which constituted these same scales were also tested for the same hypothesized difference. Responses for each item were dichotomized as encouraging the item or not encouraging the item and hypothesized differences were tested with a Chi-square contingency table test of significance. The .05 level of significance was used for all tests of significance.

In Table 52 a summary of the hypotheses and the decision of acceptance or rejection is indicated.

Significant differences were found for six of the eighteen hypothesized sub-groups between the median creative or non-creative scores. Creative scale null hypotheses 3 and 11 and non-creative scale null hypotheses 4, 6, 12 and 14 were all rejected and the alternate hypotheses accepted as summarized in Table 52.

Significant non-hypothesized differences were found between the indicated encouragement of creative or non-creative behavior and whether

TABLE 52

A SUMMARY OF HYPOTHESIZED DIFFERENCES BETWEEN SUB-GROUPS AND RESULTS

Hypothesis Number	Hypothesized Sub-Group Differences Between Median Scores	Creative Scale X^2 Value and Decision. Predicted direction > Hyp.1,3,5,7,9,11,13,15,17	Significant Creative Scale Items .05 Level	Non-Creative Scale. X^2 Value and Decision. Predicted direction < Hyp.2,4,6,8,10,12,14,16,18	Significant Non-Creative Scale Items .05 Level
1, 2	Mdn. J.H.S.* > Mdn. S.H.S.	.103 < Reject	4	1.391 < Reject	12,15,35,73
3, 4	Mdn. Multi-Area > Mdn. Limited Area	2.800 > <u>Accept</u>	11,37,42,51, 57,58,63,66, 69,71	7.932 < <u>Accept</u>	12,29,74
5, 6	Mdn. Obj. B > Mdn. Obj. A or C	1.160 > Reject	48,57	3.288 < <u>Accept</u>	22,70,74
7, 8	Mdn. Masters D. > Mdn. Bachelors D.	2.028 > Reject	3,14,21,25, 37,44,48	1.229 < Reject	None
9,10	Mdn. 1-6 yrs. ≠ Mdn. 7-15 yrs. ≠ Mdn. 16 or more yrs. experience	3.312 <> Reject	39,42	2.739 <> Reject	12,15,29,52,73
11,12	Mdn. J.H.S. Multi > Mdn. J.H.S. Lim.	4.900 > <u>Accept</u>	2,4,8,11,25, 42,48,51,57, 58,66,68,69	2.974 < <u>Accept</u>	22,41
13,14	Mdn. S.H.S. Multi > Mdn. S.H.S. Lim.	.162 > Reject	11,58	3.891 < <u>Accept</u>	12,29
15,16	Mdn. J.H.S. Multi > Mdn. S.H.S. Multi.	.422 > Reject	4,39,49	.031 < Reject	35
17,18	Mdn. J.H.S. Lim. > Mdn. S.H.S. Lim.	4.377 < Reject	23	.273 > Reject	12,15,41

*The direction indicated in this column represents the hypothesized direction for all creative scale hypotheses which are the odd-numbered hypotheses. The opposite direction was hypothesized for all non-creative scale or even numbered hypotheses.

the respondents signed or did not sign the questionnaire. While a signature on the questionnaire was optional, a significantly higher proportion of teachers who signed the questionnaire scored above the median score on the creative scale than those who did not sign the questionnaire. The value of Chi-square computed was 9.154 which exceeded the .01 level of significance. The inverse relationship was found on the non-creative scale. A significantly greater proportion of teachers who did not sign the questionnaire scored above the median score on the non-creative scale than those who signed the questionnaire. The value of Chi-square computed was 4.988 which exceeded the .02 level of significance.

Analysis of the emphasis given to various industrial arts objectives by graduates of various Michigan and out-of-state bachelor degree granting institutions indicated that a higher percentage of Eastern Michigan and Western Michigan Universities graduates emphasize the skill development (A) objective than the graduates of other state institutions. The self-realization objective (B) was emphasized by a higher percentage of teachers who received their bachelors degree at out-of-state institutions and Michigan State University than graduates of other state institutions. Because of the small number of individuals who ranked the interpreting industry objective (C) as number one, no analysis was made of this objective.

In Chapter VI, a summary of the entire study is presented and appropriate conclusions and recommendations for further study made.

IX. BIBLIOGRAPHY

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CHAPTER VI

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY

The problem investigated in this study was to define operationally the nature of creative or non-creative behavior in the field of industrial arts and to determine the extent industrial arts teachers in Michigan indicate they encourage their students to exhibit creative behavior in their classrooms.

The following two assumptions were made: the abilities involved in being creative are universal and can be developed through the educative process, and creativity is not limited to one or several fields of endeavor.

It was hypothesized that many industrial arts teachers would indicate encouragement of creative behavior, but that differences would be found between their indicated encouragement of creative behavior and such variables as: junior or senior high school teaching, multiple or limited area laboratory teaching, belief in the primary objective or purpose of industrial arts, educational background, teaching experience, and interrelationships between these variables.

A review of the literature revealed approaches to creativity from the product, process, individual and environment points of view.

Definitions of creativity often reflect one or the other of these approaches. Creativity in industrial arts was described as existing when students organize their past experiences in such a way that they achieve an unusual and useful solution to a problem. The view that these are levels or degrees of creativity provided a compromise position between the belief that only a select few are really creative and the view that everyone is creative.

Factor analysis studies by Guilford and others have consistently identified the factors of fluency, flexibility, problem sensitivity and originality. Other researchers using personality assessment techniques have identified personality and motivational characteristics of the creative individual. While many tests of creativity and inventories of non-aptitude traits of creativity have been developed, the test batteries developed by Guilford are among the more widely used or adapted tests of creativity.

Studies by Sommers and Anderson in the field of industrial arts have supported the belief that creative abilities can be developed through planned instructional activities in regular subject matter courses.

A general review of the literature on creativity revealed five major areas that provided guidelines for developing an operational definition of creativity in the field of industrial arts. Four of these areas consisted of the intellectual factors or attributes of creativity identified by Guilford and Lowenfeld as fluency, flexibility, originality and problem sensitivity. The fifth was composed of non-aptitude traits such as personality and motivational characteristics related to creativity. Research findings in each of these areas were presented and specific implications for industrial arts drawn. Related to each of the five areas, creative and non-creative behavioral statements were developed and when combined, formed the initial operational definition of creativity in industrial arts.

Major hypothesized effects were that: junior high school teachers, multiple area teachers, teachers with masters degrees and teachers who selected the objective of self-realization (B) would have a higher median score on the creative scale of the inventory than high school teachers, limited area teachers, teachers with bachelors degrees and teachers who selected the skill development (A) and interpretation of industry (C) objective. The reverse was hypothesized for the non-creative scale. The same effects were hypothesized for individual items that constituted the two scales.

As a result of the evaluation by six judges of the initial pool of creative and non-creative behavioral items and a pilot study, the final inventory was composed of forty creative items, twenty non-creative items, twelve items related to one of the three objective scales and two check items for a total of seventy-four items.

The questionnaire inventory was administered to a random sample of 297 junior or senior high school industrial arts teachers in the State of Michigan. Usable returns were received from 236 or 80 percent of the total sample.

Significant positive correlations ranging from .29 to .63 were found between each individual creative behavioral item and the entire forty creative scale items. Negative or low non-significant positive correlations were found between these same items and the entire non-creative scale. Significant positive correlations, ranging from .21 to .57 were found between nineteen of the twenty individual non-creative items and the entire non-creative scale.

A creative scale reliability coefficient of r_{tt} = .90 and a non-creative scale reliability coefficient of r_{tt} = .74 were computed using Hoyt's analysis of variance technique for unrestricted scoring methods.

Significant differences were found for six of the eighteen hypothesized sub-group differences between the median creative or non-creative scores. Creative scale null hypotheses 3 and 11, listed below, were rejected and the alternate hypotheses accepted.

Hyp. 3. H_o: Median creative score for multiple area industrial arts teachers = median creative score for limited area teachers. (Rejected)

H_1: Median creative score for multiple area industrial arts teachers > median creative score for limited area teachers. (Accepted)

Hyp. 11. H_o: Median creative score for junior high school multiple area industrial arts teachers = median creative score for junior high school limited area teachers. (Rejected)

H_1: Median creative score for junior high school multiple area industrial arts teachers > median creative score for junior high school limited area teachers. (Accepted)

The following non-creative scale null hypotheses were rejected and the alternate hypothesis accepted.

Hyp. 4. H_o: Median non-creative score for multiple area industrial arts teachers = median non-creative score for limited area teachers. (Rejected)

H_1: Median non-creative score for multiple area industrial arts teachers < median non-creative score for limited area teachers. (Accepted)

Hyp. 6. H_o Median creative score for industrial arts teachers who rank self-realization objective (B) number one = median non-creative score for teachers who rank skill development objective (A) or interpreting industry objective (C) as number one. (Rejected)

H_1: Median non-creative score for industrial arts teachers who rank self-realization objective (B) number one $<$ median non-creative score for teachers who rank skill development objective (A) or interpreting industry objective (C) as number one. (Accepted)

Hyp.12. H_o: Median non-creative score for junior high school multiple area industrial arts teachers = median non-creative score for junior high school limited area teachers. (Rejected)

H_1: Median non-creative score for junior high school multiple area industrial arts teachers $<$ median non-creative score for junior high school limited area teachers. (Accepted)

Hyp.14. H_o: Median non-creative score for senior high school multiple area industrial arts teachers = median non-creative score for senior high school limited area teachers. (Rejected)

H_1: Median non-creative score forsenior high school multiple area industrial arts teachers $<$ median non-creative score for senior high school limited area teachers. (Accepted)

Non-hypothesized differences were found between respondents who signed their questionnaires and those who did not. A significantly greater proportion of teachers who signed the questionnaire scored above the median on the creative scale than those who did not. The opposite effect was found on the non-creative scale.

II. CONCLUSIONS

The findings and analysis of the data supported the following conclusions. However, these conclusions only apply to industrial arts teachers in Michigan who teach in school districts that have separate junior and senior high school facilities. No attempt should be made to generalize beyond this population.

