# AN INVESTIGATION OF CREATIVE THINKING AMONG COLLEGE STUDENTS

DISSERTATION

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# INTRODUCTION

Human beings have always been intrigued by their own creativity and the creativity of their species; they have always been puzzled by the forces which lay behind a work of art, a new idea, a scientific theory or invention. Indeed, there is an extensive literature concerned with the dynamics of creative persons - a large segment of it by outstanding writers; much of it based upon the introspection of creative persons into their own thought processes.

Writers of biographical studies of persons often characterized as geniuses are, and have always been, virtually forced to attempt subjective explanations of the creative process, by imputing certain effects to the person's temperament, cognitive abilities and environmental influences.

It was Freud's work more than that of any single person of his time which offered an escape from such subjective limitations by systematically observing, isolating and defining regularities which appeared as the data of his psycholanalytic probing into the unconscious. Freud discovered much which sheds light on the many facets of

creativity emerging as functions of psychological abnormality and, though his interest in creativity apart from this relation was only slight, he made it seem possible to isolate the variables of creativity empirically and to systematize behavioral regularities inductively.

To the present most work done in the field of creativity tends to fall rather exclusively into two classes. It has been:

(a) Theoretical, subjective, introspective, on the one hand...

(b) overt, empirical and inductive, on the other.

A glaring lack in this sphere of endeavor is the dearth of systematic study which fruitfully combines introspective theorizing with systematic empirical observation.

Moreover, a great proportion of the work which deserves to be called scientific and thorough, although it lies in or closely borders the domain of creativity, has emphasized the abnormal or pathic manipulations of creativity. The results of this work may well need to be reevaluated from a focus of interest upon <u>creativity</u> in distinction to <u>abnormality</u>.

The twentieth century with all its promise and its problems is, above all, an era of "new kinds," a century of radical directions, and not at all as many would think simply a period of greater qualities and higher velocities. Current

views of the atom and nuclear particles are not mere refinements added to Newton's thought; the categories themselves are different. Science has had to change its manner of looking upon matter, time, space and number.

The problems which characterize our century are not less obvious: the possibility of erasing half the earth with nuclear arms within a moment's notice; the effect of radiation on genetics; one machine replacing hordes of workers; the barely credible acceleration of the birth rate. Such problems have been produced largely be "new ways of thinking." Perhaps only new ways of thinking can offer successful solutions.

Educators of the future will need to know what is required to foster the creative abilities upon which resolutions of these pressing problems depend. They will need to know in what ways these abilities are made steril, frustrated or blocked. They will need to know about the polarities of some of the functions of creativity in order to reinforce the productive and positive qualities. The following study may help to shift the focus of thinking about creativity by attempting to isolate and define its components, by determining the interrelations among them, and by pointing out some of the temporal and enviromental conditions which influence them.

## Chapter 1

## REVIEWING THE LITERATURE

The literature concerning creativity deals with three major areas: (1) the individual and his characteristics, (2) the processes through which he arrives at the creative product and (3) the environment with its facilitating or inhibiting effect on creativity or the relationship of creativity to the transactions between the individual and his environment.

The most striking features of the literature on creativity are the approaches that investigators have taken, the variety of results that have been obtained, and the numerous factors about which suggestions and speculations have been made. For example, there are those who follow a priori frame s of reference while others investigate problems in this area from an entirely empirical reference. Some have designed experiments, used psychological tests, conducted interviews, or employed some combination of these approaches, while others have speculated about creativity on the basis of biographies they have read or experiences

they have had.

Among these investigators, the criteria for a creative person vary widely: some select their subjects on the basis of scores on intelligence tests; others use the number of citations or the number of lines devoted to a person in histories or biographies. A third group utilizes the judgments of professionally qualified people, a fourth group concerns itself with people of generally acknowledged "eminence," and a fifth group studies persons engaged in professions that require creative behavior.

Creativity in the arts and sciences has been studied and a variety of personality characteristics and factors motivating creative individuals in these fields has been isolated. One person or another has argued the importance of pregenital drives, defense mechanisms, defenses against defenses, insanity, sanity, the desire for immortality, the need for order, the significance of sublimation, and the importance of self actualization. There are those who believe that creativity or creative potential exists in each of us. There are others, however, who criticize this group for permitting their democratic ideology to affect the study of the problem and who insist that few among us are "truly creative." There are those who place major emphasis on hereditary factors as well as some who believe these factors overrated.

## The criterion problem and other problems in the study of creativity

The criterion problem --- How to identify the creative person and the level of creativity achieved is one of the most critical questions in the investigation of creativity. Any study of creativity involves a set of assumptions concerning the identification of the creative individual and his work. No single criterion has been used by all investigators. For example, Terman (1), Guilford (2), and Barron (3), used statistical definitions involving deviations on psychological tests; Cattell (4), Galton (5) and Lehman (6), used number of citations or number of lines devoted to a person in general texts, histories, or biographies. Roe (7) and Stine (8) used judgments of professionally qualified people; Freud (9) and Sharpe (10) used generally acknowledged eminence as in the cases of da Vinci and Shakespeare. Rossman (11), used the number of products defined as creative, and Eiduson (12) used the pursuit of an activity, such as painting or music, assumed to require creative behavior.

## The creative individual and his characteristics

This topic includes many theoretical and speculative as well as empirical investigations and involves case studies concerning the personality characteristics of creative individuals as well as factors that motivate them.

From the a priori side come many explanations of creativity. From one point of view, it is the outcome of

a drive or a manifestation of an innate orientation toward self-actualization; Goldstein (13), Maslov (14), and Rogers (15), for example, took this direction. In his article, "Toward a Theory of Creativity," Rogers defined the creative process as "the emergence in action of a novel 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." He considered the motive for creativity to be "man's tendency to actualize himself, to become his potentialities." According to Rogers, the potentiality for creativity exists in everyone and awaits only the proper conditions to be released and expressed. Destructive and antisocial forms of creativity are seen as a consequence of denial to awareness, or repression, of large areas of experience. Experience in psychotherapy has shown that "when the individual is 'open' to all his experience.....then his behavior will be creative, and his creativity may be trusted to be essentially constructive." The fully-aware individual recognizes the demands of the culture, his behavior is socialized, though not necessarily conforming.

Rogers identifies three inner conditions of constructive creativity:

1. "openness to experience," which includes "lack of rigidity and permeability of boundaries in concepts, beliefs,

perceptions and hypotheses," "tolerance for ambiguity," and the "extensional orientation"; 2. "an internal locus of evaluation," the acceptance of one's evaluation as a part of one's self and independent of outside valuations; and 3. "the ability to toy with elements and concepts," the capacity to combine elements in new ways, "to shape wild hypotheses."

Rogers concludes that creativity may be fostered by the establishment of "psychological safety" and "psychological freedom." Psychological safety is established by a. "accepting the individual as of unconditional worth," b. "providing a climate in which external evaluation is absent," and c. "understanding empathically." Psychological freedom is accomplished through the absence of restraints on symbolic expression.

A second viewpoint, taken by Abraham (16), Brill (17), and Freud (18), regards creativity as an outcome of the individual's capacity to sublimate his pregenital sexual drives.

The stance taken by Fairbairn (19), Lee (20), and Sharpe (21), gives a central role to the individual's destructive impulses and his capacity to make restitution for them through creative work. Aside from these broader orientations, a variety of motivational factors is regarded as characteristic of the creative individual. Adler (22),

for instance, discusses compensation for inferiority. Jones (23), parturition for wishes, and Rank (24), the desire to immortalize oneself.

In addition, various personality characteristics: discontent, fault-finding, initiative, flexibility, etc., have been taken as a basis by Hatfield (25), who, in his discussion of the nature of invention, develops the point of view that human invention is continuous with evolution. "No dividing line can be drawn at any point between the highest development of human invention and the invention by other forms of life of devices which are of useful, and sometimes even of a purely pleasurable characteristic." Although the law recognizes a special faculty that differentiates the inventor from a "person skilled in the art." Hatfield finds this faculty is not revealed by an examination of either the inventor or the invention. His view is that creation is the conceiving of new forms and that civilization develops and advances from the work of individuals who jump ahead of learned habits into new arrangements which they organize and put into practice. He believes that all creative work takes place in the unconscious, which, in response to a gap in knowledge, about which the individual has intense interest, offers a suggestion or vision of a new form.

An examination of the qualities of the inventor reveals

him to be discontent, a fault-finder, a reactor, or a rebel. He displays initiative, is flexible, and shows a lack of concern for social convention. He is self-determined, enthusiastic, even passionate in his regard for his art or science, yet possesses tremendous staying power and the ability to face unpleasant facts.

Empirical investigations of creativity are divided into groupings primarily on the basis of the type of individual investigated. One grouping, for instance, concerns itself with studies of persons in a variety of different areas and studies of how various dimensions of creativity differ with differing personality characteristics. Other groupings are concerned with studies of creativity in specific areas. They include research on artists, biological and social scientists, engineers and physical scientists. The investigations vary with regard to their criteria of creativity as well as in their methods of study.

Some criteria utilized include: 1. assuming thos individuals to be creative who are in areas that may demand creativity, as in the research of Eiduson (26) and Rosen (27); 2. judgments, by persons regarded as qualified, of various individuals' creativity, as in Drevdahl (28), Roe (29) and Stine (30); 3. selecting as creative those persons who have produced many products defined as creative, as in Rossman's (31) research; and 4. as in Barron (32) assuming

individuals to be original or creative if their responses on psychological tests deviate from those usually given by other members of their group.

Starting from Barron's viewpoint and taking earlier research into account, five hypotheses were established for testing. These assumed that:

1. Original persons prefer complexity and some degree of apparent imbalance in phenomena (The Barron-Walsh Art Scale served as the measure).

2. Original persons are more complex psycho-dynamically and have greater personal scope. The measure employed was the rating of a psychiatric evaluation based on a two-hour interview concerning life history, etc.

3. Original persons are more independent in their judgment. Crutchfield's modification of the Asch experiment, and an "independence of judgment" inventory scale served as the measures.

4. Original persons are more self-assertive and dominant. A dominance-submission rating based on performance in psychodrama, the social dominance scale on the California Personality Inventory (CPI), staff ratings on dominance based on three days observations, and the Phallicism Scale of the Kraut Personal Preference Scale served as the measure of dominance.

5. Original persons reject suppression as a mechanism

for the control of impulse (the Policeman Interest Scale on Strong Vocational Blank, the early and the late anal scales from the Personal Preference Scale, and the Impulsivity Scale of the CPI, were used to test his hypothesis).

Only two of the instruments failed to confirm the hypothesis with which they were associated. These were the psychodrama dominance rating and the Self-Assertiveness Scale of the CPI. The results are discussed in the light of psycholanalytic theory concerning the anal phase of psychosexual development. It is suggested that, "Original persons, in adulthood, often like things messy, at least at first. The tendency (however) is toward a final order...." Viewed developmentally, the rejection of externally imposed controls at the anal stage is generalized to all forms of regulations of impulse by others, in favor of regulation of impulses by oneself.

To MacKinnon (33) "What seems to characterize the creative person - and this is especially so for the artistically - is a relative absence of repression and suppression as a mechanism for the control of impulse and imagery. Repression operates against creativity, regardless of how intelligent a person may be, because it makes unavailable to the individual large aspects of his own experience...Disassociated items of experience cannot combine with one another; there are barriers to communication among different systems of

experiences. The creative person, given to expression rather than suppression or repression, thus has fuller access to his own experience, both conscious and unconscious. Furthermore, because the unconscious operates more by symbols than by logic, the creative person is more open to the perception of complex equivalences in experience, facility in metaphor being one specific consequence of the creative person's greater openness to his own depth."

It is probably only a layman's idea that the creative individual is peculiarly gifted with certain qualities that ordinary people do not have. This conception can be dismissed by psychologists, very likely with common consent. The general psychological conviction seems to be that all individuals possess, to some degree, all abilities, except for the occurrence of pathologies. Creative acts can, therefore, be expected, no matter how feeble or how infrequent, from almost all individuals. The important consideration here is the concept of continuity. Whatever may be the nature of creative talent, those persons who are recognized as creative merely have more of what all of us have, at least, in the germ. It is this principle of continuity that makes possible the investigation of creativity in people who are not necessarily distinguished for it.

The creative process

The problem of learning more about the creative process

has been complicated by the multiplicity of meanings attached to such terms as creative thinking, creativity, creative, and creative processes, and by the great diversity of behavior and events to which they are applied. These conditions have made extremely difficult the possibility of integrating the findings of different thinkers and investigators.

A few examples of the diverse meanings of "creative process" are listed below.

1. The outflow of energy of individuals or groups through which a product is structured (34).

2. An action of the mind that produces a new idea or insight (35).

3. The mental process of manipulating the environment which results in the production of new ideas, patterns or relationships (36).

4. The capacity to produce through thought or imagination the capacity for original work (37).

5. The e rgence in action of a novel relational product, growing out of the uniqueness of the individual, on the other hand, and the materials, events, people or circumstances of his life, on the other(38).

6. The mental process that involves the rearrangement of past experience, with possibly some distortion, into new patterns the better to satisfy some expressed or

implied need (39).

7. The process which results in a novel work that is accepted as tenable or useful or satisfying by a group at some point in time (40).

8. The creative process is any process by which something new is produced - an idea or an object including a new form or arrangement of old elements. The new creation must contribute to the solution of some problem (41).

It will be observed that the production of something is a central element in all of these definitions and that creativity as a process is inferred from the product.

The problem involved in arriving at an adequate formulation of what is meant by "new" has been treated in an article on originality by Wilson, Guilford and Christensen (42), in which the alternative possibilities of new to society or new to the individual, are explored and some suggestions for testing its originality are presented.

As implied in several of the above-mentioned definitions, creativity in adults is usually evaluated in terms of a social criterion. The evaluation of the newness of an idea or object is usually based on the alternative of new to a society or at least new to the group doing the evaluation.

In evaluating creativity in children, it is more customary to adopt a psychological criterion in which major

emphasis is placed on the newness of an idea or object to the individual who produced it, or a modified social criterion, in which the work is evaluated in relation to the work of other pupils in the same class.

Several methods have been used to study the creative process. Patrick (43) and Wilson (44) used the interviews; Cowell (45), Hadamerd (46), Poincaré (47), Patrick (48), Spender (49), and Wilson (50), used introspective reports; Hutchinson (51), used questionnaires, and Eindhoven (52), Israeli (53), and Patrick (54), used the observations of individuals in "specially-designed situations" method; Arnheim (55) et al analyzed worksheets; Ghiselin (56), Krus (57), Kubie (58), and Murray (59), used general knowledge of experience with creative individuals.

Several authors have analyzed and described the creative process within the individual with varying degrees of specificity. Wallas (60), is one of the first to have characterized the process in terms of distinct stages which he named preparation, incubation, illumination, and verification. In his book, The Art of Thought, he explained that, if the individual is to control the most important elements in his intellectual processes, he should "begin by forcing himself to realize the existence of an unbroken series of grades from unconsciousness up to the highest level of consciousness which man has yet reached." The Art of Thought

involves improving an already existing form of behavior by conscious effort.

Wallas presents the stages of forming a new thought as follows: a. preparation: the stage in which the problem is investigated from all directions; b. incubation: the stage during which the individual is not consciously thinking about the problem; c. illumination: the stage during which the "happy idea" occurs, together with psychological factors that immediately preceded and accompanied its appearance; d. verification: in which the validity of the idea is tested and the ideas reduced to exact form. Although these four stages can be distinguished from each other, they do not fit into a "problem and solution" scheme.

Wallas then concerns himself with how conscious effort can be brought to bear upon each of the four stages. The stage of preparation "includes the whole process of intellectual education." An important part of preparation is the preliminary regulation of thought, aids to which are: "the whole traditional art of logic, the mathematical forms which are the logic of the modern experimental sciences, and the methods of systematic and continuous examination of present or recorded phenomena which are the basis of..... 'observational science,' as well as the problem-attitude, or habit of setting the mind a clear question.

The incubation stage has two facets upon which we may

direct our attention: it may seem negative in that, while it prevails, an individual undergoing this phase does not consciously think of the problem which he has surveyed and relegated to the region of the unconscious. The other facet appears to be positive and may give rise to a series of "unconscious and involuntary (or conscious and fore-voluntary) events." Voluntarily abstaining from conscious thought may take two forms: turning to other conscious mental work or relaxing from conscious work altogether. The former type of abstention saves time and has a more salutary effect on the creative process. Wallas notes that it is often possible to get more results in the same time "by beginning several problems in succession, and voluntarily having them unfinished while we turn to others, than by finishing our work on each problem at one sitting." When working on more difficult problems, nothing should be allowed to interfere with the working of the unconscious or partially-conscious processes of the mind. Mental relaxation may require physical exercise.

The illumination stage is described by Wallas as an instantaneous "flash," which cannot, therefore, be influenced by the will. It is very difficult to observe our "fringe-consciousness" that precedes illumination, but some individuals have observed it. Wallas says, "I find it convenient to use the term 'Intimation' for that moment in the illumina-

tion stage when our fringe-consciousness of an associations-train is in the stage of rising consciousness which indicates that the fully conscious flash of success is coming." This "intimation" may involve an awareness of mental activity with no emotional coloring, or mental activity colored by the emotion which may have stimulated the thought or may have been stimulated by the train of thought. "If this feeling of Intimation lasts for an appreciable time, and is either sufficiently conscious or can by an effort of attention be made sufficiently conscious, it is obvious that our will can be brought directly to bear on it. We can at least attempt to inhibit or prolong, or divert, the brain-activity which Intimation shows to be going on... We can attempt to hold on to such a train on the chance that it may succeed." If, for example, the feeling of intimation occurs while reading, it is best to look up and avoid interference as well as to make a positive effort toward attention, sidetracking the danger of putting the thought into words before it is complete.

Interference by our will is not equally present to the same extent in all subject matters and at all stages of thought, nor to all elements in a complex thought process.

In dealing with emotion during intimation, "It is easier to retain an affect indirectly by concentrating attention on the sensation which may have stimulated it

than by attending directly to the affect itself." It can help the emotion to associate an image with it. The language used in thought may inhibit the thought if one tries to state it exactly or precisely and language with emotional associations may lead to new and vivid thoughts.

Taylor (61) suggests that some of the difficulty experienced in studying creativity has been a consequence of the failure to differentiate between the various levels at which individuals may be creative. He distinguishes five levels. The first level is "expressive creativity," which involves independent expression where skills, originality, and the quality of the product are important." This is exemplified in the spontaneous drawings of children. Taylor notes that creative experiences at this level are prerequisite to later, more advanced and more highly controlled creative achievement.

The second level, "productive creativity," is distinguished by the fact that the individual gains mastery over some portion of the environment and produces objects; "inventive creativity," the third, is marked by the presence of ingenuity in combining old parts for new uses though there is no contribution of new basic ideas. It is exemplified in the accomplishments of inventors, explorers, and discoverers: those who seek new ways of seeing old things.

Thos who make significant alterations in the basic foundations or principles of a theory have achieved the fourth, or "innovative creativity," level. This is attained by very few, for they must have highly developed abstract conceptualizing skills.

"Emergentive creativity," the highest level, is a rare occurrence, requiring as it does, the ability to absorb experiences which are commonly provided, and from these to produce something that is quite different. The formulations of Einstein, Freud, Picasso, and Wright are considered as representative of this level of creativity.

In discussing the relevance of these levels for the formulation of research problems, Taylor suggests that research be directed to the problem of identifying products or individuals at each level and the place of these levels in the development of creativity.

He gives special attention to plasticity in two aspects of the creative process: perception and communication, suggesting that "...creative persons will perceive a configuration in more possible ways and more quickly than less creative persons who tend to rigidly perseverate on their first impression." On the basis of his own research in non-verbal communication, he concludes that "...non-verbal forms of communication may be more effective in transmitting human thoughts and feelings than the familiar verbal

and formal types..."

Taylor's work encompasses three aspects of training for creativity: a. training in communication (in its broadest sense) and in understanding the basic assumptions underlying the linguistic of our communication system, b. learning to see things in structural or spatial relations, and c. gaining insight into the dynamics of the creative process. With respect to this latter point he concludes, "The great creative men have given ample evidence of their intimate psychological understanding of the very processes which allow them to be creative."

The environment and its effect on creativity

Among psychologists, who tend to stress the effect of environment and climate upon creativity, Thurstone (62) says, "Even though we are ignorant about the nature of creative talent, we can be pretty sure it can be encouraged or discouraged by environmental conditions."

Those who are responsible for the continuing care and cultivation of personality, or for explaining changes in personality effected by the cultural or physical surroundings are likely to favor an environmental approach to these problems.

Concerning the perennial question of the primacy of hereditary or environmental factors in determining an individual's primary intellectual abilities, there are those

who maintain that a creative genius is due entirely to a lucky accident of a certain unique combination of genes. At the other extreme, G. A. Ferguson (63), proposed that the primary abilities are generalized learned habits or skills produced by certain kinds of practice. Guilford (64) takes an intermediary position, believing that although heredity probably does determine both upper and lower limits within which development can occur, experience or learning may have considerable room within which to operate and to produce results. However it may be, the finding of a very large number of distinct intellectual abilities definitely means that the combined effects of heredity and learning do not produce uniform results in all areas of mental functioning.

Mooney (65) presented a model with the purpose of integrating four different, and often antagonistic, approaches to the problem of creativity. These deal with the environment, the person, the process, and the product involved in the creative act. He concludes that educators, managers, and social scientists are the ones interested in the environmental milieu in which the creation takes place, the first two with an end to influencing it and the third with an end to studying it. The personnel manager and the psychologist are likely to be interested in the personal characteristics of the creative person. Creative people,

themselves, will be interested in the creative process in general as a means toward enriching their own. Finally, the administrator of a business enterprise or public institution will concern himself with the creative product itself, and will measure the man, the process, and the environment by the product.

These four approaches to creativity correspond to four aspects of life itself: (1) the environment, (2) the culture, (3) the transactions between the two, and (4) the consequent adaptations. To every organism there corresponds an environment which it assimilates and with which it maintains dynamic equilibrium. The organism, itself, influences the environment, belongs to it, extends its being into it. There is thus a dynamic interplay of forces, for which the organism itself is the stage. Finally this process has an end: the inclusion of materials necessary, or at least compatible, with organization, and the exclusion of materials that are incompatible, and a resulting synthesis. Only when these four aspects of an organism are dealt with, can there be a well-rounded description and explanation.

The creative person is essentially the embodiment of all these characteristics in heightened form. He is open to the environment, yet tries to develop his potentialities as he conceives them and to maintain his individuality even as he imposes discipline upon himself. He seeks to make

his experiences more meaningful by increasing his sensitivity.

Stein (66), taking another approach to the subject, defines the creative product as a "novel work that is accepted as tenable or useful or satisfying by a group at some point in time"; he goes on to clarify and expand each part of this definition.

By "novel" he means a deviation from the status quo. It represents a reintegration of existing materials or knowledge for the production of something new. It is a consequence of interaction between a creative individual and his environment. The psychological characteristics which distinguish the creative individual are: 1. a heightened sensitivity to gaps or disequilbria in the environment, 2. a capacity to tolerate ambiguity, or to "live with" the disequilibria until they can be effectively resolved. 3. the capacity to generate hypotheses toward the resolution of the problem which is, in turn, dependent on the effective communication between the individual and his environment, and between some or all of the inner personal regions, 4. the capacity to test hypotheses generated, and 5. the ability to communicate the results to others.

In saying that the creative work is "tenable or useful or satisfying," Stein is covering the referent areas of ideas, things, and aesthetic experiences, respectively.

He stresses that the results of the creative process must be communicated to others. This implies two requisites: for the creative person: 1. he must have mastered a means, or medium, of communication and, 2. he must have eliminated from the creative product those elements that are completely idiosyncratic.

To say that the creative work must be accepted by some group implies that, in some way, it must be congruent with the needs or experiences of that group, i.e., that it "resonates" with these needs or experiences. The acceptance, in addition to defining the creative work, offers feedback to the creative person so that he can clarify, alter, or make progress in his future work.

In indicating that the creative work is accepted "at some point in time," provision is made for the fact that such products may be evaluated differently in different historical periods.

While he admits the possibility of "universals", Stein stresses the problematic aspect of defining them. In this regard, it is pointed out that the individual attempting to define them is himself bound to a particular historical period and its value judgments.

The culture exerts a variety of forces on the production of creative work. By providing or withholding freedom, it influences the opportunity of the individual to sense

the existing gap and to communicate his resolution of these restrictions. Through its child-rearing practices, it may influence the individual's sensitivity and his ability to effect resolutions.

The stage of culture development helps to define the areas in which problems will be seen and the means available for solving them; similiarly, the dominant philosophy of the culture may not only give direction to creative strivings, but may actually stimulate or impede the production of creative works.

The critic and partisan of creative endeavors are individuals representing foci of power over the directions of progress. They may determine the exposure of the culture to various creative products and may be the determining factors in whether some products are even created.

Stein concludes with a discussion of how stresses and strains within the culture may influence communication between the creative individual and the public. Special attention is given to the fact that the accepting public must have some of the same inner personal freedom as the artist if it is to appreciate his work.

Techniques and instruments used to investigate the creative individual and his characteristics, the nature of the creative process, and environmental influences

upon it are so various that a special chapter has been devoted to analyzing them.

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## Chapter 2

## VARIOUS APPROACHES TO THE STUDY OF CREATIVITY

As the foregoing review of the literature suggests creative thinking and creative behavior are complex phenomena. Taken together they constitute the irreducible expressive qualities of each personality in which the uniqueness of the individual dwells. The study of personality by psychologists has been made difficult and their data have been made provisional by the fact of this uniqueness and by its dynamic pattern of never being the same at different points in time. This irreducible nature of individuality, therefore, allows us to employ every legitimate method of analysis in its study.