1. Teachers who teach in multiple area laboratories indicate a greater encouragement of creative behavior and less encouragement of non-creative behavior than teachers who teach in limited area or unit shop laboratories.
2. Junior high school teachers who teach in multiple area laboratories indicate a greater encouragement of creative behavior and less encouragement of non-creative behavior than junior high school teachers who teach in limited area or unit shop laboratories.
3. Teachers who identified themselves by signing the questionnaire indicated a greater encouragement of creative behavior and less encouragement of non-creative behavior than teachers who did not sign the questionnaire.
4. Senior high school teachers who teach in limited area or unit shop laboratories indicate a greater encouragement of non-creative behavior than senior high school multiple area teachers.
5. Teachers who indicated they emphasize skill development or interpreting industry objectives of industrial arts also indicate greater encouragement of non-creative behavior than teachers who indicated they emphasize a self-realization objective of industrial arts.
6. Teaching at the junior or senior high school level has no effect on indicated encouragement of creative or non-creative behavior.
7. Differences in educational experience as characterized by bachelors degree or masters degree teachers has no effect

on indicated encouragement of creative or non-creative behavior.

8. Differences in number of years of teaching experience has no effect on indicated encouragement of creative or non-creative behavior.

9. Creative and non-creative behavior in industrial arts can be described by the forty creative and twenty non-creative behavioral items on the inventory used in this study.

It was concluded that creativity in industrial arts can be operationally defined and that industrial arts teachers in Michigan differ significantly in their indicated encouragement of creative behavior in accordance with multiple area or general shop teaching and limited area or unit shop teaching.

III. IMPLICATIONS AND RECOMMENDATIONS

It appears that the effect of the environment, as described by multiple and limited area laboratories, influenced the indicated encouragement of creative or non-creative behavior more than any other variable tested in this study. At the junior high school level indicated encouragement of both creative and non-creative behavior appears to be equally influenced by these different environmental conditions. On the other hand, at the senior high school level these environmental conditions were more influential on indicated encouragement of non-creative behavior than creative behavior. Environmental effects also partially explain the lack of influence of the grade level of teaching and in the case of the creative scale the reverse of the predicted effect. As shown by the test of hypotheses 17 and 18, limited area laboratories at the junior high school level tend to reduce indicated encouragement of creative behavior and increase indicated encouragement of non-creative behavior more than at the senior high school level.

Therefore, if creative behavior is to be effectively encouraged in industrial arts classes it would appear that the learning environment should be characterized by a wide range of experience areas or as described in this study, the multiple area laboratory. It would also appear to be more important at the junior high school level than the senior high school level of teaching, since the limited area laboratory tends to be more restrictive on indicated encouragement of creativity at the junior high school level even though the primary purpose is exploratory at this grade level.

As a result of this study the writer visualizes several other implications for the field of industrial arts.

In order to assist in the development of the creative abilities of students, teachers must become more familiar with the nature of creative behavior so they can develop instructional activities that will permit and encourage this type of behavior. This suggests that teacher education should play a major role of leadership in the development of a greater understanding and appreciation of creativity.

Institutions that prepare industrial arts teachers should examine their programs of preparation to determine the extent curricular experiences either inhibit or promote an understanding and sensitivity of the nature of creativity in industrial arts and its importance at all levels of education. Undergraduate programs of preparation should provide experiences for all students with creative learning activities.

and the effects of different environmental conditions on creativity. Specific attention should be directed to: the desired behavioral outcomes related to an objective of creativity, the development of instructional activities that will permit and foster this type of behavior, and the evaluation of changed behavior.

Through in-service educational programs, teachers in the field can become aware and develop an understanding of creativity and the implications for the field of industrial arts and their specific teaching situation. Equally challenging to the field of teacher education should be the opportunity to extend knowledge in this area through demonstration projects, continued research and experimentation, publication, and assistance to individual school districts where requested.

Other agencies such as state departments of education and individual school districts that produce curriculum guides or courses of study in which minimum standards of industrial arts content and instructional activities are prescribed should examine the extent to which these standards permit flexibility and latitude for the development of the students creative abilities.

Producers of project materials should exercise care when producing these materials so as to insure the opportunity for students to express themselves in a creative manner when making a project. Instead of identifying a specific project with all the construction details worked out it is suggested that perhaps the problem or product design approach be utilized. Problem statements and design ideas could be developed that would permit and promote fluent, flexible and original thinking on the part of each student instead of a follow the plan exactly, type of approach.

Another suggestion relates to project contests and displays. Criteria for evaluating and judging projects should include some means for recognizing creative ideas and solutions. Special categories should be developed for creative and experimental projects that do not fit many of the narrowly defined existing categories.

Study results have suggested a number of possibilities for further research. Specifically, further study and research is suggested on refinement and validation of the creative and non-creative scales that were developed. While the scales appear to have a high degree of internal consistency, evidence presented suggests some clustering of items related to the factors or attributes of creativity identified as fluency, flexibility, problem sensitivity and originality. Further item and factor analysis might support the existence of these same factors and identify other factors or clusters of items. Various sub-scales could then be developed and tested.

Replication of the quesionnaire aspect of this study should be carried out with other samples representative of broader populations of industrial arts teachers. Teachers teaching in smaller school districts and at both the junior and senior high school levels should be included and comparisons made with categories used in this investigation.

This study produced some evidence of the relationship between role or objective of industrial arts orientation of the teacher and the indicated encouragement of creative or non-creative behavior. More direct evidence of this relationship was found on the non-creative scale. A more accurate measure of the primary objective or purpose of industrial arts orientation should be used and perhaps extended to include philosophical orientation. Robert Swanson's "Inventory of Viewpoints on Education"

(1:177-180) might be appropriate to use in conjunction with the inventory developed in this study.

A detailed item analysis should be carried out on the items that were developed and related to the three statements of industrial arts objectives found in Part III of the questionnaire and the items constituting the creative and non-creative scales.

The findings indicated that variables of teaching level (senior high school or junior high school) and educational experience (bachelors or masters degrees) were not significantly related to indicated encouragement of creative or non-creative behavior. However, since differences found within these variables were generally in the predicted direction, but not of sufficient magnitude to be significant, further investigation is recommended. On the variable of teaching experience, no direction was predicted. Results while not significant showed that teachers with less than seven years of teaching experience tend to indicate greater encouragement of non-creative behavioral items than teachers with seven or more years teaching experience. Further invetigation of this and other variables such as: occupational involvement, self-concept, area of greatest technical specialization and degree-granting institution is recommended.

The significant relationship between signing the questionnaire and indicated encouragement of creative behavior and not signing and indicated encouragement of non-creative behavior should be investigated more extensively; because, perhaps the individuals who signed the questionnaire may have responded in a manner that they percieved would be more acceptable to teacher educators but not necessarily representative of their true beliefs.

Perhaps the most significant recommendation would be to develop studies to determine if teachers who indicated they encourage creative or non-creative behavior actually do encourage students to behave in the manner described.

As with most studies, more questions and problems remain to be answered than those clarified by this study. Hopefully,continued effort can be directed toward extending our knowledge in this important area of educational research.

IV. BIBLIOGRAPHY

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APPENDICES

APPENDIX A

A THEORETICAL MODEL FOR IDENTIFYING THE RELATIVE CREATIVE ABILITIES OF INDUSTRIAL ARTS STUDENTS

A THEORETICAL MODEL FOR IDENTIFYING THE RELATIVE CREATIVE ABILITIES OF INDUSTRIAL ARTS STUDENTS

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When a student organizes his past experience in such a manner as to reach an unusual and useful solution to a perceived problem, he has formulated a creative idea. When the idea is expressed in an observable, overt form, he has developed a creative product. A student's creative ability is evidenced by a) the relative degree of unusualness and usefulness of each of his products, and b) the total number of his creative products.

The following material elaborates upon this general definition and provides guidelines for identifying and rating the creative abilities of industrial arts students.

I. *Identifying and Rating a Creative Product*

A. *Product.* An idea or combination of ideas expressed or manifested in any overt, observable form as a solution to a non-factual type problem is a product. Products may take many forms in the industrial arts, such as verbal (oral and written) communications, physical acts, two-dimensional representations, and three-dimensional objects.

B. *Unusualness.* To be creative a product must possess some degree of unusualness. The quality of unusualness may, theoretically, be measured in terms of probability of occurrence; the less the probability of its occurrence, the more unusual the product. The specific probability of occurrence of a particular student's product must be based on the actual or anticipated varieties of products of a peer group having similar experiential background. Thus, to rate the degree of unusualness of a student's product, it is theoretically necessary to a) be familiar with the frequency of occurrence of varieties of peer products, b) to select some probability level to represent the norm for "common" products, and c) to possess means for translating probability deviations from the norm into ratings of unusualness.

C. *Usefulness.* While some degree of unusualness is a necessary requirement for creative products, it is not a sufficient condition. To be creative, an industrial arts student's product must also satisfy the minimal principal requirements of the problem situation; to some degree it must "work" or be potentially "workable." Completely ineffective, irrelevant solutions to teacher-imposed or student-initiated problems are not creative.

Like the quality of unusualness, usefulness is also relative. It is theoretically possible to establish a scale of product usefulness ranging from complete inadequacy to fulfill any of the requirements of the problem situation to products which far exceed the safety, economic, aesthetic, functional and other requisites of an acceptable solution. For example, one point on such a scale might represent the value of the commonly advocated classroom/laboratory practice or the "typical" teacher solution. Care must be taken in evaluating each product to distinguish between the usefulness of the idea inherent in the product and the quality of the manipulative or verbal skill evidenced in expressing the idea as a product; it is the former characteristic that must be rated and not the latter. Identification of the problem, awareness of the actual or potential value of the product-solution, and familiarity with the usefulness of the standard solution are therefore prerequisite to rating the usefulness of a specific student product.

D. *Combining Unusualness and Usefulness.* When a product possesses some degree of both unusualness and usefulness it is creative. But because these two criterion qualities are considered variables, the degree of creativity among products will also vary. The extent of each product's departure from the typical and its value as a problem solution will, in combination, determine the degree of creativity of each product. Giving the two qualities equal weight, as the unusualness and/or usefulness of a product increases so does its rated creativity; similarly, as the product approaches the conventional and/or uselessness its rated creativity decreases. The following table illustrates one possible model for combining the two essential qualities to arrive at a final creativity rating for each product.

Table 1.

Combined Product Creativity Ratings for Given Ratings of Unusualness and Usefulness

(Usefulness Rating)

If the same problem was solved by a group of *one hundred* typical seventh grade students, would you find —		The solution does *not* satisfy the principal requirements of the problem	The solution satisfies the principal requirements of the problem	The solution is as good as the commonly advocated or "typical" teacher solution	The solution is better than the commonly advocated or "typical" teacher solution
		0	1	2	3
More than 10 similar products	0	0	0	0	0
Between 6-10 similar products	1	0	1	2	3
Between 1-5 similar products	2	0	2	4	6
Less than 1 similar product	3	0	3	6	9

II. *Classifying Creative Products*

While the same thought processes might be universally employed to formulate creative ideas, it is entirely conceivable that the particular type of thought materials being manipulated will differentially influence the efficiency of the processes for various individuals. This could result in students displaying relatively high creative ability with one type of content and relatively low creative ability with another. To provide for this possible phenomenon, creative products should be classified according to a system which reflects fundamental and potentially significant differences among the thought materials used in their production.

For the creative products of industrial arts students, the categories of behavioral, symbolic, and figural content [1] are proposed. Behavioral content is contained in products dealing primarily with individual and group relationships, such as pupil-teacher and pupil-pupil interactions in persuasive or instructional situations. Symbolic content is displayed in products which represent the aesthetic and other abstract qualities of real, tangible objects or processes, i.e. systems of measurement, dimensioning, coding, and representation, and the artistic aspects of design. Products with figural content contain ideas for the manipulation of real, concrete, inanimate objects and processes; the mechanics of performing an operation, the combination or use of materials for functional purposes, and the sequence or kind of operations used in completing a project are illustrations of this type of content.

It should be emphasized that the system classifies the content of the idea manifest in the unusual aspect of the product, and not the particular form of the product itself. For example, oral suggestions are products; these may contain unusual ideas for securing better cooperation among students (behavioral), improving the aesthetic qualities of a design (symbolic), or for arranging machinery for a mass production project (figural). Similarly, a sketch might utilize conventional symbols in an unusual manner (symbolic), or depict a new device for mitering wood (figural).

In addition to the proposed categories of creativity based on type of content (behavioral, symbolic, figural), the possibility exists that the more specific materials (wood, metal, etc.) dealt with in various industrial arts classes might also influence the extent of each student's creative abilities. Until there is an opportunity to test such an hypothesis, care must be taken in assuming that ratings of creative abilities in one industrial arts course are equivalent to what they might be in other industrial arts courses.

Consequently, during initial attempts to rate creativity, industrial arts courses differing in content should be treated discretely, and within each course behavioral symbolic, and figural creative abilities should be rated separately.

[1] J. P. Guilford, "Three Faces of Intellect," *American Psychologist*, 14:469-479, 1959.

III. *Assessing the Relative Creative Abilities of Students*

Within a given industrial arts course, each product of every student should be evaluated in terms of its unusualness. If a product is judged to be unusual to some degree (above a zero rating), its usefulness must then be estimated, and the two ratings entered on the student's record in the proper content category (behavioral, symbolic, or figural).

Under similar environmental conditions, the higher the ratings for each creative product and the greater the number of creative products within each content category, the more creative the student is with content of that nature. To assess the relative creative abilities of students, it is possible to compare their creative production, over a given length of time, in each of the content categories. A relative measure of total "creativity" may be obtained by comparing students' cumulative creative productivity in all content categories.

APPENDIX B

PRELIMINARY CREATIVE OR NON-CREATIVE BEHAVIOR INVENTORY

B_1

SUMMARY OF JUDGES' RESPONSES

APPENDIX B

PRELIMINARY

CREATIVE OR NON-CREATIVE BEHAVIOR INVENTORY
(For Research Purposes Only)

Introduction

The behavioral statements in this inventory were developed to represent creative or non-creative behavior in specific and general industrial arts laboratory situations from grades 7 through 12. These statements have been derived from the writings and research of psychologists, sociologists, educators and business leaders concerned with the general characteristics and attributes of creative people and how creative abilities can be developed.

General Directions

As an expert in the field of industrial arts and being familiar with the research on creativity, you are asked to classify each item in the inventory according to whether you think the item either indicates and/or would lead to the development of creative or non-creative behavior in industrial arts.

For each item please ask yourself the following question: If industrial arts teachers encourage students - to or who - exhibit the type of behavior described, in their classes, then would you classify this behavior as:

		Code Letter
1.	Creative behavior	(C)
2.	Non-creative behavior	(N)
3.	Behavior that has no relationship to creativity or non-creativity or items you do not understand	(X)

Specific Directions

1. Please indicate how you would rate or classify each item by encircling the appropriate code letter in the right hand margin. For example:

   C. An item rated as creative — C N X
   N. An item rated as non-creative — C N X
   X. An item rated as neither creative or non-creative — C N X

2. Please circle just one code letter, C - N - X for each item.

3. Please respond to all items.

Inventory Items

1. Encourage students to strive for quality and perfection in the laboratory work they do. C N X

2. Encourage students to value their own growth and development. C N X
3. Encourage students to think of many ideas about how to get something done. C N X
4. Encourage students to reject a proven solution to a problem and take a chance that they will find another solution. C N X
5. Encourage students to accept criticism and change their ideas accordingly. C N X

6. Encourage students to sketch three or more tentative design ideas before making a specific project. C N X
7. Encourage students to think through their suggestions before making them. C N X
8. Encourage students to think things through before acting. C N X
9. Encourage students to accept things as they are. C N X
10. Encourage students to suggest ways they might improve a project if they were to make it again. C N X

11. Encourage students to explore and experiment with clever or uncommon project design ideas they have. C N X
12. Encourage students to use their first solution to a design or fabrication problem. C N X
13. Encourage students to explore new ideas, whether or not they have any practical use. C N X
14. Encourage students to solve a problem as quickly as possible and not to meditate on it too much as it will only confuse them. C N X
15. Encourage students to suggest only ideas and solutions that they think have merit. C N X

16. Encourage students to warn other students of various difficulties or problems they might encounter while working on a particular project. C N X
17. Encourage students who approach a problem in a different way from the rest of the group or class. C N X
18. Encourage students to exercise caution in looking for problems, since more than enough will usually come up anyway. C N X
19. Encourage students to depend on specific facts instead of feelings or hunches to guide them to a solution. C N X
20. Encourage students who suggest the accepted way of doing things. C N X

21. Encourage students to combine only compatible materials when making a project. C N X
22. Encourage students to shift to another problem when a solution does not appear likely. C N X
23. Encourage students to accept as the best theory the one that has the best practical application. C N X
24. Encourage students to be sure an idea is workable before suggesting it. C N X
25. Encourage students to suggest different ways of handling student responsibilities for laboratory cleanliness. C N X

26. Encourage students who always look for problems. C N X
27. Encourage students to get their design ideas from accepted sources of good design. C N X
28. Encourage students who seem to have many ideas about how to solve a problem. C N X
29. Encourage students to rely upon the greater experience of others when confronted with a problem. C N X
30. Encourage students who question the advisability of following a stated plan of procedure when constructing a project. C N X

31. Encourage students to concentrate their work in an area that is closely related to a particular job classification. C N X
32. Encourage students to select and execute quantity production projects in the laboratory. C N X
33. Encourage students to keep their ridiculous ideas and silly ideas to themselves. C N X
34. Encourage students to look at the materials and equipment in the laboratory but not to touch things unless told to do so. C N X
35. Encourage students to try out construction operations on scrap material before using them on a project. C N X

36. Encourage students to explore several possible courses of action before selecting the most effective. C N X
37. Encourage students to try out a wild or silly idea. C N X
38. Encourage students to arrange in a workable sequence their plan of procedure for making a project. C N X
39. Encourage students to recognize in advance problems that may come up when constructing a project. C N X
40. Encourage students to concentrate on the present operation and plan the next step when they get to it. C N X

41. Encourage students to feel, handle and manipulate all kinds of materials and objects. C N X
42. Encourage students to accept the obvious answer. C N X
43. Encourage students who make more suggestions than they can immediately use. C N X
44. Encourage students to observe and do as others do. C N X
45. Encourage students to suggest their best idea for solving a problem. C N X

46. Encourage students who seem to have a spirit of play. C N X
47. Encourage students to disagree with the instructor. C N X
48. Encourage students to laugh at their own blunders. C N X
49. Encourage students to plan the task they will do next, while working at a current task. C N X
50. Encourage students to be satisfied only with their highest quality of work. C N X

51. Encourage students to question the obvious. C N X
52. Encourage students to defend their own ideas in the face of criticism. C N X

53. Encourage students to be submissive or compliant with respect to authority. C N X
54. Encourage students who seem to come up with a complex solution to even simple problems. C N X
55. Encourage students to rely heavily on their own experience. C N X
56. Encourage students to take a basic idea for the solution of a design problem and then vary it in different ways. C N X
57. Encourage students to try out a hunch just to see what will happen. C N X
58. Encourage students to accept readily the suggestions of the instructor. C N X
59. Encourage students to recognize and develop the abilities and strengths they possess. C N X
60. Encourage students to repeat technical operations until they have mastered them. C N X
61. Encourage students who impetuously or hastily decide to act on something. C N X
62. Encourage students to stick to the tried and true way of doing things. C N X
63. Encourage students to make concessions to avoid unpleasantness. C N X
64. Encourage students to critically analyze and evaluate themselves. C N X
65. Encourage students to resist repeating or doing things a second time. C N X
66. Encourage students to perform shop operations only in the manner suggested by the teacher or text. C N X
67. Encourage students to work on problems where the outcome is unpredictable. C N X
68. Encourage students to experiment with an idea that may have no practical meaning for anyone else. C N X
69. Encourage students to never give up trying to solve a problem. C N X
70. Encourage students to produce unusual responses to specific situations. C N X
71. Encourage students to consult with their instructor to find out possible difficulties they might encounter while making a project. C N X
72. Encourage students to rely on what they know to be true instead of hunches. C N X
73. Encourage students who suggest a radical idea or solution to a problem. C N X
74. Encourage students to solve problems using solutions that have proved to be successful. C N X
75. Encourage students to be curious about things. C N X

76. Encourage students to find out how things fit together. C N X
77. Encourage students who say: "I don't think that will work because:" C N X
78. Encourage students who like to handle and touch everything in the laboratory. C N X
79. Encourage students to strive for wide variations between possible solutions to a specific design problem. C N X
80. Encourage students to proceed first with the intial solution to a problem when another becomes evident during the process. C N X