Allport (1), for example, surveyed fifty-two methods which have been used in studies of personality which are equally valid for studies of creativity, though some are more applicable than others.

The methods which most readily adapt themselves to the study of creativity are most often used in combinations rather than as isolated approaches. The following are frequently employed with one or more of the others: (1) anal-

ysis of heredity, (2) study of the cultural setting, (3) analysis of biography and/or autobiography, (4) analysis of creative production, (5) questionnaire, (6) psychometric tests, (7) laboratory experiment, (8) factor analysis, (9) psychoanalysis, (10) projective test, (11) interview, (12) case study.

1. Analysis of Heredity

Sir Francis Galton, 1822-1911, (2), is remembered as the great proponent of a heredity-transmission theory of "man's natural abilities." His methods of study as well as his arguments antedate modern eugenic techniques. Galton's hypothesis was that man's natural abilities are inherited. This led him eventually to conclude that as the result of judicious marriages for several consecutive generations, there could be produced a highly gifted race of men who would possess peculiar powers enabling them to do whatever they were bred for. He tried to test his hypothesis by citing a large number of instances in which eminent men of his time had outstanding relatives. In presenting his argument, he explained the degree of selection implied by the words <u>eminent</u> and <u>illustrious</u>. He defined <u>eminence</u> in a very painstakingly analytical, biographical handbook, <u>Men of the Time</u>. It contains data about 2,500 American and continental celebrities whom the world had honored for their unusual abilities, skills, or

achievements. Galton selected from this list the names of those who had distinguished themselves either as leaders of popular or scholarly opinion, or those who had come to public notice as a result of their having produced what was held to be "original," usually as it pertained to what is called "catalogued knowledge," rather than to momentarily-sensational achievement.

One term of Galton's needs clarification: natural ability. By "natural ability," he meant "those qualities of intellect and disposition which urge and qualify a man to perform acts that lead to reputation...a nature which, when left to itself, will urged by an inherent stimulus, climb the path that leads to eminence, and has strength to reach the summit - one which if hindered or thwarted, will fret and strive until the hinderance is overcome and it is again free to follow its labour-loving instinct." (3)

The outcome of Galton's study allowed him to conclude "...no man can achieve a very high reputation without being gifted with very high abilities..." and "...few who possess these very high abilities can fail in achieving eminence."

Since Galton's time, several eugenic techniques of studying giftedness have come to be used: (1) analysis of record charts obtainable from eugenic associations, (2) studies in which the rearing of foster children is compared and contrasted with the rearing of children by their

biological parents, (3) studies of identical twins who have been reared apart. The study of foster children aimed to determine whether common environment is as important an influence as common heredity. The study of twins reared apart attempted to determine, in more nearly similiar ("identical") subjects, the reverse effect.

2. Studies of Cultural Setting

The objectives of this method are threefold: (1) to roote the production of invention and creative ideas in the social structure of the individual, (2) to uproot romantic notions concerning "the creator" and the unique world in which he supposedly lives, (3) to de-emphasize the roles of the unconscious, chance, and accident in the production of what is inventive or creative.

In 1935, Liphshitz (5) wrote an article in which he reviewed the current literature concerning invention. In it he decried almost total lack of understanding exhibited by most of these commentators concerning the social roots of inventions. He opened fire particularly on those who, in general histories or biographies, had pictured the inventor as "heroic" living almost in complete isolation from the world around him or as some "freak," far above the common herd of mankind though he may, almost mysteriously, produce inventions surprisingly related to human life. Liphshitz's argument, based on what appears to be

an intensive study of the history of inventions, is that inventions originate in response to social needs and that they require a sufficiently advanced stage of culture as well as proper technical heritage in that culture in order to make their appearance.

Guilfillan (6) examined the literature dealing with the production of inventions and found that wartime is a particularly unfavorable time for the creativeness of individuals, although the fields of transportation, communication and optics seem unusually full of successes during such a time. His explanation was that the occurrences form trends, adding to this corollary principle that an invention of importance is a multitudinous collection of smaller inventions.

Studies in such fields as art, literature and music usually take into account the social setting of creative work as well as the cultural backgrounds of the individuals who create. Recent books, particularly, attest to this: histories, appreciations, criticisms in their respective fields. Scholars have made use of numerous methods in such works: moreover, the more recent the work, the less limited in preconceived "rightness of method" the work is likely to be. The significant fact here is that there are such things as social roots of creativity and inventiveness; these roots have, more often than not, been recog-

nized in the literature of the arts as distinct from the literature of the sciences.

3. Analysis of Biographies and Autobiographies

Analysis of biographies is favored by most investigators. It makes use of letters, diaries, autobiographical notes, marginalia, memoranda, biographical sketches, journalistic reports, and, in recent years, mechanically recorded relevancies. It is a convenient and economical way to study a personality longitudinally, and much of what is known about creativity and those who create is acquired in this way. The objection is sometimes raised that biographers - and perhaps, not a few autobiographers - tend to write romantically about their subjects or that the writers lack much pertinent information. Autobiographers, particularly, are held to be sordidly exhibitionistic, on the one hand, or highly unrealistic, on the other.

Some examples of biographical studies are Freud's (7) Leonardo da Vinci: A Study in Psychosexuality, Rees' (8) A Psychology of Artistic Creation as Evidence in Autobiographical Statements of Artists, and Portnoy's (9) A Psychology of Art Creation.

4. Analysis of the Creative Product

A good example of how an analysis and a study of the product of creativity can lead to insight concerning the origin of such a product is Stites's (10) book, The Art

and Man. His evaluation of the masterpieces studied is based upon the objective scales of (a) usefulness, (b) associative value, and (c) aesthetic value. However, he always takes into consideration the matrix in which the masterpieces were conceived. He has much to say about both the motivation and the process underlying artistic production.

Lowenfeld (11) cites many examples of the abuse of the practice of analyzing products. He observed teachers of art passing judgement upon drawings of children. Many of these teachers employed the same standards to judge the art of children as they did in judging adult art, ignoring the child's age, background, previous training and emotional constitution.

When employed in such a fashion, this method of judging art blinds and binds the users, both teacher and student. The dynamics and the process of the creative personality are, thus, kept within excessively narrow limits if not totally destroyed.

Nothing has been found in the literature to suggest that any investigator thus far has attempted a categorical arrangement of the concepts and objects of creativity which would be comparable to the way in which zoologists classify animals by phyla and species, nor has any attempt been made to approach research in creativity in this way. There

are many indications that people commonly recognize distinctions between ideas and products yet no-one has suggested a system of classification which might serve as a starting point for an organized program of research concerning creativity.

5. The Questionnaire

The questionnaire has been used in numerous studies in the past thirty or forty years. It is a paper-and-pencil instrument by means of which those being tested can select replies from among various alternatives offered them. The material collected is a report of the behavior and thought which the persons tested judge to be most characteristic of themselves.

Rossman's (12) work is an illustration of how the questionnaire has been used in creativity research. He obtained the replies of 710 inventors to an alternate choice questionnaire which, concerned their childhoods, their educations, and their ages at the time of their first inventions. He (13) also received replies from 176 patent attorneys and 78 research directors. The following example of the type of question Rossman asked: "Are inventors different from non-inventors?". The respondents were required to check either "Yes" or "No."

Two advantages of the questionnaire are its ease of circulation and its economy. These make it a practical

tool for obtaining factual information. Disadvantages are that answers may be falsely given or that questions may be misunderstood. In all tests of this type, absolutely unambiguous questions are difficult to construct, and a limited choice of possible answers is a matter of necessity. Both attributes of the questionnaire make of it a method subject to inaccuracy.

Bartlett (14) has demonstrated how the forced choice of a yes or no answer to the above-cited question led to conclusions which were not supported by an open-ended approach. In response to Rossman's question, "Are inventors different from non-inventors?," forty per cent of the 176 patent attorneys replied in the affirmative, sixty per cent being in the negative, but, when called upon to give outstanding characteristics of inventors, the patent attorneys replied that successful inventors differed distinctly from non-inventors in the degree to which they (both groups) possessed certain important characteristics.

Therefore, the questionnaire is valuable as a tool for testing creativity only when the interpretors of the tests take into account the above-mentioned advantages and disadvantages. This method ought to be used carefully to obtain what is hoped is specific, but limited factual information.

6. Psychometric Scales

Many kinds of tests to identify creative thinkers have been devised and adapted. Such tests are used to measure degrees of originality or to rank individuals in terms of originality. In 1916, Chassell (15) reported the results of investigations conducted at the Psychological Laboratory of Northwestern University - using twelve tests either devised or modified for this purpose. The following tests were described in the Chassel report: (1) word building, (2) picture writing, (3) analogues, (4) original analogues, (5) chain puzzles, (6) triangle puzzles, (7) Royce's rings, (8) completion tests, (9) economic prophecies, (10) code tests, (11) invention for sheet music, (12) novel situations. The tests will not be described here as their general pattern is already familiar to students of psychology. Although these tests were not considered satisfactory at the time of the investigation, Chassell thought that all of them appeared to measure some phase of the trait of originality.

Since 1916, other kinds of tests have been constructed. In general, they have failed to satisfy the purpose for which they were devised. It is probably a safe generalization that some of the tests now on the market do measure certain, specific abilities involved in creativity; however, the real problem is that it is not known exactly what the abilities involved in creativity are. It is clear

that they must be found before they can be tested. There is the additional problem of how much of any one ability can be identified. When these probelms are solved, accurate tests can be constructed which will measure the quantity of each ability associated with the various kinds of creative expression.

7. Laboratory Experiments

Experimental psychologists have been interested in how persons with no previous experience or study along certain lines can produce new concepts or associations in an area which is obviously strange to them. They have attempted to describe the process by which imaginative creation occurs, and they have experimented to find out which circumstance hinder it. Youtz (16), under the auspices of the Creative Educational Foundation, published a review of the literature of experimental psychology concerning problem solving and creative imagination. He reported, in outline form, a number of experimental investigations of the factors supposedly influencing the production of the imaginatively novel.

The main point of his study is his attempt to explore what investigators have explored most often: the degree of each of the factors represented in any production considered to be imaginatively novel. This is what other investigators have done.

Although available experimental data warrants the belief that each factor involved in imaginatively novel production can be isolated and measured, it cannot be confirmed that any such measurements taken to date are exact and irreproachable ones.

Some conclusions about factors recently isolated may be tentatively listed as follows: (1) past experience supplies and organizes habit segments which the individual combines in novel ways to solve problems or to create new ideas, (2) new solutions usually appear full-blown to the individual, and interim stages of arriving at the solution are not recognized by him, (3) anyone can be creative to some degree, (4) habits hinder the arriving at a solution of a present problem, (5) stress, frustration, and dissatisfaction are influential in inhibiting further progress in the thinking up of new ideas, (6) ample time and a lack of any fear which might produce stress aid creativity, (7) moderate motivation is preferable to too little motivation which produces aimlessness and is to be chosen over too much motivation which reduces flexibility, (8) emotional behavior reduces the effectiveness of logical reasoning, (9) mere experience is not enough to insure novel production, since segments of experience must at least be combined in effective ways.

Experimental studies are respected for their adequate

controls, but they are frequently attacked for their artificial approach to complex phenomena such as creativity.

8. Factor Analysis

Factor analysis is a statistical technique employed to analyze data which have already been collected by other methods. Thurstone (17) stated that this technique originated in 1930 when the question arose as to the number of abilities required to account for experimental results and when the question of the nature of each, isolated ability was posed. Before this time, the question had been whether the observed correlations could be explained by means of a single intellective factor. The new approach was supposed to determine the number of abilities required and to describe the nature of each in isolation. This statement of number and nature was to be used as the basis of explanation.

Some years thereafter, a number of primary mental abilities were isolated by means of the multiple-factor method. It was determined that two individuals may share the same level of intellectual endowment and yet differ markedly in ability. A number of distinct components of intelligence were isolated and psychologically identified; consequently, predictions could be made with some confidence concerning which of the primary abilities were involved in any task.

Thurstone (18) recommended that profiles of creative

and/or inventive people be plotted in order to see whether this plotting would reveal any promising leads. He also suggested the construction of two types of tests: (1) a test for primary abilities previously identified as intellective and cognitive and (2) a factorially more complex test for ability factors not as yet isolated or identified, adding that creative talent may represent temperamental adjuncts to intellective traits. Consequently, if such representation is accurate, creative talent can be conceived as a combination of intellective and personality traits.

In a series of studies made under contract with the Office of Naval Research, Guilford and his associates (19) discussed abilities important in creative thinking, particularly as it is related to science, engineering, and invention. Their approach was to formulate hypotheses and to construct tests to measure each of the hypothesized abilities. After the tests were administered, they analyzed the results factorially, and revised any of the original hypotheses in need of revision, on the basis of the test results.

Guilford formulated the following hypotheses relative to creative people: (1) creative people are superior in their ability to recognize problems, (2) they can call up a relatively large number of ideas per unit of time,

(3) they have flexibility in mental operations, (4) originality is best conceived as a continuum because an individual is original in proportion to the degree of the uncommonness of his responses to stimuli, (5) they are superior to others in the process of being identified because of their abilities to drop old functions as well as to attack new ones.