81. Encourage students to try out many possible solutions for problems. C N X
82. Encourage students to accept readily the suggestions of other students. C N X
83. Encourage students to meditate and mull over problems or possible solutions to problems. C N X
84. Encourage students who like to day dream. C N X
85. Encourage students to express all the ideas they might have about a possible solution to a problem. C N X

86. Encourage students who suggest wild or silly ideas. C N X
87. Encourage students to develop short-cut methods of performing a technical operation. C N X
88. Encourage students to trust their feelings to lead them through an experience. C N X
89. Encourage students who are quick with suggestions C N X
90. Encourage students to carefully evaluate each idea or suggestion before presenting it. C N X

91. Encourage students to devise many solutions to a problem with specified properties, for example: design a container that will hold a liquid and can be folded up or collapsed. C N X
92. Encourage students to express only sensible ideas. C N X
93. Encourage students to eliminate the risk of being wrong by checking with the instructor. C N X
94. Encourage students to grow up and not play around anymore. C N X
95. Encourage students to use tools for purposes other than their intended use. C N X

96. Encourage students to risk making a mistake by trying to make something they are not sure will be a success. C N X
97. Encourage students to propose entirely new approaches to a problem. C N X
98. Encourage students to increase their speed, accuracy and efficiency when performing specific hand or machine tool processes. C N X
99. Encourage students to make decisions independent of others. C N X
100. Encourage students to be unconcerned with perfection when making a project. C N X

101. Encourage students to ask questions about things that seem obvious to others. C N X
102. Encourage students who recognize problems and difficulties in almost any situation. C N X
103. Encourage students to become familiar with the many different industrial enterprises within their own community. C N X
104. Encourage students to suggest how the laboratory could be improved. C N X
105. Encourage students to understand the organization and management of industry. C N X

106. Encourage students to suggest the use of materials in an unconventional manner. C N X
107. Encourage students who try to direct their own learning. C N X
108. Encourage students to make a few high quality projects instead of numerous low quality ones. C N X
109. Encourage students to follow a sequential operational plan of procedure diligently. C N X
110. Encourage students to leave the materials alone in the laboratory until they are needed. C N X

111. Encourage students to strike out in a different direction when having difficulty with several similar solutions. C N X
112. Encourage students to improvise if they do not have the correct tool for the job. C N X
113. Encourage students to tackle a job that possible involves many unknown difficulties. C N X
114. Encourage students to tackle a problem that might be too complex for them. C N X
115. Encourage students to quickly recognize difficulties they might encounter in constructing a project. C N X

116. Encourage students to visit local manufacturing concerns on their own. C N X
117. Encourage students to carry all projects through to completion. C N X
118. Encourage students to criticize themselves for their own foolishness or ineptitude. C N X
119. Encourage students to jump from one activity to another sometimes before completion. C N X
120. Encourage students to suggest unusual or different combinations of materials. C N X

121. Encourage students to follow closely a prescribed way of constructing an article. C N X
122. Encourage students to produce ideas in quantity rather than quality. C N X
123. Encourage students to strive for perfection when making any project. C N X

124. Encourage students to shift to a different activity if they become disinterested in the one they are working on. C N X
125. Encourage students to express in some manner what is usually held back. C N X

126. Encourage students to use existing designs and plans for projects. C N X
127. Encourage students to use materials only for the purpose they were intended. C N X
128. Encourage students to avoid making mistakes by making projects that have been made before. C N X
129. Encourage students to be impressed more with what they do not know than what they do know. C N X
130. Encourage students who look for problems to work on that challenge all their capacities. C N X

131. Encourage students to outline a plan of procedure for making a project and not deviate from it. C N X
132. Encourage students to avoid tackling a problem that seems difficult. C N X
133. Encourage students to figure out problems for themselves instead of finding out what others have done. C N X
134. Encourage students to develop a high degree of performance and perfection with one technical operation before performing other operations. C N X
135. Encourage students to select projects according to the operations involved. C N X

136. Encourage students to produce a large quantity of different projects and not be concerned with their quality. C N X
137. Encourage students to recognize how one operation might affect the success of a later operation. C N X
138. Encourage students to be different in things that have meaning to them. C N X
139. Encourage students to perfect a limited number of tool skills to as high a levelas possible. C N X
140. Encourage students to disagree with suggestions made by other students. C N X

141. Encourage students to act on a sudden impulse. C N X
142. Encourage students to express crack-pot ideas. C N X
143. Encourage students to be concerned more about the individual ideas or parts rather than how they fit together. C N X
144. Encourage students who produce a diversity of different ideas when only one is called for. C N X
145. Encourage students to sketch or suggest one good design idea before making a project. C N X

146. Encourage students to look for new and novel ways of doing things. C N X
147. Encourage students to learn on their own. C N X
148. Encourage students to suggest alternate operational plans of procedure when planning a project. C N X
149. Encourage students to work with a material or engage in an activity where they have had little or no previous experience. C N X
150. Encourage students to resist doing what other students have done. C N X

151. Encourage students to recall how a particular problem was solved before. C N X
152. Encourage students to keep in check their own feelings and ideas. C N X
153. Encourage students to suggest many alternate uses for fastening devices such as a: nail, screw, staple, cotter-key, etc. C N X
154. Encourage students to remember that the physical arrangement and condition of the laboratory is the responsibility of the school board and the instructor. C N X
155. Encourage students to stick with one project design idea once selected. C N X

156. Encourage students to openly recognize their own limitations and imperfections. C N X
157. Encourage students to use tools only for their designed purpose. C N X
158. Encourage students to select a national industrial corporation, find out all they can about it and make a report to the class. C N X
159. Encourage students to question and challenge instructions. C N X
160. Encourage students to accept things as they are instead of looking for problems. C N X

161. Encourage students to feel, smell and taste, where possible, the various materials they use in the laboratory. C N X
162. Encourage students to relate and compare the techniques and processes used in industrial arts laboratories with those employed in industry. C N X
163. Encourage students to use an everyday object for a different purpose. C N X
164. Encourage students to set up and operate a student business such as a toy repair service. C N X
165. Encourage students to recognize that a construction problem has a limited number of possible solutions. C N X

166. Encourage students to play with the materials available in the laboratory. C N X
167. Encourage students to consult others before making a decision. C N X

168. Encourage students to be impressed with the knowledge they possess. C N X
169. Encourage students to suggest new ways of joining materials. C N X
170. Encourage students to express their individual likes and dislikes about an activity or area of work. C N X

171. Encourage students to be like other students. C N X
172. Encourage students to suggest how a particular hand tool might be improved. C N X
173. Encourage students who dislike doing the same things the same way all the time. C N X
174. Encourage students to try something which has not occurred to others to try. C N X
175. Encourage students to select projects to make from a list of suggested projects. C N X

176. Encourage students to keep at a task, once selected. C N X
177. Encourage students to plan their learning experience only after consultation with their teacher. C N X
178. Encourage students to apply the initial solution they think of to solve a problem. C N X
179. Encourage students to develop competence by doing things repeatedly. C N X
180. Encourage students to consult numerous sources when searching for design ideas. C N X

181. Encourage students who desire to work on a highly complex project. C N X
182. Encourage students to fool around with new ideas even if they turn out later to be a total waste of time. C N X
183. Encourage students to sketch on paper as many tentative problem solutions as possible before executing a particular solution. C N X
184. Encourage students to accept their final solution to a problem as the best solution possible. C N X
185. Encourage students to offer a few good ideas rather than suggesting many ideas. C N X

186. Encourage students to let someone else make a project first so they can find out the problems and difficulties they encountered. C N X
187. Encourage students to look for widely differing ways of performing shop operations. C N X
188. Encourage students to make many projects. C N X
189. Encourage students to suggest several possible ways of fabricating an article. C N X
190. Encourage students to follow all instructions without question. C N X
191. Encourage students to select projects that will not be too complex or difficult for them to make. C N X

APPENDIX B_1

SUMMARY OF JUDGES' RESPONSES TO PRELIMINARY CREATIVE OR NON-CREATIVE BEHAVIOR INVENTORY - ORIGINAL SCALE ASSIGNED, (C) CREATIVE OR (N) NON-CREATIVE, FOR EACH ITEM AND THOSE ITEMS WHERE FIVE OR ALL SIX JUDGES AGREED WITH THE ORIGINAL SCALE ASSIGNED

Item No.	Assigned Scale C	Assigned Scale N	No. of Judges Agreeing with Assigned Scale	Item No.	Assigned Scale C	Assigned Scale N	No. of Judges Agreeing with Assigned Scale
1		x		38	x		5
2	x			39	x		
3	x		6	40		x	
4	x		5	41	x		6
5		x		42		x	6
6	x		6	43	x		5
7		x	5	44		x	
8		x		45		x	
9		x	6	46	x		
10	x		6	47	x		
11	x		6	48	x		
12		x	5	49	x		
13	x		5	50		x	
14		x	6	51	x		5
15		x	5	52	x		5
16	x			53		x	
17	x		6	54	x		
18		x	6	55	x		
19		x		56	x		5
20		x		57	x		6
21		x		58		x	
22	x			59	x		5
23		x		60		x	
24		x	6	61	x		
25	x			62		x	5
26	x		6	63		x	
27		x		64	x		
28	x		6	65	x		
29		x	5	66		x	
30	x			67	x		5
31	none			68	x		6
32	none		5	69		x	
33		x	5	70	x		6
34		x		71		x	
35		x		72		x	
36	x		6	73	x		6
37	x		5	74		x	

Appendix B_1 Continued

Item No.	Assigned Scale C	Assigned Scale N	No. of Judges Agreeing with Assigned Scale	Item No.	Assigned Scale C	Assigned Scale N	No. of Judges Agreeing with Assigned Scale
75	x		6	121		x	
76	x		6	122	x		
77	x			123		x	
78	x			124	x		
79	x			125	x		6
80		x	5	126		x	5
81	x		6	127		x	6
82		x		128		x	5
83	x		6	129	x		
84	x			130	x		5
85	x		5	131		x	6
86	x			132		x	
87	x		6	133	x		
88	x			134		x	
89	x		5	135		x	
90		x		136	x		
91	x		6	137	x		
92		x	5	138	x		
93		x		139		x	
94		x		140	x		
95	x			141	x		
96	x			142	x		
97	x		6	143		x	
98	none			144	x		5
99	x		5	145		x	
100	x			146	x		6
101	x		5	147	x		6
102	x		6	148	x		5
103	none			149	x		6
104	x		5	150	x		
105		x		151		x	
106	x		6	152		x	
107	x		6	153	x		5
108		x		154		x	
109		x		155		x	
110		x		156	x		
111	x			157		x	
112	x		6	158	none		
113	x		6	159	x		
114	x			160		x	6
115	x			161	x		5
116	none			162	none		
117		x		163	x		5
118	x			164	x		
119	x			165		x	5
120	x		6	166	x		5

Appendix B_1 Continued

Item No.	Assigned Scale C	Assigned Scale N	No. of Judges Agreeing with Assigned Scale	Item No.	Assigned Scale C	Assigned Scale N	No. of Judges Agreeing with Assigned Scale
167		x		180	x		5
168		x		181	x		
169	x		6	182	x		5
170	x			183	x		6
171		x		184		x	6
172	x		6	185		x	
173	x			186		x	
174	x			187	x		5
175		x		188	x		
176		x		189	x		6
177		x		190		x	5
178		x	6	191		x	
179		x					
Totals					107	77	83

Summary:

1. Total number creative items 107
2. Total number non-creative items 77
3. Number of creative items on which 5 or 6 judges agreed 60
4. Number of non-creative items on which 5 or 6 judges agreed 22

APPENDIX C

DATA COLLECTING SCHEDULE

APPENDIX C

DATA COLLECTING SCHEDULE

		Dates
1.	Questionnaire and cover letter pilot run - seven teachers - two visits each	12/10/63 - 12/18/63
2.	Questionnaire and cover letter revision and printing	12/20/63 - 12/30/63
3.	First mailing of questionnaire to 297 teachers	1/8/64 - 1/13/64
4.	First follow-up - 185 printed post cards	1/18/64 - 1/20/64
5.	Second follow-up - letter and second questionnaire to 130 individuals	1/27/64 - 1/28/64
6.	First mailing of questionnaire to 23 corrected addresses - Follow-up corrected addresses	2/14/64 2/24/64
7.	Third follow-up - post card to 53 individuals	2/17/64

APPENDIX D

PILOT STUDY FORMS

D_1 INTRODUCTORY LETTER

D_2 PROPOSED COVER LETTER

D_3 PILOT STUDY QUESTIONNAIRE

D_4 REACTION AND SUGGESTION SHEET

APPENDIX D_1

INTRODUCTORY LETTER

Dear Mr.________________:

Your agreement to participate in this pilot study is sincerely appreciated. As one of ten industrial arts teachers, you will have the opportunity to assist in the development of a survey questionnaire for a study which may help to improve the image of industrial arts education among teachers, counselors, administrators and the general public.

Specifically, I would like your candid reactions to this proposed questionnaire so your suggestions could be incorporated into the final instrument. Might I suggest the following procedure:

1. Read the proposed cover letter
2. Complete Part I - General Information Section
3. Complete Part II - Industrial Arts Student Behavior Inventory
4. Complete Part III - Industrial Arts Objective Emphasis
5. Complete the reaction and suggestion sheet

While the reaction and suggestion sheet that has been enclosed, requests some specific information, I encourage you to write directly on the questionnaire any questions or points you would like to bring to my attention concerning the directions, format, clarity of items or areas that are confusing. Since the improvement of this instrument is my major concern at this time, your specific responses to the questionnaire items will not be analyzed but will be held in strict professional confidence.

In a few days I will call and make arrangements to pick up this questionnaire and at that time get your verbal reaction to this instrument.

Thank you for your assistance and cooperation.

Sincerely yours,

Kenneth R. Clay, Instructor
College of Education
Michigan State University
Phone:Office 3551763
Home ED20696

APPENDIX D_2

PROPOSED COVER LETTER

Dear Mr.________________:

Although there are numerous demands on your time, will you please take a few minutes for a task which may improve the image of industrial arts education among teachers, counselors, administrators and the general public.

As you are aware, in recent years there has been frequent criticism of what many call the frill subjects or programs of education. With the current emphasis being placed on science, math and foreign languages; industrial arts and other programs often find it increasingly difficult to maintain strong acceptance and respectability within the total school program. A major source of this criticism stems from a general lack of knowledge and understanding of the type and range of activity and behavior you and other industrial arts teachers develop in your classrooms.

The enclosed questionnaire is part of a study being conducted to determine the type and range of student behavior that is being encouraged and developed daily by industrial arts teachers in their classrooms.

By obtaining answers from you, a member of a small but carefully selected group of industrial arts teachers, to the questions in the attached questionnaire, valuable information should be provided about the type of activity and behavior teachers encourage their students to exhibit in the classroom. As a result, you will help inform educators and the general public of some significant but not always apparent outcomes of industrial arts programs.

Will you cooperate in this investigation by completing the attached questionnaire at your earliest convenience and returning it to me in the self-addressed envelope provided for your convenience? In return for your consideration of this questionnaire a summary of the results will be made available to you.

Your name need not be signed to this questionnaire unless you so desire. The identity of individual teachers is not sought, and if such identity is revealed, it will be held in strict professional confidence.

Thank you for your help and cooperation.

Sincerely yours,

Kenneth R. Clay, Instructor
Industrial Education

APPENDIX D_3

PILOT STUDY QUESTIONNAIRE

Part I GENERAL INFORMATION

DIRECTIONS: Please answer every item as it applies to you in your present teaching assignment. Either check or supply the appropriate response.

1. Educational Background (College)

( ) Bachelors Degree
( ) Masters Degree
( ) 20 semester or 30 quarter hours beyond Masters Degree

2. Major Field of study in college

( ) Industrial Arts
( ) Vocational Education
( ) Others - List________________, ______________, ______________

3. Technical area of highest competence and specialization. Example: woods, metals, drafting, etc.________________ ________________

4. Number of years teaching experience in Industrial Arts prior to this year________________

5. Are you certified to teach vocational classes?

( ) Yes ( ) No
( ) Check if currently teaching reimbursed vocational classes

6. Check all the grades in which you are currently teaching Industrial Arts

( ) 6th grade
( ) 7th grade
( ) 8th grade
( ) 9th grade
( ) 10th grade
( ) 11th grade
( ) 12th grade
( ) Other grade________________

7. Check all the technical areas in which instruction is given in the laboratory or shop where you do most of your teaching.

( ) Woodworking
( ) Metalworking
( ) Graphic Arts
( ) Auto and power mechanics
( ) Electricity or electronics
( ) Drafting
( ) Materials testing
( ) Plastics
( ) Leather
( ) Ceramics
( ) Textiles
( ) Photography
( ) Jewelry
( ) Other areas

____
____

Part II INDUSTRIAL ARTS STUDENT BEHAVIOR INVENTORY

INTRODUCTION: As a teacher in the field of Industrial Arts you are asked to indicate the general degree to which you encourage your students to exhibit the type of behavior described in each of the following series of behavioral statements. Since these statements are rather general in nature, please respond to them regardless of your specific technical area of teaching, for example: drafting, metals,woods, general shop, etc.

SPECIFIC DIRECTIONS

A. For each statement please indicate the degree of your encouragement by encircling the appropriate code letter preceding each statement as illustrated in the following two sample items.

I never	sometimes	usually	always	
N	S	U	A	encourage students to observe all safety rules and regulations.
I N	S	U	A	encourage students to assist other students with their work.

B. Please circle just one code letter, N - S - U - A for each item.

C. Please respond to all items.

INVENTORY ITEMS

		NEVER	SOMETIMES	USUALLY	ALWAYS	
1.	I	N	S	U	A	encourage students to value their own growth and development.
2.	I	N	S	U	A	encourage students to think of many ideas about how to get something done.
3.	I	N	S	U	A	encourage students to reject a proven solution to a problem and take a chance that they will find another solution.
4.	I	N	S	U	A	encourage students to sketch three or more tentative design ideas before making a specific project.
5.	I	N	S	U	A	encourage students to think through their suggestions before making them.
6.	I	N	S	U	A	encourage students to accept things as they are.
7.	I	N	S	U	A	encourage students to suggest ways they might improve a project if they were to make it again.
8.	I	N	S	U	A	encourage students to explore and experiment with clever or uncommon project design ideas they have.
9.	I	N	S	U	A	encourage students to use their first solution to a design or fabrication problem.
10.	I	N	S	U	A	encourage students to explore new ideas, whether or not they have any practical use.
11.	I	N	S	U	A	encourage students to solve a problem as quickly as possible, and not to meditate on it too much as it will only confuse them.
12.	I	N	S	U	A	encourage students to suggest only ideas and solutions that they think have merit.
13.	I	N	S	U	A	encourage students who approach a problem in a different way from the rest of the group or class..

		NEVER	SOMETIMES	USUALLY	ALWAYS	
14.	I	N	S	U	A	encourage students to exercise caution in looking for problems.
15.	I	N	S	U	A	encourage students to be sure an idea is workable before suggesting it.
16.	I	N	S	U	A	encourage students who always look for problems.
17.	I	N	S	U	A	encourage students who seem to have many ideas about how to solve a problem.
18.	I	N	S	U	A	encourage students to rely upon the greater experience of others when confronted with a problem.
19.	I	N	S	U	A	encourage students to concentrate their work in an area that is closely related to a particular job classification.
20.	I	N	S	U	A	encourage students to select and execute quantity production projects in the laboratory.
21.	I	N	S	U	A	encourage students to keep their ridiculous ideas and silly ideas to themselves.
22.	I	N	S	U	A	encourage students to try out construction operations on scrap material before using them on a project.
23.	I	N	S	U	A	encourage students to explore several possible courses of action before selecting the most effective.
24.	I	N	S	U	A	encourage students to try out a wild or silly idea.
25.	I	N	S	U	A	encourage students to arrange in a workable sequence their plan of procedure for making a project.
26.	I	N	S	U	A	encourage students to feel, handle and manipulate all kinds of materials and objects.
27.	I	N	S	U	A	encourage students to accept the obvious answer.
28.	I	N	S	U	A	encourage students who make more suggestions than they can immediately use.
29.	I	N	S	U	A	encourage students to be satisfied only with their highest quality of work.
30.	I	N	S	U	A	encourage students to question the obvious.
31.	I	N	S	U	A	encourage students to defend their own ideas in the face of criticism.
32.	I	N	S	U	A	encourage students to take a basic idea for the solution of a design problem and then vary it in different ways.
33.	I	N	S	U	A	encourage students to try out a hunch just to see what will happen.
34.	I	N	S	U	A	encourage students to recognize and develop the abilities and strengths they possess.
35.	I	N	S	U	A	encourage students to stick to the tried and true way of doing things.