9. Psychoanalysis

A basic concept in psychoanalysis is that all artistic creation arises from the unconscious. The method of exploring the unconscious is a thorough questioning of the subject, listening to and recording his answers. In these answers, the psychoanalyst looks for hidden motives and reasons for the creative person's obscure sequences of behavior. Several techniques are used to supplement the informal method of analysis. Among the more familiar ones are the free association method, dream analysis, automatic writing analysis, analysis of fantasies, and hyponotism.

Psychoanalysts have posited a reasonably comprehensive theory of creativity, and demonstrated its validity in terms of conflict and choices of defenses; they have given many valuable insights into the dynamic factors which underlie the choice of means of expression. However, psychoanalysis, so far, has been unable to solve the most basic problem of all: the question of the roots of talent

and genius. Freud admitted that analysis can do nothing toward eludicating the basic nature of the artistic gift, suggesting that it was probably constitutional and, therefore, inaccessible to any method known at the time. Not all of Freud's disciples agreed with him, however, and many have continued to explore the depths of personality in search of the origin of creativity.

10. Projective Tests

Projective tests present subjects with ambiguous stimuli which provide considerable freedom of response. The Rorschach Ink-blots and the Thematic Appreciation Test are both well-known examples of projective tests. Projective tests make use of a stimulus so novel that a subject can bring to it no specific knowledge of how to respond, no conditioned response.

Burchard (20), in his presidential address to the Society for Projective Techniques and Rorschach Institute, in 1952, presented the thesis that projective techniques have much to offer in the investigation of creativity. He voiced shock concerning the extent to which such techniques had been neglected in this area of research. He supported his charge with the statement that, by "generous count," he could find only eight studies which had employed the Rorschach and none which had used another type of projective test. His count included an unpublished doctoral

dissertation, a study published only in the Dutch language, two studies of commercial artists, and a study concerning creativity in college students.

Thurstone (21) seems not to agree with Burchard concerning the potential value of the use of projective tests, (in creativity research) at least in their present form. He states, "Most men who try to do scientific work in the field have very little respect for the projective tests as they are ordinarily used." He gives, as the reason for this, the fact that the projective tests in current use are open at both ends. In other words, they are as unstructured for the examiner in his interpretation as they are for the subject.

11. Interview

Perhaps the oldest, as well as the most commonly used, approach in studies of creativity is the interview. Poets have been asked about poetic inspiration; musicians have been questioned about sources of tunes and other "original" ingredients of their work, and inventors have been asked about the sources of and the processes of the forming of the inventive idea. Many valuable insights have been obtained in this fashion. Nevertheless, there is a problem involved in the use of the interview. Creative people usually claim that they "know" the answeres to the questions or they object to being questioned. Amy Lowell's (22)

attitude is more or less typical. She replied, "In answering the question: 'How are poets made?' My instinctive answer is a flat 'I don't know,'" If Lowell's answer is both truthful and typical, then the interview method of creativity research must be held to be a less direct approach than other approaches.

The non-directive technique, developed by Carl R. Rogers and his students (23), seems to hold more promise that better responses as well as more honest ones will be obtained than does the direct question-answer method. The aim of the non-directive approach is to stimulate the person being interviewed to formulate his own thoughts and to express them freely. The interviewer's role is in helping passively the interviewee to clarify his expressions. The interviewer does this by restating what the interviewee says, by attempting to define and to reformulate the ideas involved, and by encouraging the subject to tell more than he otherwise might tell. The interviewer does not engage in fault-finding; neither does he correct the responses given or attempt to impose his own ideas upon an answer. He does not assume the responsibilities of the interviewee nor permit him to surrender the responsibility for his answers or other behavior.

12. Case Studies

In its purest form, a case study is a coherent,

comprehensive, individualized report which brings together in a direct and objective way everything relevant which is known about a person. It is intended to be an honest and complete description of a personality, in the light of the various influences in his life. The use of case studies is to be seen in Terman's monograph entitled "Scientists and Nonscientists in a Group of 800 Gifted Men."

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## Chapter 3

## Creativity Tests and Their Application

Although published research data concerning creativity is scanty, there are some promising major projects still in process. The most obvious reason for the present dearth is that, until a few years ago, investigators were frustrated by the complexities attending study in this area.

The recent surge of research activity has been predominantly exploratory, the subjects of the projects largely scientists. Many of the most provocative of current studies have sought to probe into the nature of creativity and the creative personality in preference to constructing creativity tests. In consequence, numerous characteristics have been isolated with varied types of measuring instruments.

When research of this kind has been focused on a single trait, independence, for example, constants have not infrequently resulted that serve as standards against which other concomitants of creativity can be measured. Comparisons can be made, for instance, between independence as it appears in high-level aptitude tests and the same characteristic in personality or motivation tests. The resulting discovery of

concomitants may eventually permit the construction of tests suitable for testing potential creativity.

In general, the tests which have been used to measure creative giftedness have not followed the pattern of research typically used to measure intellectual giftedness. Moreover, some researchers argue that the burgeoning research movement in creativity, with its broad approach and resistance to premature crystallization, is much healthier than was the intelligence-testing method. The use of the former rather than the latter method is especially significant in relation to long-range research purposes as well as in the avoidance of pitfalls which beset the intelligence test.

In the United States, the efforts of relatively large and sustained research programs involving creativity have been loosely coordinated by The University of Utah Research Conference on the Identification of Creative Scientific Talent (1955, 1957, 1959, 1961). Because of this systematization, a considerably larger body of basic research findings defining human characteristics is now available, e.g., those findings which have emerged from factorial research studies concerning intelligence, personality or motivation.

The availability of computers has facilitated the use of large and complex patterns of tests and has made possible major studies in factor analysis and multiple correlation

which involve several individual criteria of creativity. Matching alternative analyses of relatively long, psychological inventories against creative criteria is gradually becoming routine. However, researchers rather than computers have selected and must continue to select the predictors from large number of potentially valid predictors of creative performance for any particular study. Consequently, each experimental battery of tests differs from the other. Nevertheless a typical battery will include a small subset of twenty or thirty promising new intellectual tests not generally found in intelligence-test composites, along with various non-intellectual tests. Some experimental batteries used to test creativity have been entirely non-intellectual in nature. For example, in the currently unpublished Utah studies concerning The National Aeronautics Space Administration scientists, C. W. Tyler used only a long, complex, biographical inventory as a predictor of each of the various criteria.

Traditional Measures of Creativity

If school marks were efficient predictors of creativity, the identification of persons with outstanding creative potential would be simple, however they have demonstrated low validity in predicting creative performance Taylor (1). If school marks are ever to be of use as valid predictors of creative potential, a significant number of school ac-

tivities will have to be changed in order to produce an environment in which creative performance and behavior can occur.

Something other than the passive acquisition of knowledge is needed before creative performance can occur; the learning of facts does not guarantee the succession of the incubation and insight stages. One would not be at a loss to find examples of men learned in the academic world who show little creative behavior in their fields.

Gradually accumulating evidence supports the notion that traditional intelligence tests, at best, reveal only minor variations in creative performance. They do not directly measure the ability to create new ideas or inventions.

In a significant number of factor-analysis studies, the factor involving the ability to sense problem areas (to be flexible in each of several ways, and to produce new and original ideas) is either unrelated to - or has little relation to - the tests used to measure intelligence. French (2) and Guilford (3), Chorness (4) studies civilian Air Force personnel who had suggestions officially accepted by their organizations. He found that the approximate I.Q. scores (from the information scales of the Wechsler-Bellevue Intelligence Scale), in this sampling, were spread across the entire range of the scale.

D. W. Tyler (5) found that the Terman Concept-Mastery Test, designed specifically as an adult-intelligence measure for Terman's follow-up studies, had no significant correlations with supervisory ratings of scientists' creativity, productivity, or originality. All other intellectual tests in the Tyler study showed at least some significant validities with these criteria. It may be argued that there was some restriction of range in his study. In a sampling with an unrestricted range, it is quite possible that more of the non-significant correlations will remain essentially zero than will become significant correlations. As a result, questions arise which concern the correlation between I.Q. scores and creativity, as measured by creativity-aptitude tests in general current use.

Factor studies, like those of French (6), and Guilford (7), reveal that each part of the creativity battery as: ideational fluency, originality, spontaneous flexibility, etc., are isolated and distinct categories. When compared with some of the standard categories of traditional intelligencetest (verbal, numerical, spatial, reasoning, memory, etc.) the new dimensions command attention. Because they are new dimensions, they generally have zero or low correlation with the previously established categories.

Most of these findings are illustrated dramatically in a three-year study conducted at the University of Minnesota

Laboratory Elementary School. There was a marked difference between the highly creative (as identified by the Minnesota Creative Thinking Test) and the highly intelligent children (as identified by the Stanford-Binet, an individually administrated test). The highly creative group ranked in the upper 20 per cent in creative thinking, but not in intelligence; the highly intelligent group ranked in the upper 20 per cent in intelligence, but not in creative thinking. Those who were in the upper 20 per cent on both measures were eliminated, but the overlap was small.

In fact, if children were to be identified as gifted on the basis of intelligence tests only, approximately 70 per cent of the most creative children would be eliminated from consideration. This ratio has remained constant for all intelligence tests and grade levels. Although there was an average difference of over 25 I.Q. points between the two groups, there were no statistically significant differences between the two achievement measures used in any year (Gates Reading and Iowa Test of Basic Skills). These results have been duplicated in a Minneapolis Public High School situation. Getzels and Jackson (8) had earlier obtained the same results in a private secondary school.

It is of special interest that the children with high I.Q.s were rated by their teachers as the more desirable, better known or understood, more ambitious, and more hard

working or studious, of the two groups, though the highly creative child appears to learn as much as the highly intelligent one, at least in some schools, without appearing to work hard. The highly creative child is learning and thinking when he appears to be "playing around." He tends to learn more effectively by "playing" creatively than by "working" under authority, and even engage in manipulative or exploratory activities which are discouraged or forbidden. He enjoys learning and thinking, and this looks like play to an outsider. Studies made on these contrasting classes have generally shown adequate sampling.

In many ways, everything else cited on this specific point corroborates the above basic findings: Stein (9), Parnes and Meadow (10), Gatzels and Jackson (11) and Torrance (12), all separately found low or zero (not high in any sense) relation between IQ and creativity scores. The majority of the studies suggested that the relation of intelligence-test scores or components of intelligence tests to creative performance is generally low (.20 to .40) in unselected populations, and .00 and even negative for homogeneous samples at high levels of intelligence, MacKinnon (13) Hollard (14) Mullins (15) and Yamamoto (16).

The best conclusion at present is that intelligence, as measured, accounts for only a minor proportion of the variation in creative performance, and used alone, it is

an inadequate measure of creativity.

Anne Roe (17, 18), in studies of eminent scientists, reported that their intelligence scores were all distinctly above average. However, her main focus was on "non-intelligence" characteristics which play a role in accounting for creativity and career choices. She felt that a comparison group should be studied in the same way as the eminent scientists had been, the comparison group being matched as equally promising on the basis of their academic career measures. Many scientists who looked equally promising on achievement and intelligence measures, typically available during the academic career, failed to attain the eminence of the group she studied; therefore, she wanted to check for important group differences on other psychological scores.

Taylor (19) concludes that it is unfortunate that such a well-matched comparison group has not yet been studied. It might be added that such eminent scientists have been screened through a long formal academic program, and the grades they received usually correlated to a marked degree with their intelligence test scores. Such academic prerequistes apply frequently to scientific personnel who move into research positions, than to persons in artistic fields of endeavor.

Some of the findings cited earlier have cast doubt

upon the efficacy for long formal academic programs in producing persons capable of doing creative scientific research. Martin and Pachares (2), among others, found academic marks poorly correlated - often lacking correlation - with on-the-job performance in research work.

This outlook is supported by the surprising ability of some high-school students to carry out research work of published quality. The report of Riley et al (21), cites several examples from newly-emerging research participation projects in NSE Summer Science Program for Secondary Students. In some areas, conversely, large numbers of persons with graduate research degrees fail to produce publishable works.

The best conclusion, at present, is that intelligence, as measured, accounts for only a minor proportion of the variation in creative performance, and, that intelligence, by itself, is not at all a sufficiently adequate measure of creativity. In fact, nearly all research which has attempted to measure and study creativity has been focused upon nonintelligence intellectual tests, nonintellectual tests, biographical inventories and environmental factors.

Investigators of promise have emphasized a broad range of assessment variables: an emphasis somewhat in contrast to the identification of the so-called intelligence type of giftedness by means of such a single measure as IQ scores.

Creativity measures have mainly included new intellectual characteristics not contained in IQ tests, motivational, biographical, sociometric and other personality characteristics.

MacKinnon and the staff of the Institute of Personality Assessment and Research have invited for a three-day assessment program, creative individuals, in the areas of writing, architecture, and mathematics, nominated by nationally-recognized persons in the fields concerned.

MacKinnon (22) reported that these subjects were being evaluated on a multiplicity of variables, such as: problem-solving experiments; tests designed to discover what a person does not know (or is unable to reval) about himself; tests and questionnaires that permit a person to manifest various aspects of his personality and to express his attitudes, interests, and values; by searching interviews. In this regard, Barron (23) reported that such qualities as: an intensity of moral and aesthetic commitment, a component of sexuality in psychic creativity, voluminous production, diligence, discipline and total commitment with respect to their work, appeared in MacKinnon's highly selective group.

In a study made by D. W. Taylor (24), at the American Institute for Research, the Test for Selecting Research Personnel, showed significant, though somewhat low, valida-

tion (in the 20's and 30's) matched against supervisors ratings on creativity when compared with several other tests. The test, consisting of 150 multiple-choice problem situations, analyzed three types of job performances relevant to research: (1) formulating problems and hypotheses; planning and designing investigations, (2) conducting investigations and interpreting research results, (3) accepting organizational and personal responsibility.

Stein (25) studied forty-six industrial-research chemists. He subjected them to a two-day individual and group psychometric analysis designed to yield both biographical and self-evaluative information about certain variables. The biographical data revealed that the more creative chemists in contrast to the less creative ones, came from lower socio-economic levels, had engaged in solitary activities earlier in life and had parents of lower educational level who were more distant and inconsistent. The self evaluative component showed, that the more creative chemists tended to be more autonomous, strove for more distant goals and had more negative attitudes. They were more cautious and realistic, more consistent in their desires for rewards, had a more differentiated value hierarchy and perceived themselves as assertive and authoritative persons with leadership ability.

The validity of such personality inventories as the

California Personality Inventory, Sixteen Personality Factor Questionnaire, and Saunder's Experimental Personality Research Inventory is generally low, although there is considerable variation according to a study by Holland and Astin (26). In the latter work, the Personality Research Inventory yielded valid-appearing scores in self-acceptance, tolerance of ambiguity, self-sufficiency, masculine vigor, artistic ability versus practicality, progressivism versus conservatism, and a liking for thinking. However, only eight per cent of the validity coefficients for all 130-criterion tests were significant at the five per cent level. The evidence for the validity of nonintellectual originality scales falls at about the same level, although there is again a wide range of correlations.

Simple self-ratings in adolescent and adult samples have proven of moderate validity for a variety of creative performances. In Taylor's (27) study of Air Force scientists, the best over-all predictor, among fourteen criteria of creativity, was a self-rating of creativity. This was also valid for each of the six creativity components of the fourteen factors. Self-ratings on several other characteristics (resourcefulness, desire for discovery, discrimination of value, and intuition) also had moderate validity for many of the creativity criteria.

Supervisors' ratings appear to be of some value for

predicting creative performance, according to Buel (28). Supervisors' ratings of creativity have also been used successfully as rating criteria, and they have been predicted significantly by psychological scores in several studies.

The multivariable approaches to creativity consist of factor-analysis studies of well-designed batteries. For example, L. L. Thurstone and his students analyzed the intelligence-test composites into multiple factors and later extended their efforts into new intellectual areas not covered by intelligence tests, Thurstone (29).

Guilford and his colleagues have actively advanced this type of work during the past 15 years; their efforts culminated in Guilford's (30) three-dimensional model of the structure of the intellect. His most relevant study is the factor analysis of a large battery of creativity tests, (Guilford et al (22, 23), which forms the basis for the components of memory, cognition, evaluation, convergent production, and especially, divergent production all of which are involved in creative work. More specifically, the most frequent high-level aptitude (or intellectual) factors are probably fluency, flexibility, and originality Guilford (24). Because of the importance to this study of Guilford's work in factor analysis it will be reviewed in detail in the following chapter.

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## Chapter 4

## FACTOR ANALYSIS AND THE INTELLECTUAL TRAITS OF CREATIVITY

Within the past fifteen years, there has been a concerted effort among psychologists to isolate the factors, which compose creativity. Thurstone and Guilford, more than others, have devoted their energies to this task applying the techniques of factor analysis in studing creativity. Guilford (1) has explained that factor analysis is a systematic procedure used to summarize inter-correlations of scores and other measures. It is a procedure, moreover, by which researchers attempt to determine threads of consistency which cross perpendicularly through categories which describe intelligence, temperament, interest and other dimensions of human behavior variables. Guilford (2) compares personality, by means of the above-mentioned procedure, to a geometrical hypersphere of dimensions; each dimension interpreted to be a dependable, convenient reference variable and concept. He states:

> With this frame of reference, many of the findings and issues became clarified. The reason that different intelligence tests do not intercorrelate perfectly, even when errors of measure-

> ment have been taken into account, is that each test emphasizes a different pattern of primary abilities. If many types of creative performance are only moderate or low, and I predict that such correlations will be found, it is because the primary abilities represented in those tests are not all important for creative behavior. It is also because some of the primary abilities important for creative behavior are not represented in the test at all. It is probably safe to say that the typical intelligence test measures to a significant degree not more than a half dozen of the intellectual factors than that. Some of the abilities contributing to creative success are probably non-intellectual; for example, some of them are perceptual. Probably, some of the factors most crucial to creative performance have not yet been discovered in any type of test. In other words, we must look well beyond the boundaries of the I.Q. if we are to fathom the domain of creativity.

COMPONENTS OF INTELLIGENCE TESTS

For the last few years, Guilford has been directing studies concerning thinking abilities at the University of Southern California. This work has been supported by the Navy Electronics Laboratory in San Diego, Office of Naval Research. The research has been concentrated on the nature of thinking and intelligence as related to creativity. Factor analysis has been used. In a 1952 report, Guilford (3) discussed some of the components of intelligence tests which have been isolated. Using these components as a basis, he suggested several hypotheses concerning patterns of abilities which seem to correlate positively with creative production. The components he described are explained below.

Verbal comprehension is an ability best measured by a vocabulary test; nevertheless, such a test does not require of the person being tested a very profound familiarity with words. A reading knowledge (always a rather vague term) is all that is necessary. This verbal factor does correlate very highly with most measures of school achievement.

Inductive type tests were used, and three factors were revealed by this use. The key factors is the examinee's discovery of something. Guilford gave the following labels to these factors: (1) education of perceptual relations, (2) education of conceptual relations, (3) education of conceptual patterns. The first-mentioned factor is characteristic of those tests whose items are in the form of figures. The second-mentioned factor is characteristic of those tests whose items are composed of numbers, letters, or words. The third-mentioned factor occurs in tests of both figural and non-figural content. The thing to be discovered by the examinee is the system of relations.

In deductive type tests, two factors were isolated. The first deductive factor is the ability to evaluate conclusions and to decide whether or not conclusions are logically consistent with premises. This factor shows up in tests of the true-false as well as of the multiple-choice form. The second deductive factor which Guilford called

eduction of correlates, a term borrowed from Spearman (4), is the ability to construct a second object to complete a picture which has been presented to an examinee in the form of one object plus a relationship. In other words, the second deductive factor is the ability to see two objects and any relationship which holds between them.

## GUILFORD'S HYPOTHESES CONCERNING THE NATURE OF CREATIVE ABILITY

Guilford's hypotheses concerning the nature of creative ability have, for the most part, been verified by only one or two pilot studies. A single analysis was used to give positive indication of the significance of the following factors. One factor is an ability to see problems, to be sensitive to their existence. This factor might include sensitivity to defects or deficiencies, to gaps in knowledge, to incongruities, and to the odd and unusual in general. Guilford also established that two tests, one measuring the ability to see defects in mechanical devices and the other, which measures awareness of defects in social institutions, correlate very substantially.

## FLUENCY OF IDEAS

The hypothesis of fluency of ideas is that stimuli touch off a rapid flow of thought responses in all types of creative people. Guilford's studies verify four types of fluency: (1) word fluency, (2) associational fluency, (3)

expressional fluency and (4) ideational fluency.

Word fluency was first discovered and reported by Thurstone (5).

It is an ability to produce words, each of which contain a specified letter. The meanings of the words themselves and their associations have no weight in this component. What is tested is the sheer ability of the testee to call up words with which he is familiar. This purely quantitative factor would seem relatively unimportant to creative work, nevertheless, Drevdahl (6), has found it to be related to general success in both science and art students.

Associational fluency, in which comprehension of word meanings is important for successful responses, tests the examinee's grasp of synonyms, antonyms, and other word associations. In contrast to word fluency tests, in which letter requirements are observed, associational fluency tests require the examinee to recall the meanings of words.

Expressional fluency is a factor best measured in a test requiring the production of phrases or sentences. A unique characteristic of this kind of test is the requirement to arrange written words into acceptable sentence structures within a limited period. Guilford does not know whether this ability is a function of spoken language, but it seems reasonable to assume some correlation between fluency in writing and in speech.

Ideational fluency is a factor which tests the speed with which an examinee can call up ideas related to a given topic or which serve certain purposes. It is probably most useful in the study of both fluency and creativity. Quantity is the important consideration in the scoring of this factor. Quality need not be considered if the examinee's responses are appropriate. Guilford considers this the leading component in creativity.

Flexibility. Guilford found that two flexibility factors appeared in various tests. One type called spontaneous flexibility, is defined as the ability or disposition to produce a great variety of ideas unhampered by inertia or perseveration. In responses to this test, the examinee often shows his freedom to roam about in his thinking, although it is not necessary for him to do so.

Adaptive flexibility, the second type defined by Guilford, is so named because it facilitates the examinee's solution of problems. They type of solution varies radically from problem to problem. This is best shown in that type of problem which requires a more usual type of solution. The problem may appear on the surface, to be accessible to familiar or conventional methods, but such solutions will not work. The solution of each problem is facilitated by the ability of the examinee to depart from former modes of thinking and to make use of new or unusual ones.

ORIGINALITY

Three experimental approaches indicated that a single, common factor could be originality. (A) The first is a statistical measure of the uncommonness of the responses. (B) The second is an account of remote associations and relationships. This test is so designed as to call for the examinee's associating ideas and things considered logically or temporally separated. Examinees are asked to list all of the consequences they can think of. The number of remote consequences that an examinee gives indicates originality; the number of obvious consequences he lists indicates ideational fluency. This means that it takes a quality criterion to indicate the extent of originality which characterizes a person. (C) The third approach is a measure of the degree of "cleverness" of the responses.

The idea that there is an ability to improvise comes from Gestalt psychology, which to redefine the functions of various objects: boxes, poles, etc., in order to adapt these objects as tools. This ability is called redefinition.

Elaboration was predicted to be a coefficient of originaltiy and it was isolated in a study of planning abilities. This factor, however, needs to be further verified and analyzed.

Guilford (7), concluded that not all of his early expectations of finding factors have been supported by the

resulting data. He and his associates predicted a unitary ability to analyze and also a unitary ability to synthesize in the thinking processes. Both hypotheses were given ample opportunity to be verified. Nevertheless, the results did not support these hypotheses.

The results Guilford did obtain, however, do not refute the idea that these two kinds of operations exist. The results do indicate that individuals do not differ systematically from one another with respect to a general ability to analyze in connection with many kinds of tasks. Nor do individuals differ systematically in a general ability to synthesize. In this sense, analysis and synthesis are comparable to problem-solving. Factor analysis, however, has not been used successfully to detect a unitary ability to solve problems. A number of unitary abilities presumably play roles in the solving of problems, but the combinations of these abilities as well as their respective importance depend upon the kind of problem to be solved. A similar conclusion may be drawn concerning analyzing and synthesizing.

For almost ten years, investigators at the Pennsylvania State University had been trying to find criteria which might help them distinguish creative from non-creative people in the arts. While conducting their experiment, they heard of an entirely independent study by J. P. Guilford

concerning the same problem; finding criteria for measuring the componants of creativeness. Guilford's study concerned the sciences; that of the Pennsylvania State University related to the arts. Whereas the subjects of the Lowenfeld (8) study, which is based on several doctoral studies, ranged from a group of highly creative sophisticated artists to a "non-art group," the subjects of the Guilford study were individuals working some in the exact, some in the applied sciences.

Although the two entirely independent studies of entirely different groups were made for different purposes, the significant outcome was that both groups of investigators arrived at almost exactly the same criteria of creativity. These criteria can now be used to make a significant differentiation between the creative and the less creative person. The Pennsylvania group conducted a study in which the two series of tests were correlated singly and as a whole. As far as their evidence goes, there is a highly significant correlation between the attributes tested in the two investigations. This, therefore, establishes for the first time that creativeness has isolable characteristics in the arts as well as in the sciences.

THE PLACE OF CREATIVE ABILITIES IN INTELLECT

Since 1949, Guilford and his associates, in a program entitled the Aptitude Project of the University of Southern

California, have been trying to classify intellectual abilities by means of factor analyses. Among the broad areas of ability which they have studied are reasoning, planning, evaluation, and creativity. One outcome of their study particularly regards creativity has led to a rather wide use of tests in this area of investigation. They are employed to differentiate groups to identify categories or as training methods.