36.

37.

38

39

		NEVER	SOMETIMES	USUALLY	ALWAYS	
36.	I	N	S	U	A	encourage students to critically analyze and evaluate themselves.
37.	I	N	S	U	A	encourage students to work on problems where the outcome is unpredictable.
38.	I	N	S	U	A	encourage students to experiment with an idea that may have no practical meaning for anyone else.
39.	I	N	S	U	A	encourage students to produce unusual responses to specific situations.
40.	I	N	S	U	A	encourage students who suggest a radical idea or solution to a problem.
41.	I	N	S	U	A	encourage students to be curious about things.
42.	I	N	S	U	A	encourage students to find out how things fit together.
43.	I	N	S	U	A	encourage students to proceed first with the initial solution to a problem when another becomes evident during the process.
44.	I	N	S	U	A	encourage students to try out many possible solutions for problems.
45.	I	N	S	U	A	encourage students to meditate and mull over problems or possible solutions to problems.
46.	I	N	S	U	A	encourage students to express all the ideas they might have about a possible solution to a problem.
47.	I	N	S	U	A	encourage students to develop short-cut methods of performing a technical operation.
48.	I	N	S	U	A	encourage students who are quick with suggestions.
49.	I	N	S	U	A	encourage students to devise many solutions to a problem with specified properties, for example: design a container that will hold a liquid and can be folded up or collapsed.
50.	I	N	S	U	A	encourage students to express only sensible ideas.
51.	I	N	S	U	A	encourage students to propose entirely new approaches to a problem.
52.	I	N	S	U	A	encourage students to increase their speed, accuracy and efficiency when performing specific hand or machine tool processes.
53.	I	N	S	U	A	encourage students to make decisions independent of others.
54.	I	N	S	U	A	encourage students to ask questions about things that seem obvious to others.
55.	I	N	S	U	A	encourage students who recognize problems and difficulties in almost any situation.
56.	I	N	S	U	A	encourage students to become familiar with the many different industrial enterprises within their own community.
57.	I	N	S	U	A	encourage students to suggest how the laboratory could be improved.

		NEVER	SOMETIMES	USUALLY	ALWAYS	
58.	I	N	S	U	A	encourage students to understand the organization and management of industry.
59.	I	N	S	U	A	encourage students to suggest the use of materials in an unconventional manner.
60.	I	N	S	U	A	encourage students who try to direct their own learning.
61.	I	N	S	U	A	encourage students to improvise if they do not have the correct tool for the job.
62.	I	N	S	U	A	encourage students to tackle a job that possibly involves many unknown difficulties.
63.	I	N	S	U	A	encourage students to visit local manufacturing concerns on their own.
64.	I	N	S	U	A	encourage students to suggest unusual or different combinations of materials.
65.	I	N	S	U	A	encourage students to express in some manner what is usually held back.
66.	I	N	S	U	A	encourage students to use existing designs and plans for projects.
67.	I	N	S	U	A	encourage students to use materials only for the purpose they were intended.
68.	I	N	S	U	A	encourage students to avoid making mistakes by making projects that have been made before.
69.	I	N	S	U	A	encourage students who look for problems to work on that challenge all their capacities.
70.	I	N	S	U	A	encourage students to outline a plan of procedure for making a project and not deviate from it.
71.	I	N	S	U	A	encourage students to develop a high degree of performance and perfection with one technical operation before performing other operations.
72.	I	N	S	U	A	encourage students to perfect a limited number of tool skills to as high a level as possible.
73.	I	N	S	U	A	encourage students who produce a diversity of different ideas when only one is called for.
74.	I	N	S	U	A	encourage students to look for new and novel ways of doing things.
75.	I	N	S	U	A	encourage students to learn on their own.
76.	I	N	S	U	A	encourage students to suggest alternate operational plans of procedure when planning a project.
77.	I	N	S	U	A	encourage students to work with a material or engage in an activity where they have had little or no previous experience.
78.	I	N	S	U	A	encourage students to suggest many alternate uses for fastening devices such as a: nail, screw, staple, cotter-key, etc.
79.	I	N	S	U	A	encourage students to openly recognize their own limitations and imperfections.

		NEVER	SOMETIMES	USUALLY	ALWAYS	
80.	I	N	S	U	A	encourage students to select a national industrial corporation, find out all they can about it and make a report to the class.
81.	I	N	S	U	A	encourage students to accept things as they are instead of looking for problems.
82.	I	N	S	U	A	encourage students to feel, smell and taste, where possible, the various materials they use in the laboratory.
83.	I	N	S	U	A	encourage students to relate and compare the techniques and processes used in industrial arts laboratories with those employed in industry.
84.	I	N	S	U	A	encourage students to use an everyday object for a different purpose.
85.	I	N	S	U	A	encourage students to set up and operate a student business such as a toy repair service.
86.	I	N	S	U	A	encourage students to recognize that a construction problem has a limited number of possible solutions.
87.	I	N	S	U	A	encourage students to play with the materials available in the laboratory.
88.	I	N	S	U	A	encourage students to suggest new ways of joining materials.
89.	I	N	S	U	A	encourage students to express their individual likes and dislikes about an activity or area of work.
90.	I	N	S	U	A	encourage students to suggest how a particular hand tool might be improved.
91.	I	N	S	U	A	encourage students to try something which has not occurred to others to try.
92.	I	N	S	U	A	encourage students to apply the initial solution they think of to solve a problem.
93.	I	N	S	U	A	encourage students to consult numerous sources when searching for design ideas.
94.	I	N	S	U	A	encourage students to fool around with new ideas even if they turn out later to be a total waste of time.
95.	I	N	S	U	A	encourage students to sketch on paper as many tentative problem solutions as possible before executing a particular solution.
96.	I	N	S	U	A	encourage students to accept their final solution to a problem as the best solution possible.
97.	I	N	S	U	A	encourage students to look for widely differing ways of performing shop operations.
98.	I	N	S	U	A	encourage students to suggest several possible ways of fabricating an article.
99.	I	N	S	U	A	encourage students to follow all instructions without question.

Part III. INDUSTRIAL ARTS OBJECTIVE EMPHASIS

DIRECTIONS: Please read the following three statements of typical Industrial Arts objectives.

A. To develop the students ability to perform skillfully hand or machine operations with the tools and materials and to increase their knowledge of the working qualities, characteristics and problems encountered while working with tools and materials. 1 2 3

B. To help students understand their capabilities and limitations; likes and dislikes; strengths and weaknesses and therefore, gain a better understanding of themselves and their potentiality. 1 2 3

C. To develop the students ability to interpret and understand industry and the role it plays in our industrial society. 1 2 3

DIRECTIONS: Now having read these three objectives of Industrial Arts, please rank in order according to the degree of emphasis you give to each in your Industrial Arts classes. Please circle one number after each statement and only use a number once for all three objectives.

Note: Number one (1) indicates the highest degree of emphasis.

1. A

2. W

3.

4.

APPENDIX D_4

REACTION AND SUGGESTION SHEET

1. About how long did it take you to answer this questionnaire?______

2. Would the introductory letter motivate you to respond to this questionnaire? ( ) Yes ( ) No Comments:

3. Did the introductory letter adequately explain the purpose of the study? ( ) Yes ( ) No Comments:

4. Do you think responses from a large group of Industrial Arts teachers to these questionnaire items will help educators and the public gain a better understanding of Industrial Arts and what is accomplished in programs of Industrial Arts? ( ) Yes ( ) No Comments:

5. Were the directions for responding clear and sufficient for you?
   Part I ( ) Yes ( ) No
   Part II ( ) Yes ( ) No
   Part III ( ) Yes ( ) No
   Comments:

6. How did you feel about responding to Part II?
   a. Were the statements meaningful? ( ) Yes ( ) No
   b. Was it difficult to determine the degree of emphasis you give to each item in your classroom? ( ) Yes ( ) No
   c. Was this section too lengthly? ( ) Yes ( ) No

7. Would you have answered this questionnaire if you had received it in the mail? ( ) Yes ( ) No If "no," why not?

APPENDIX E

FINAL QUESTIONNAIRE, COVER AND FOLLOW-UP LETTERS

E_1 FINAL QUESTIONNAIRE - BEHAVIOR INVENTORY

E_2 COVER LETTER

E_3 FIRST FOLLOW-UP POST CARD

E_4 SECOND FOLLOW-UP LETTER

E_5 THIRD FOLLOW-UP POST CARD

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APPENDIX E_1

MICHIGAN STATE UNIVERSITY EAST LANSING

COLLEGE OF EDUCATION

INDUSTRIAL ARTS ACTIVITY QUESTIONNAIRE

Part I BASIC DATA

DIRECTIONS: Please answer every item as it applies to you in your present teaching assignment. Either check or supply the appropriate response.

1 Educational background (College)
( ) Bachelors Degree
( ) Masters Degree
( ) 20 semester or 30 quarter hours beyond Masters Degree

2 Major field of study in college
( ) Industrial Arts
( ) Vocational Education
( ) Others - List ____________________

____

3 Number of years teaching experience in Industrial Arts prior to this school year.

____

4 Are you certified to teach vocational classes?
( ) No ( ) Yes
( ) Check if currently teaching reimbursed vocational classes.