CLASSIFICATION OF INTELLECTUAL FACTORS

To further our knowledge of the human intellect in general is admittedly more important than to probe into the nature of creativity alone. Creative abilities gain significance when compared with other kinds of abilities and when relationships are found which exist among them. Guilford (9) has indicated that it is becoming clear that creative performance in everyday life cannot be fully accounted for by such abilities as are isolated by research workers. Many other abilities may make their contributions, depending upon the situation or the task. Furthermore, some relationships among the factors suggest that there are creative abilities yet to be discovered.

Out of Guilford's (10), factor analyses have emerged three profitable means of grouping the factors of intellect which he has succeeded in isolating: (1) by operation (2) by content, (3) by product. An overview of these may help

to elucidate his remarks.

1. OPERATIONS. There are five fundamental kinds of intellectual activities or processes: (1) cognition, (2) memory, (3) divergent production, (4) convergent production, and (5) evaluation. These activities are what the individual does with the raw materials, information, of experience.

A. Cognition: discovery, awareness, rediscovery, recognition of information in various forms, or comprehension and understanding.

B. Memory: the retention of information in any form.

C. Divergent production: the generation of information from given information. The emphasis is upon the variety of output from the same source.

D. Convergent production: the generalization of information from given information. The emphasis is upon the achievement of conventionally accepted or "best" outcomes, concentration or narrowing down upon the "correct" answer.

E. Evaluation: the reaching of decisions or the making of judgments concerning the goodness, correctness, suitability, adequacy, desirability, or goal satisfaction.

2. CONTENT. Guilford's categories for classing the content of intellectual factors are: (1) figural, (2) symbolic, (3) semantic, and (4) behavioral.

A. Figural content: information in concrete form, as it is perceived or recalled in the form of images. The

term figural implies some degree of organization or structuring.

B. Symbolic content: information in the form of signs having no significance in and of themselves e.g., letters, numbers, musical notations, etc.

C. Semantic content: information in the form of meanings which commonly become attached to words, or meanings to which words commonly become attached. This content is important in verbal thinking and in the taking of verbal tests in which the things signified by words must be known.

D. Behavioral content: information (essentially nonverbal) which is involved in human interactions in which the attitudes, needs, desires, intentions, thoughts, etc., of other persons as well as of the subject are important.

3. PRODUCT. Products are results from the organism's processing of information: (1) units, (2) classes, (3) relations, (4) systems, (5) transformations, (6) implications.

A. Units: relatively segregated or circumscribed items of information having a "thing" character.

B. Classes: aggregates of items of information so grouped because of the common properties of class members.

C. Relations: recognized connections between or among units of information. These connections are based upon variables which apply to them.

D. Systems: organized or structured aggregates of items of information. They are complexes of interrelated or interacting parts.

E. Transformations: are changes in existing or known information or changes in its uses, as in productions.

F. Implications: are extrapolations of information in the form of expectancies, predictions, antecedents, and consequents.

Guilford stated that the three classifications of intellectual abilities outlined and defined above can be combined: as a cross classification they collectively provide a unified theory of intelligence which can be represented in a cubical model (Figure 1).

Most of the isolated creative abilities lie in the area of divergent thinking.

In tests of such abilities, there is no one right answer. Therefore, a variety of answers permits a good score. In terms of the model, <u>ideational fluency</u> is interpreted as the ability to produce divergently a number of semantic (meaningful) units (ideas). <u>Spontaneous ability</u> is reinterpreted as the divergent production of classes. <u>Associational fluency</u> is regarded to be an ability to produce a variety of meaningful "correlates." Correlates are units of information that complete a relationship in the

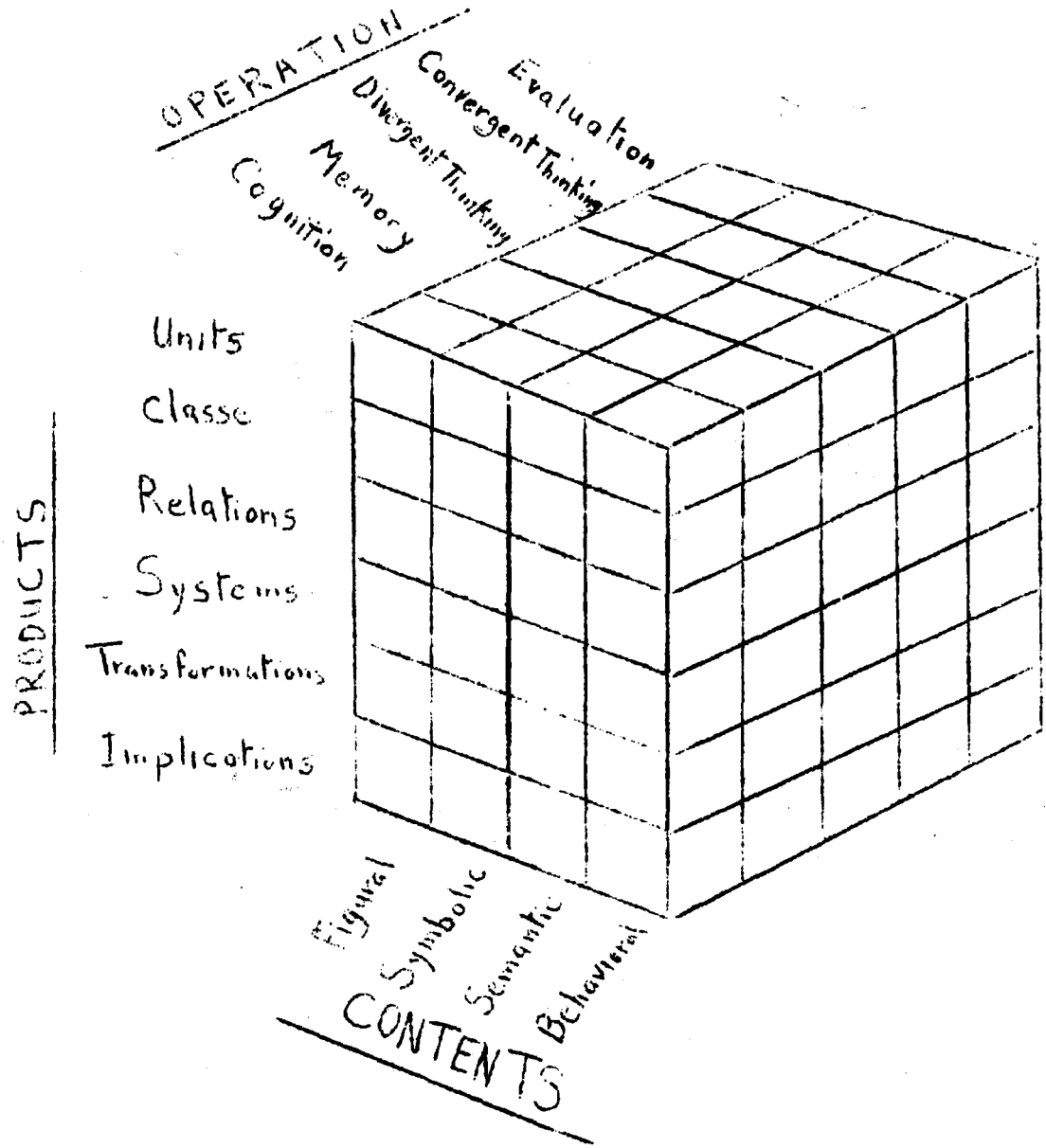


Figure 1

Theoretical model for the complete "Structure of Intellect" Project on Aptitudes of High Level Personal University of Southern California

event that one relation and another unit are given. The factor first called "originality" is now recognized as the ability to produce a variety of transformations.

It is to be noted that the contents of the abilities just mentioned are all in the semantic or verbal category. The structure of intellect model may be used as support for the suggestion that distinctions of a similar nature can be made concerning figural and symbolic material. Three such abilities are already known: word-fluency factors, expressional-fluency factors.

Word-fluency factors are tested by an examinee's rapid listing of words (symbolic units). Expressional fluency factors are tested by an examinee's forming of sentences which are interpreted as symbolic system. Expressional fluency, thus, can be interpreted as the ability to produce divergent symbolic systems, hence abilities to think divergently in order to produce results differ according to the kind of information used.

Variables to be studied in this study: From the factor-analytic study of tests of intellectual performance there emerged what Guilford regarded as components or aspects of intellect; he referred to the aggregate of these as a structure of intellect. Guilford's structure of intellect is divided into two categories, (1) a small group of memory

abilities and (2) a large one of thinking abilities. This study is concerned with the latter category. What Guilford calls thinking abilities are classified into three sub-categories: cognitive, production and evaluating, according to the basic operations performed by the test respondent.

Cognitive abilities have to do with the acquisition of new information through discovery, rediscovery, or recognition; productive abilities are concerned with the use of information to arrive at certain conclusions; and evaluative abilities involve the use of judgment by the respondent of the correctness, suitability, or adequacy of available information, such judgement being scored on criteria of identity, consistency, and goal satisfaction.

Productive abilities are further sub-divided into convergent and divergent kinds of thinking. Convergent thinking consists of generating new information leading to a right or to a recognized best, or conventional, answer. Divergent thinking consists of thinking in different directions, sometimes in search of alternative routes that will lead to the same goal, sometimes a seeking for variety of outcomes. The latter may signify arrival at the goal, or in some tests, the goal itself is to produce a diversity of responses. Guilford believes that the majority of creative-ability factors are subsumed under what he has called diver-

gent thinking: word fluency, associational fluency, expressional fluency, ideational fluency, adaptive fluency, spontaneous fluency and originality.

He stresses the point, that although these factors seems to represent ways in which creative thinkers are to be distinguished from other thinkers, many other intellectual abilities may play roles from time to time in the creative person's work.

Figure 2 includes Guilford's division of the structure of intellect and the factors included in the present study.

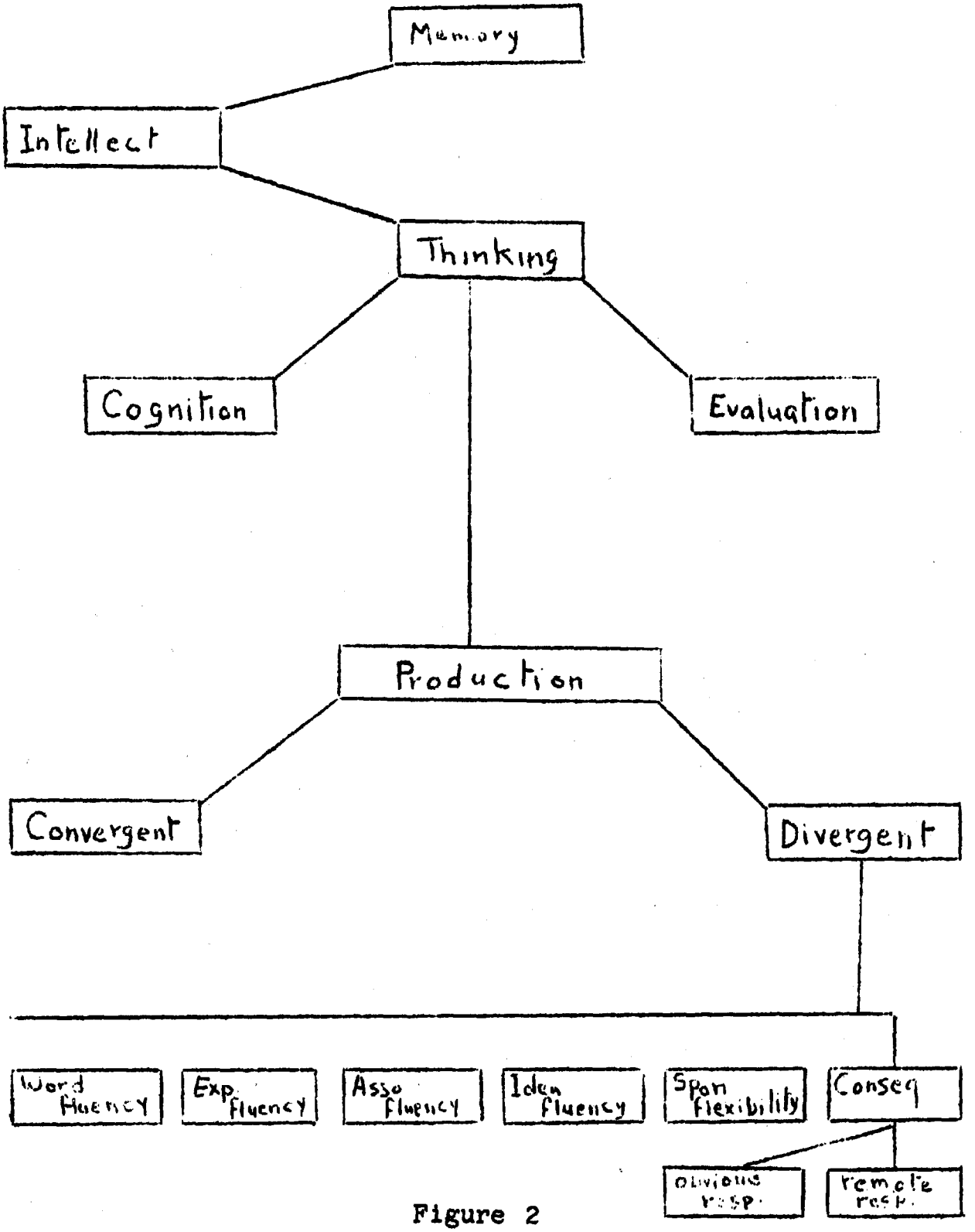


**Figure 2**

**Variables to be studied**

References - Chapter 4


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# Chapter 5

## RESEARCH PROCEDURE

Creativity became an object of scientific study primarily because of the general interest in individual differences. This approach recognizes that individuals differ psychologically in traits or attributes that can be conceived either as a continuum or as a set of dimensions, that there can be varying degrees of a quality possessed by different individuals. This concept was eventually applied to creativity, but not seriously until about ten years ago. The new way of looking at the matter permitted investigators to think that there are not only a few peculiarly gifted persons but that individuals in general possess some degree of the same creative trait or traits.

This assumption has opened the door to many kinds of research. We need no longer study creativity by means of studying persons who are recognized as possessing it to a high degree: henceforth, anyone can serve as a subject for investigations. We can discover the various aspects of creativity and the conditions under which creative performance occurs or does not occur.

As in the case of all psychological characteristics that make up personality, we may be forced to recognize that heredity establishes limits of development for an individual. Yet there is considerable faith among psychologists and educators that an individual rarely realizes his full development in any respect and that there is generally considerable room for improvement.

On the basis of this consideration, education, and more specifically, certain types of education, can be characterized as adverse or as encouraging effect depending upon the way in which education is defined, whether it is assumed to be an "open" system or a "closed" system.

Statement of the Problem

The primary objective of this study is to assess and compare the degree of creativity among four groups of college students at the Ohio State University. These groups are selected to represent differing orientation as reflected in their academic curricula. The four curricula selected are those commonly supposed to promote differences in kind and quality of creative ability.

This study is designed to answer these questions:

1. Are there any differences in creativity among students registered in different colleges?
2. Is there a significant difference between freshmen and seniors in creative ability.

3. Is there a significant difference between males and females in these colleges?

Another objective is to inter-correlate scores of the creativity subtests separately and as a unit with the Ohio State Psychological Test (O.S.P.E.), designed to measure potentials for scholastic achievement, a component of this test: Reading Comprehension and the Cumulative Point-Hour Ratio (P.H.R.) of the student.

To be determined are:

A. How do both the component and total creativity scores related with the O.S.P.E.?

B. How do the former relate with the Reading Comprehension score?

C. How do they relate with the Point Hour Ratio?

D. What variables of the battery of creativity yield the maximum multiple correlation coefficient with O.S.P.E., Reading, and P.H.R.?

Samples and Population

The Study population is constituted of students from The Ohio State University. This particular university was chosen for several reasons:

1. It is more accessible to the writer.

2. Its student body offers a population sufficiently large and heterogeneous to offset the chance of getting a stratified samples.

3. It may be more representative of the typical university, not subject to unusual restrictions regarding residence, curricular requirements, fees or narrowly selected student body.

From this population, three colleges and one school were selected to represent the university because they are assumed to foster differences in creativity by their program. These are:

1. The College of Agriculture
2. The College of Education
3. The College of Engineering
4. The School of Fine and Applied Arts

Method of Selection

From each of these faculties a sample of eighty students was selected: forty from the freshman class and forty from the senior class, defined as follows:

1. A freshman is a first-year student who has completed only one quarter of academic study.
2. A senior is a student scheduled to graduate during this academic year (1963)

Male and female distributions in the samples are in the same proportions to present in the given colleges.

Table I shows the sample composition:

1. The College of Education

| Freshmen = 40 | | Seniors = 40 | |
|---|---|---|---|
| Male | Female | Male | Female |
| 28 | 12 | 30 | 10 |

2. The College of Education

| Freshmen = 40 | | Seniors = 40 | |
|---|---|---|---|
| Male | Female | Male | Female |
| 10 | 30 | 10 | 30 |

3. The College of Engineering

| Freshmen = 40 | | Seniors = 40 | |
|---|---|---|---|
| Male | Female | Male | Female |
| 38 | 2 | 40 | 0 |

4. The School of Fine and Applied Arts

| Freshmen = 40 | | Seniors = 40 | |
|---|---|---|---|
| Male | Female | Male | Female |
| 10 | 30 | 10 | 30 |

| Total 320 | = 86 | 74 | 90 | 70 |
|---|---|---|---|---|

Psychological Test Battery

Selection of the tests: Because of the availability of a number of promising psychological tests, both in published and experimental forms, it was not considered necessary to develop any new tests. The selection of specific tests from those at hand was based on their expected usefulness in determining the relation between certain basic intellectual aptitudes and scholastic achievement.

The intellectual aptitudes selected for testing were

those posited by Guilford (1), (2), (3), in his work on the structure of the intellect as belonging to the domain of creativity. Relatively pure factorial measures of these tests were developed by Guilford and his staff.

The scores of well-known test of scholastic achievement: the Ohio State University Psychological test O.S.P.E. required of each students entering the university upon his enrollment and the cumulative point-hour ratios obtained from each college office to determine whether they were functions of creativity or any of its components.

Composition of the Experimental Creativity tests-battery

The experimental aptitude test battery to be correlated with the foregoing was composed of six tests yielding scores on intellectual aptitudes. The tests and their measures are as follows:

1. The Word Fluency Test (4), measures the aptitude for producing rapidly a list of words each of which satisfies the specific requirement that it contain a certain letter. Only the symbolic or structural aspect of words is relevant; meaning or semantic content is irrelevant.

The reliability coefficients for samples of Naval Air Cadets and Naval Officer Candidates (high school with some college education) with general intellectual level substantially above average were .75 (4).

2. The Associational Fluency Test (4), measures the aptitude for producing words from a restricted area of meaning:

In this test the examinee is asked to write words similar in meaning to the given word. Reliability coefficients for the above samples on this test were .63 (4).

SAMPLE ITEM

Write words similar to the word HARD.

HARD: difficult severe
solid unfeeling
tough
stiff

3. The Expressional Fluency Test (4), measures the aptitude for rapidly producing words in connected discourse where the sentence is important.

In this test the examinee is to write sentences of four words each. Each word must begin with the letter indicated.

SAMPLE ITEM

| k | u | y | i |
|---|---|---|---|
| keys | up | your | interest |
| kill | unless | yellow | insects |
| kidnapping | upsets | young | infants |
| k | u | y | i |

4. The Ideational Fluency Test (4), measures the aptitude for producing many ideas where free expression is encouraged and where quality of ideas is not important.

Reliability coefficents for the mentioned naval group were .76 (4).

In this test the examinee is to name things that belong in certain classes.

SAMPLE ITEM

Name FLUIDS that will Burn.

gasoline
Kerosene
hydrogen
alcohol

5. The Alternate Uses Test (5), measures the aptitude for producing a diversity of ideas in a relatively unrestricted situation.

In this test the examinee will be asked to consider some common objects. Each object has a common use which will be stated. He is to list as many as six other uses for which the object or parts of the object could serve.

This test, for samples of young adults with I.Q.'s above average has an estimated reliability from .68 to .81 and a validity of .52 (5).

EXAMPLE. Given: A NEWSPAPER (Used for reading.)
He might think of the following other uses for a newspaper.

a. start a fire
b. wrap garbage
c. swat flies
d. stuffing to pack boxes
e. line drawers or shelves
f. make up a kidnap note

6. The Consequences Test (6), measures the aptitude for producing clever or uncommon responses to a specific situation.

This is a test of the examinee's ability to think of a large number of ideas in connection with a new and unusual situation.

In scoring this test, the responses are classified as being either "obvious" or "remote." The number of "obvious" responses provides a score for the factor of ideational fluency and the number of "remote" responses provides a score for originality.

The obvious responses have shown a reliability coefficent of .86 and the remote responses .82 for young adult samples. The validity for the obvious responses was .62 and for the remote responses .42 (6).

SAMPLE ITEM: What would be the result if people no longer needed or wanted sleep.

SAMPLE RESULT:

1. Get more work done
2. Alarm-clocks not necessary
3. No need for lullaby song books
4. Sleeping-pills no longer used
5. _____
6. _____

O.S.P.E. (7). The widely-known and widely used O.S.P.E. has been revised many times since its initiation. Few tests have been the object of more careful, prolonged or continuous study, and a number of important contributions to psychological test theory have accompanied its development.

It is a verbal test of scholastic ability, based upon college-grade level as a criterion. This test is composed of three subtests for which norms are available for each grade from nine through twelve, and for college freshmen. There are 150 items in all. The subtests consist of:

(1) Thirty same-or-opposite items

(2) Sixty words analogy items

(3) Sixty reading-comprehension items based on ten

paragraphs. The subject-matter of the reading paragraphs may be classified as six passages concerned with natural science and mathematics, two concerned with social-science material and two consisting of literary description. All items of the test are of the multiple-choice variety with five suggested responses. The total is the score of all the three subtests

The two-hour work-limit or power test is self-marking, the testee employing an electrographic pencil to record his answers. A score is obtained by using an IBM mark-sense card.

Percentile norms for the total scores and subtests separately are available based on a sample of 3,799 freshmen in Ohio colleges. The unusual technical effort expended in the development of this test has yielded dividends in terms of increased validity for each year of its use.

The recent form of the test is reported to have a consistent correlation of +.60 with the criterion of scholastic performance showing an occasional coefficient greater than .70. The level of reliability of the total score is .94.

As a test designed to measure college aptitude, the Ohio State University Psychological test is particulary useful in providing accurate differentiations in ability

for the upper half of the general high-school senior population from which most college freshmen are drawn.

In a study by Peters & Loge (7), the authors conclude that the correlations between the O.S.P.E. and the American College test (ACT) subtests are relatively high and that the .83 correlation coefficient between the O.S.P.E. and the ACT total clearly suggests that the two are very closely related.

Administration and Scoring of Tests

All the tests of Guilford's intellectual aptitude battery (creativity) were administered as timed tests, the time available for each ranging from six to twenty minutes. The whole battery was administered to sixteen groups of twenty students each during two forty-five minutes sessions. essions were scheduled daily over a three week period during the class time of each group. Preliminary instructions given before each session assured the students that the test results would be confidential, known only to themselves and to the persons scoring the tests. They were assured that the results would in no way affect their present college status. All tests were administered by the writer.

Six of the intellectual aptitude tests (creativity) employed required answers of the divergent open-end type. Since these tests were not amenable to either mechanical

scoring or key-scoring techniques, they required a four-week period to score by hand. As some, in addition, required a high degree of discretion in judging correct answers, it was decided to have them scored independently by two scorers in order to determine the magnitude of disagreement between the independent scores.

The total O.S.P.E. scores, its subtest, reading comprehension, and the P.H.R. were secured for each sample in the study from respective college office.

LIMITATIONS OF THE STUDY: Among the variables which could not be controlled in this study, it may be mentioned, that the freshmen and the seniors are two different groups, not the same sample at an interval of four years. Ideally this should be a four-year longituinal study of the changes taking place in the various abilities of a given student in a certain college. The time factor alone made this impossible.

The data on interaction between sex and year, as well as between sex and college, are available for the freshman group in all colleges, and for the senior group in all but the College of Engineering for which there was no adequate sample of the female population. For the study, this is a shortcoming which could not be avoided.

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# Chapter 6

## ANALYSIS OF RESULTS

Statistical Treatment of the Data. The means and standard deviations were computed for each of the six creativity tests,[1] the Ohio State Psychological Examination, the Reading Comprehension Sub-Test of the O.S.P.E., and the Cumulative Point-Hour ratio. These statistics were computed separately for the freshmen (160), the seniors (160) and for the total (320) groups. The means and standard deviations obtained are shown in Tables 1, 3, and 5.

Using the obtained means and standard deviations, all of the raw scores were transformed to T scores using the formula:

$$T_{ij}=50+10\ \frac{x_{ij}-\bar{x}_j}{S_{xj}}$$

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[1] Two scores were used for the consequences test, the remote score measuring originality (6A) and the obvious score measuring ideational fluency (6B).

where $x_{ij}$ is the score of subject i on variable j, $\bar{x}j$ and $S_{xj}$ are the mean and standard deviation for variable j, for the sample in question, and $T_{ij}$ is the corresponding standardized score.

The T scores for each subject for the six creativity tests (excluding 6 B), were added and averaged to obtain a total creativity score. Using the obtained T scores inter-variable correlation coefficients among the variables, sex, the six creativity tests, total creativity score, O.S.P.E., reading comprehension and point-hour ratio were then computed for the total, freshm n and senior groups. The correlation coefficients are shown in Tables 1, 3 and 5.

The regression of the battery of six creativity tests plus total with each of the criterion variables, O.S.P.E., Reading Comprehension and Cumulative Point-Hour ratio was also determined for the total, freshmen and senior groups. The multiple correlation coefficients and the F- tests ratios obtained are shown in Tables 2, 4 and 6.