5 Check all the grades in which you are currently teaching Industrial Arts classes.
6 ( ) 6th grade & below
7 ( ) 7th grade
8 ( ) 8th grade
9 ( ) 9th grade
10 ( ) 10th grade
11 ( ) 11th grade
12 ( ) 12th grade
13 ( ) Other grade ____________

14 Technical area of highest competence and specialization. Example: woods, metals, drafting, etc.
15

____

16 Check all the technical areas in which you give instruction in the laboratory or shop where you do most of your teaching.
17 ( ) Woodworking
18 ( ) Metalworking
19 ( ) Graphic Arts
20 ( ) Auto and power mechanics
21 ( ) Electricity or electronics
22 ( ) Drafting
23 ( ) Materials testing
24 ( ) Plastics
25 ( ) Leather
26 ( ) Ceramics
27 ( ) Textiles
28 ( ) Photography
29 ( ) Jewelry
30 ( ) Other areas
31 ( ) ____________________
32 ( ) ____________________

40

Part II INDUSTRIAL ARTS STUDENT ACTIVITY AND BEHAVIOR INVENTORY

INTRODUCTION: As a teacher in the field of Industrial Arts you are asked to indicate the general degree to which you encourage your students to exhibit the type of behavior described in each of the following series of behavioral statements. Since these statements are rather general in nature, please respond to them regardless of your specific technical area of teaching, such as: drafting, metals, woods, general shop, etc.

SPECIFIC DIRECTIONS

A. For each statement please indicate the degree of your encouragement by encircling the appropriate code letter preceding each statement as illustrated in the following two sample items.

	NEVER	SOMETIMES	USUALLY	ALWAYS	
I	N	S	U	A	encourage students to observe all safety rules and regulations.
I	N	S	U	A	encourage students to assist other students with their work.

B. Please circle just one code letter N - S - U - A for each item.

C. Please respond to all items.

INVENTORY ITEMS

LEAVE BLANK		NEVER	SOMETIMES	USUALLY	ALWAYS	
1 ______	I	N	S	U	A	encourage students to value their own growth and development.
2 ______	I	N	S	U	A	encourage students to think of many ideas about how to get something done.
3 ______	I	N	S	U	A	encourage students to reject a proven solution to a problem and take a chance that they will find another solution.
4 ______	I	N	S	U	A	encourage students to sketch three or more tentative design ideas before making a specific project.
5 ______	I	N	S	U	A	encourage students to think through their suggestions before making them.
6 ______	I	N	S	U	A	encourage students to accept things as they are.
7 ______	I	N	S	U	A	encourage students to suggest ways they might improve a project if they were to make it again.
8 ______	I	N	S	U	A	encourage students to explore and experiment with clever or uncommon project design ideas they have.
9 ______	I	N	S	U	A	encourage students to use their first solution to a design or fabrication problem.
10 ______	I	N	S	U	A	encourage students to suggest only ideas and solutions that they think have merit.
11 ______	I	N	S	U	A	encourage students who approach a problem in a different way from the rest of the group or class.
12 ______	I	N	S	U	A	encourage students to exercise caution in looking for problems, since more than enough will usually come up anyway.
13 ______	I	N	S	U	A	encourage students to be sure an idea is workable before suggesting it.
14 ______	I	N	S	U	A	encourage students who always look for problems.
15 ______	I	N	S	U	A	encourage students to rely upon the greater experience of others when confronted with a problem.
16 ______	I	N	S	U	A	encourage students to select and execute quantity production projects in the laboratory.
17 ______	I	N	S	U	A	encourage students to try out construction operations on scrap material before using them on a project.
18 ______	I	N	S	U	A	encourage students to explore several possible courses of action before selecting the most effective.
19 ______	I	N	S	U	A	encourage students to try out a wild or silly idea.
20 ______	I	N	S	U	A	encourage students to arrange in a workable sequence their plan of procedure for making a project.
21 ______	I	N	S	U	A	encourage students to feel, handle and manipulate all kinds of materials and objects.
22 ______	I	N	S	U	A	encourage students to accept the obvious answer.
23 ______	I	N	S	U	A	encourage students who make more suggestions than they can immediately use.
24 ______	I	N	S	U	A	encourage students to be satisfied only with their highest quality of work.
25 ______	I	N	S	U	A	encourage students to question the obvious.

____ I N S U A encourage students to take a basic idea for the solution of a design problem and then vary it in different ways.

____ I N S U A encourage students to try out a hunch just to see what will happen.

____ I N S U A encourage students to recognize and develop the abilities and strengths they possess.

____ I N S U A encourage students to stick to the tried and true way of doing things.

____ I N S U A encourage students to run around in the shop or laboratory.

____ I N S U A encourage students to critically analyze and evaluate themselves.

____ I N S U A encourage students to work on problems where the outcome is unpredictable.

____ I N S U A encourage students to experiment with an idea that may have no practical meaning for anyone else.

____ I N S U A encourage students who suggest a radical idea or solution to a problem.

____ I N S U A encourage students to proceed first with the initial solution to a problem when another becomes evident during the process.

____ I N S U A encourage students to try out many possible solutions for problems.

____ I N S U A encourage students to meditate and mull over problems or possible solutions to problems.

____ I N S U A encourage students to express all the ideas they might have about a possible solution to a problem.

____ I N S U A encourage students to develop short cut methods of performing a technical operation.

____ I N S U A encourage students to devise many solutions to a problem with specified properties, for example: design a container that will hold a liquid and can be folded up or collapsed.

____ I N S U A encourage students to express only sensible ideas.

____ I N S U A encourage students to propose entirely new approaches to a problem.

____ I N S U A encourage students to increase their speed, accuracy and efficiency when performing specific hand or machine tool processes.

____ I N S U A encourage students to make decisions independent of others.

____ I N S U A encourage students to ask questions about things that seem obvious to others.

____ I N S U A encourage students to become familiar with the many different industrial enterprises within their own community.

____ I N S U A encourage students to suggest the use of materials in an unconventional manner.

____ I N S U A encourage students to improvise if they do not have the correct tool for the job.

____ I N S U A encourage students to tackle a job that possibly involves many unknown difficulties.

____ I N S U A encourage students to visit local manufacturing concerns on their own.

____ I N S U A encourage students to suggest unusual or different combinations of materials.

____ I N S U A encourage students to use existing designs and plans for projects.

____ I N S U A encourage students to use materials only for the purpose they were intended.

____ I N S U A encourage students to avoid making mistakes by making projects that have been made before.

____ I N S U A encourage students to outline a plan of procedure for making a project and not deviate from it.

56 ________ I N S U A encourage students to perfect a limited number of tool skills to as high a level as possible.

57 ________ I N S U A encourage students to suggest alternate operational plans of procedure when planning a project.

58 ________ I N S U A encourage students to work with a material or engage in an activity where they have had little or no previous experience.

59 ________ I N S U A encourage students to suggest many alternate uses for fastening devices such as a: nail, screw, staple, cotter-key, etc.

60 ________ I N S U A encourage students to learn as much as they can.

61 ________ I N S U A encourage students to select a national industrial corporation, find out all they can about it and make a report to the class.

62 ________ I N S U A encourage students to accept things as they are instead of looking for problems.

63 ________ I N S U A encourage students to feel, smell and taste, where possible, the various materials they use in the laboratory.

64 ________ I N S U A encourage students to relate and compare the techniques and processes used in industrial arts laboratories with those employed in industry.

65 ________ I N S U A encourage students to recognize that a construction problem has a limited number of possible solutions.

66 ________ I N S U A encourage students to suggest new ways of joining materials.

67 ________ I N S U A encourage students to express their individual likes and dislikes about an activity or area of work.

68 ________ I N S U A encourage students to suggest how a particular hand tool might be improved.

69 ________ I N S U A encourage students to try something which has not occurred to others to try.

70 ________ I N S U A encourage students to apply the initial solution they think of to solve a problem.

71 ________ I N S U A encourage students to fool around with new ideas even if they turn out later to be a total waste of time.

72 ________ I N S U A encourage students to sketch on paper as many tentative problem solutions as possible before executing a particular solution.

73 ________ I N S U A encourage students to accept their final solution to a problem as the best solution possible.

74 ________ I N S U A encourage students to follow all instructions without question.

Part III INDUSTRIAL ARTS OBJECTIVE EMPHASIS

DIRECTIONS: Please read the following three statements of typical Industrial Arts objectives.

51 A. To develop the students ability to perform skillfully hand or machine operations with tools and materials and to increase their knowledge of the working qualities, characteristics and problems encountered while working with tools and materials. 1 2 3

52 B. To help students understand their capabilities and limitations, likes and dislikes, strengths and weaknesses and therefore gain a better understanding of themselves and their potentiality. 1 2 3

53 C. To develop the students ability to interpret and understand industry and the role it plays in our industrial society. 1 2 3

DIRECTIONS: Now having read these three objectives of Industrial Arts, please rank them in order according to the degree of emphasis you give to each in your Industrial Arts classes. Please circle one number after each statement and only use a number once for all three objectives. **Note:** Number one (1) indicates the highest degree of emphasis.

Signature ______________________________
Optional

THANK YOU FOR YOUR COOPERATION

MICHIGAN STATE UNIVERSITY EAST LANSING

COLLEGE OF EDUCATION

APPENDIX E_2

COVER LETTER

Although there are numerous demands on your time, will you please take a few minutes for a task which may improve the image of industrial arts education among teachers, counselors, administrators and the general public.

As you are aware, in recent years there has been frequent criticism of what many call the frill subjects or programs of education. With the current emphasis being placed on science, math and foreign languages; industrial arts and other programs often find it increasingly difficult to maintain strong acceptance and respectability within the total school program. A major source of this criticism stems from a general lack of knowledge and understanding of the type and range of activity and behavior you and other industrial arts teachers develop in your classrooms.

The enclosed questionnaire is part of a study being conducted to determine the type and range of student behavior that is being encouraged and developed daily by industrial arts teachers in their classrooms.

Your response, as a member of a small but carefully selected group of industrial arts teachers, to the attached questionnaire should provide valuable information about the type of activity and behavior teachers encourage their students to exhibit in the classroom. As a result, you will help inform educators and the general public of some significant but not always apparent outcomes of industrial arts programs.

Will you cooperate in this investigation by completing the attached questionnaire at your earliest convenience and returning it to me in the self-addressed envelope provided for your convenience? In return for your consideration of this questionnaire a summary of the results will be made available to you.

Your name need not be signed to this questionnaire unless you so desire. The identity of individual teachers is not sought and if such identity is revealed, it will be held in strict professional confidence.

Thank you for your help and cooperation.

Sincerely yours,

Kenneth R. Clay

Kenneth R. Clay, Instructor
Industrial Education

APPENDIX E_3

FIRST FOLLOW-UP PRINTED POST CARD

Dear Industrial Arts Teacher:

Within the past week you received an important questionnaire that is part of a study to determine the type and range of activity and behavior teachers encourage and develop in their classrooms.

YOUR RESPONSE IS IMPORTANT. If you have already returned your questionnaire, please accept my thanks. If not, won't you take a few minutes to complete it so your response can be used to help inform educators and the public of some significant, but not always apparent outcomes, of industrial arts programs.

Thank you for your anticipated prompt response.

Kenneth R. Clay, Instructor
Industrial Education
Michigan State University

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MICHIGAN STATE UNIVERSITY EAST LANSING

COLLEGE OF EDUCATION

APPENDIX E_4

LETTER FOR SECOND FOLLOW-UP

Several weeks ago you received a form entitled, "Industrial Arts Activity Questionnaire" which you were encouraged to complete and return. In addition, you have also received a postal card thanking you for responding or asking you to complete the questionnaire if you had not already done so.

While the response has been gratifying, it is important that the opinions and reactions of everyone in this carefully selected sample be surveyed in order to obtain an accurate and complete picture of the range of activities and behavior Industrial Arts teachers encourage and develop in their laboratories.

Remember:

1. Your responses will be kept completely CONFIDENTIAL.

2. Your answers are IMPORTANT if the results are to show the complete picture.

3. Data from this study can be used to help inform educators and the public of some significant, but not always apparent, outcomes of Industrial Arts programs.

4. Your EXPERIENCE AND OPINIONS are needed.

5. A summary of the results will be made available to you.

If you have completed and mailed your questionnaire, please accept my sincere thanks and appreciation. In case the previous form has been lost or mislaid, an additional copy is enclosed.

Please complete and return this questionnaire in the enclosed stamped envelope today. Won't you take the time to help achieve an improved and more accurate understanding of our professional field?

Sincerely yours,

Kenneth R. Clay, Instructor
Industrial Education

APPENDIX E_5

THIRD FOLLOW-UP PRINTED POST CARD

YOUR HELP IS NEEDED!

To date the response has been excellent to the Industrial Arts Activity Questionnaire which you received a few weeks ago. I hope that your reactions are included among the 70 percent who have responded. If not, won't you share your opinions so they can be included with others when the final tabulation is made.

Please answer your questionnaire and mail it today. I shall personally appreciate your assistance in helping achieve a representative return.

Sincerely yours,

Kenneth R. Clay, Instructor
Industrial Education
Michigan State University

APPENDIX F

INTER-ITEM CORRELATION MATRICES

F_1 CREATIVE SCALE

F_2 FACTORS OF FLUENCY AND PROBLEM SENSITIVITY

F_3 FACTORS OF ORIGINALITY AND FLEXIBILITY

APPENDIX F_1

CORRELATION MATRIX*

CREATIVE SCALE BEHAVIORAL ITEMS

Item No.	2**	3	4	7	8	11	14	18	19	20	21	23	25	26	27	28	32	33	34	36	37	38	39	40	42	44	45	47	48	49	51	57	58	59	63	66	68	69	71	72	75	76
2
3	22
4	20	09
7	23	08	15
8	20	24	32	25
11	18	27	11	09	32
14	06	04	-09	08	01	15
18	22	07	20	30	29	24	13
19	13	29	10	22	25	21	23	29
20	18	-08	19	23	09	10	09	27	11
21	18	10	11	12	22	13	17	19	15	10
23	09	12	02	05	14	24	18	11	33	-04	15
25	13	21	00	09	08	15	31	26	19	18	19	05
26	13	08	14	08	32	21	07	28	17	07	12	12	11
27	16	24	03	00	22	17	10	31	41	03	18	20	10	19
28	09	08	-11	03	03	19	23	27	21	09	18	08	12	13	16
32	21	26	02	12	25	23	04	30	31	06	21	23	22	11	42	20
33	13	19	13	25	26	31	13	28	52	18	19	40	22	18	32	20	48
34	23	24	21	05	20	35	11	28	45	15	19	33	16	16	27	24	43	52
36	23	03	30	13	29	29	14	34	29	14	20	20	10	20	22	16	28	24	24
37	23	11	15	17	16	27	17	22	22	18	13	15	15	-03	06	27	29	28	36	44
38	31	-01	28	14	20	31	16	25	19	25	25	11	08	17	12	16	15	25	26	45	40
39	12	09	02	-04	18	15	17	02	29	-10	12	17	02	08	16	17	24	08	27	33	31	15
40	34	15	13	15	33	19	08	32	30	12	24	[illegible]	13	28	15	26	36	30	35	37	28	28	30
42	13	22	26	11	38	29	14	22	22	10	20	16	18	15	21	14	21	24	30	23	19	27	16	28
44	09	04	12	12	13	17	20	31	13	20	24	19	13	01	10	23	13	21	21	21	26	23	24	09	27
45	10	07	05	04	06	18	12	10	04	08	28	15	08	10	10	17	12	11	18	15	05	20	25	08	13	23
47	6	21	03	06	27	27	24	13	41	19	21	31	19	01	23	23	25	43	50	24	28	16	20	20	30	23	14
48	08	04	00	13	10	16	31	14	16	07	30	12	03	-04	09	21	06	12	08	20	18	05	22	18	12	11	13	24
49	06	14	00	05	03	13	12	14	20	13	15	09	16	01	28	21	46	25	29	30	23	07	19	19	24	12	16	31	35
51	18	04	16	06	20	33	13	29	24	15	27	20	20	16	18	17	17	31	33	20	18	24	15	25	35	09	21	35	28	19
57	22	11	12	18	19	18	15	24	24	23	12	05	19	17	08	08	21	25	15	25	27	25	07	23	19	13	03	33	23	24	21
58	03	12	00	04	11	11	10	08	19	06	15	12	09	06	09	07	15	21	15	04	12	05	02	02	15	08	21	28	18	20	22	11
59	23	00	09	20	02	12	28	24	06	14	21	04	09	11	05	19	09	12	04	30	13	29	05	28	13	12	13	10	29	14	26	36	23
63	08	11	09	08	15	14	15	13	13	26	29	12	30	02	-03	09	07	17	07	02	13	15	-03	09	10	14	03	12	10	-01	25	20	06	08
66	33	17	20	13	22	23	14	25	14	17	08	09	19	18	11	10	10	22	16	24	09	28	-01	29	28	13	07	29	20	10	41	39	02	48	15
68	17	02	08	29	22	10	14	35	26	26	23	01	33	24	11	25	20	25	24	19	12	30	03	34	21	27	09	25	10	12	28	44	-02	34	11	46
69	23	17	24	10	27	26	19	32	34	24	26	20	27	16	32	31	39	33	39	32	28	27	23	33	34	29	11	21	18	22	31	26	11	28	26	30	37
71	15	20	15	08	26	30	10	27	38	13	28	23	09	18	35	17	39	39	38	31	16	22	30	32	28	16	19	37	20	31	33	25	19	11	02	15	24	46
72	28	11	43	17	26	16	-01	21	16	29	16	-03	16	22	08	04	14	19	17	30	17	32	09	31	25	17	07	17	04	15	34	30	07	32	13	33	35	34	35
r with total creative scale	75	43	31	34	32	49	50	30	54	54	35	45	34	37	34	41	37	51	59	59	56	48	51	36	56	52	40	32	55	38	43	57	50	29	44	31	49	53	63	58	50
r with total non-creative scale	76	-03	-22	-19	01	-18	-18	09	-19	-30	-01	-14	-13	-21	-09	-15	-11	-16	-17	-32	-11	-16	-12	-07	-08	-21	-09	-10	-34	-08	-08	-23	-20	-17	05	-08	-14	-17	-19	-20	-18	-30
$\bar{X}$ correlation	17	13	12	12	20	20	14	23	23	13	19	14	15	13	17	16	22	25	25	23	20	21	14	23	21	17	12	25	15	19	24	20	11	17	12	20	22	26	23	20

*All correlations have been rounded to two significant places and decimal points have been omitted.

**Numbers correspond to the numbers of the creative scale items on the final inventory form in Appendix E.

APPENDIX F_2

CORRELATION MATRIX*

Fluency Creative Behavior Items

Item No.	2**	4	23	36	38	40	59	72
2								
4	20							
23	09	02						
36	23	30	20					
38	31	28	11	45				
40	34	13	13	37	28			
59	23	09	04	30	29	28		
72	28	43	-03	30	32	31	32	
$\bar{X}_r$ Fluency Scale	24	21	8	31	29	26	22	28
$\bar{X}_r$ Entire C scale	17	12	14	23	21	23	17	23

CORRELATION MATRIX*

Problem Sensitivity Creative Behavioral Items

Item No.	7**	14	18	20	25	45	68
7							
14	08						
18	30	13					
20	23	09	27				
25	09	31	26	18			
45	04	12	10	08	08		
68	29	14	35	26	33	09	
$\bar{X}_r$ Prob. Sen. Scale	17	18	24	19	21	9	26
$\bar{X}_r$ Entire C_{scale}	12	14	23	13	15	12	22

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*All correlations have been rounded to two significant places and decimal points have been omitted.

**Numbers correspond to the numbers of the creative scale items on the final inventory found in Appendix E, page 242.

APPENDIX F_3

CORRELATION MATRIX*

Originality Creative Behavioral Items

Item No.	8**	11	19	33	34	39	42	44	49	66	69	71
8												
11	32											
19	25	21										
33	26	31	52									
34	20	35	45	52								
39	18	15	29	08	27							
42	38	29	22	24	30	16						
44	13	17	13	21	21	24	27					
49	03	13	20	25	29	19	24	12				
66	22	23	14	22	16	-01	28	13	10			
69	27	26	34	33	39	23	34	29	22	30		
71	26	30	38	39	38	30	28	16	31	15	46	
$\bar{X}_r$ Originality Scale	23	25	28	30	32	19	27	19	19	17	31	36
$\bar{X}_r$ Entire C_{scale}	20	20	23	25	25	14	21	17	19	20	26	23

CORRELATION MATRIX*

Flexibility Creative Behavioral Items

Item No.	26	47	48	51	57
26					
47	01				
48	-04	24			
51	16	35	28		
57	17	33	23	21	
$\bar{X}_r$ Flexibility Scale	8	23	18	25	24
$\bar{X}_r$ Entire C_{scale}	13	25	23	24	20

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*All correlations have been rounded to two significant places and decimal points have been omitted.

**Numbers correspond to the numbers of the creative scale items on the final inventory found in Appendix E, page 242.