Differences in scores of each of the creativity tests and total creativity are associated with differences in college and college-year interaction. They were analyzed by analysis of variance. The means and F- test ratios obtained, and the F- test ratios required for the accepted level of significance are shown in Tables 7 through 20.

A. Correlational Analysis: As stated previously, three separate correlational analyses were conducted, i.e., for the freshman, senior and total groups. The intercorrelations among the variables, sex, the six creativity test scores, O.S.P.E. Scores, Reading Comprehension Subtest Scores and Cumulative Point-Hour Ratios were determined. For these analyses two scores for the consequences test were used, remote and obvious.

1. Freshman - Class Analysis. An examination of Table 1 reveals that all of the significant intercorrelations obtained were of moderate to low magnitude. In this analysis, correlation coefficients greater than 0.15 and 0.20 are significant at the .05 and .01 levels of confidence, respectively. The intercorrelations among the creativity tests are positive with but one exception. Also, the majority of the intercorrelations among the tests are significant at the .05 level.

Table 1 shows that sex is negatively correlated with ideational fluency, Test No. 4, Associational fluency, Test No. 2, and originality (consequences-remote) Test No. 6A. This means that the female subjects scored higher on these tests than the male subjects for the freshman group. All of these correlations were significant at the (.05 level) of confidence. Sex yielded no significant

Table 1

Correlation Matrix (Freshmen = 160)

| Variables | Sex | Creativity Tests | | | | | | | OSPE | Read. | P.H.R. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6A | 6B | | | |
| Sex | 1.00 | -0.14 | -0.21 | 0.08 | -0.39 | 0.01 | 0.14 | -0.26 | -0.13 | 0.06 | -0.05 |
| 1-W.Flu. | | 1.00 | 0.16 | 0.13 | 0.32 | 0.12 | 0.13 | 0.28 | 0.23 | 0.15 | 0.00 |
| 2-Ass.flu. | | | 1.00 | 0.11 | 0.20 | 0.17 | 0.21 | 0.16 | 0.35 | 0.29 | 0.13 |
| 3-Exp.flu. | | | | 1.00 | 0.15 | 0.21 | 0.34 | -0.07 | 0.18 | 0.20 | 0.12 |
| 4-Id.flu. | | | | | 1.00 | 0.18 | 0.25 | 0.43 | 0.11 | 0.01 | 0.06 |
| 5-Alt.Uses | | | | | | 1.00 | 0.39 | 0.16 | 0.25 | 0.21 | 0.14 |
| 6A Cons.rom | | | | | | | 1.00 | 0.09 | 0.33 | 0.33 | 0.22 |
| 6B Cons.obv. | | | | | | | | 1.00 | -0.06 | -0.09 | -0.01 |
| O.S.P.E. | | | | | | | | | 1.00 | 0.90 | 0.49 |
| Reading | | | | | | | | | | 1.00 | 0.45 |
| P.R.H. | | | | | | | | | | | 1.00 |
| Means | | 42.71 | 12.18 | 7.25 | 56.51 | 19.44 | 12.61 | 44.46 | 59.96 | 59.96 | 2.19 |
| Std. dev. | | 9.14 | 4.77 | 2.94 | 13.45 | 7.77 | 6.86 | 15.64 | 25.68 | 27.35 | 0.64 |

positive correlations with any of the tests.

The Word Fluency Test yielded significant positive correlations with ideational fluency, ideational fluency (consequences-obvious), and associational fluency. The correlation coefficients obtained were 0.32, 0.28 and 0.16 respectively.

The Associational Fluency Test showed moderate to low significant positive correlations with all tests except expressional fluency.

Expressional fluency correlates highly ($p \leq .01$) with the remote response (No. 6A) and somewhat less so with the Alternate Uses Test.

Ideational fluency is correlated with ideational fluency (consequences-obvious), as would be expected, originality (consequences-remote), and flexibility (alternate uses).

As Guilford pointed out,[2] the obvious responses,

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[2]Consequence Manual for Administration, Scoring and Interpretation (Second Edition). "In scoring the test, the responses are classified as being either "obvious" or "remote." The number of "obvious" responses provides a score for the factor of ideational fluency and the number of "remote" responses provides a score for originality."

No. 6B, correlate highly (above .01) with ideational fluency because they measure the same aptitude. These data should help to validate Guilford's hypothesis in regard to this point.

The measure of originality, Consequences Test (remote), correlates significantly with spontaneous flexibility (alternate uses),expressional fluency, ideational fluency and associational fluency.

It should be pointed out that there is no correlation between the remote responses and the obvious responses, or between originality and ideational fluency of the Consequence Test.

CORRELATIONS WITH O.S.P.E. SCORES: With the exception of the Ideational Fluency Test and the Consequences Test (obvious responses), all of the creativity tests yielded significant positive correlations with O.S.P.E. scores - note the two exceptions measure the same factor. O.S.P.E. has its highest correlation with the Associational Fluency Test and its second highest correlation with the Consequences Test (remote responses). The correlations with the Alternate Uses, Word Fluency and Expressional Fluency Tests were low, though significant.

Reading Comprehension correlations generally parallel the O.S.P.E. correlations, but are lower in magnitude.

The Consequences Test-Remote Responses (measure of originality) was the only test to correlate significantly with the cumulative Point-Hour Ratio.

Multiple correlations - Freshmen. Table 2 shows the results obtained for the multiple correlations between the total creativity battery with O.S.P.E., Reading Comprehension and P.H.R. for the freshman group. Table 2 reveals that the multiple correlations obtained between the battery of creativity tests and the O.S.P.E. and the Reading Comprehension Subtest were significant at the .05 level. The magnitude of the coefficients, .48 and .44, would be described as moderate.

The tests that yielded significant regression weights for predicting the O.S.P.E. were Word Fluency, Associational Fluency, Consequences (remote responses), and Consequences (obvious responses). The tests that yielded significant regression weights for predicting the Reading Comprehension Subtest were Associational Fluency and Consequences (remote responses).

Table 2

Multiple Correlations-Freshmen

| VARIABLES | R | F obtained | F required $P \leq .05$ |
|---|---|---|---|
| O.S.P.E. | .48 | 6.67 | 2.37 |
| Reading | .44 | 5.16 | 2.37 |
| P.H.R. | .26 | 1.55 | 2.37 |

2. Seniors Class Analysis. An examination of Table 3 reveals that all of the significant intercorrelations obtained were of moderate to low magnitude. As in the previous analysis, correlation coefficients greater than 0.15 and 0.20 are significant at the .05 and .01 levels of confidence, respectively. The intercorrelations among the creativity tests are positive with but one exception. Also the majority of the intercorrelations between the tests are significant at the .01 level. The intercorrelations among the creativity tests were markedly higher for the senior group, possibly as an effect of the four years of college in integrating these students' experiences.

As Table 3 reveals, the sex variable shows a significant correlation with ideational fluency, as was the case with the freshman group. This again implies that the female

Table 3

Correlation Matrix (Seniors = 160)

| Variables | Creativity Tests | | | | | | | OSPE | Read. | P.H.R. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sex | 1 | 2 | 3 | 4 | 5 | 6A | 6B | | | |
| Sex | 1.00 | -0.03 | -0.11 | 0.05 | -0.25 | 0.01 | -0.14 | 0.07 | 0.07 | 0.17 | 0.00 |
| 1-W.flu. | | 1.00 | 0.42 | 0.45 | 0.49 | 0.34 | 0.27 | 0.23 | 0.03 | 0.30 | 0.19 |
| 2-Ass.flu. | | | 1.00 | 0.37 | 0.43 | 0.25 | 0.21 | 0.18 | 0.39 | 0.29 | 0.11 |
| 3-Exp.flu. | | | | 1.00 | 0.39 | 0.26 | 0.26 | 0.17 | 0.26 | 0.23 | 0.12 |
| 4-Id.flu. | | | | | 1.00 | 0.18 | 0.26 | 0.20 | 0.30 | 0.21 | 0.18 |
| 5-Alt.Uses | | | | | | 1.00 | 0.27 | 0.11 | 0.22 | 0.24 | 0.13 |
| 6A Cons.rom. | | | | | | | 1.00 | -0.01 | 0.03 | 0.00 | 0.08 |
| 6B Cons.obv | | | | | | | | 1.00 | -0.03 | 0.01 | 0.00 |
| O.S.P.E. | | | | | | | | | 1.00 | 0.88 | 0.49 |
| Reading | | | | | | | | | | 1.00 | 0.44 |
| P.H.R. | | | | | | | | | | | 1.00 |
| Means | | 43.68 | 12.40 | 7.91 | 61.33 | 22.90 | 19.63 | 50.91 | 60.52 | 60.97 | 2.63 |
| Std. dev. | | 10.10 | 4.12 | 3.32 | 15.14 | 7.85 | 11.45 | 18.73 | 26.18 | 27.20 | 0.45 |

subjects scored higher on this test. The Word Fluency Test correlated significantly positive with all other creativity measures in this analysis. Education and maturation no doubt have much to do with this observed effect. Word fluency and ideational fluency show the highest correlation of any pair of tests in the battery.

Associational fluency also correlated positively with all the other tests. The highest correlations were with ideational fluency and expressional fluency (at the level of .01), followed by the alternate uses, remote responses part of the Consequences Test and the obvious responses.

Expressional fluency also correlated positively with the other factor measures: ideational fluency, alternate uses and remote responses at the .01 level. It correlates at the .05 level with the obvious responses, i.e., the score of the Consequences Test (6P).

Ideational fluency correlated most highly with word fluency, associational fluency and expressional fluency (Tests 1, 2, and 3). The correlations with the other tests, although significant, were low.

Alternate uses correlated highest with word fluency. The correlation with the Consequences Test-Obvious (ideational fluency) was the only non-significant result for

this test.

Correlation with O.S.P.E. Scores: The O.S.P.E. showed significant positive correlations with five of the seven creativity factor measures. The non-significant correlations were with the two Consequences Test measures, remote and obvious responses. The correlations between the O.S.P.E. scores and creativity test scores were generally higher for the senior group than for the freshman group. The differences between the groups were reflected by the higher correlation between the O.S.P.E. and ideational fluency for the senior group, and the correlation between the O.S.P.E. and the Consequences Test (remote responses) for the freshman group with a corresponding lack of correlation for the senior group.

CORRELATION WITH READING SCORES: As in the freshman group analysis, the reading comprehension correlations with the creativity tests paralleled the O.S.P.E. results, but were slightly lower.

CORRELATION WITH THE POINT-HOUR RATIO: The only significant correlations with P.H.R. were with word fluency and ideational fluency, at the .05 level. These appear to be chance effects.

In general Table 3 shows that while the seniors rank far ahead on some factors (word fluency, expressional

fluency, ideational fluency) they fall far below the freshmen in one important instance, the remote responses which measure originality, possibly because the former have become habituated to requiring primarily the kind of knowledge which allows them to pass examinations successfully.

MULTIPLE CORRELATIONS - SENIORS. Table 4 shows the results obtained for the multiple correlations between the total creativity battery with O.S.P.E., Reading Comprehension and P.H.R. As in the case of the freshman group multiple correlations, the senior group analysis yielded significant multiple correlations between the battery of creativity tests and the O.S.P.E. and the Reading Comprehension Subtest. The obtained coefficients were again of moderate magnitude, .49 and .42.

The tests that yielded significant regression weights for predicting the O.S.P.E. were Associational Fluency and Consequences (obvious responses). The obtained regression weights that were significant for predicting the Reading Comprehension Subtest were of the Associational Fluency and Consequences (remote responses) Tests.

Table 4

Multiple Correlations-Seniors

| VARIABLES | R | F obtained | F required $P \leq .05$ |
|---|---|---|---|
| O.S.P.E. | .49 | 6.90 | 2.37 |
| Reading | .42 | 4.53 | 2.37 |
| P.H.R. | .23 | 1.25 | 2.37 |

3. Total Samples (Freshmen and Seniors) Analysis. An examination of Table 5 reveals that all of the significant intercorrelations obtained were of moderate to low magnitude. In this analysis correlation coefficients greater than 0.11 and 0.14 are significant at the .05 and .01 levels of confidence, respectively. The intercorrelations among the tests are positive. Also the majority of the intercorrelations among the tests are significant at the .01 level.

On Table 5 significant correlations between sex and scores of all colleges, freshman and senior classes undifferentiated, appear only with the factors of associational fluency, positive, and with ideational fluency negative.

An examination of Table 5 reveals that with two exceptions, all of the intercorrelations among the creativity tests were significant and positive. The two exceptions,

Table 5

Correlation Matrix (Total = 320)

| Variables | Sex | Creativity Tests | | | | | | | OSPE | Read. | P.H.R. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6A | 6B | | | |
| Sex | 1.00 | -0.08 | -0.16 | 0.06 | -0.30 | 0.02 | -0.02 | -0.07 | -0.03 | 0.12 | -0.01 |
| 1-W.flu. | | 1.00 | 0.29 | 0.31 | 0.42 | 0.24 | 0.22 | 0.25 | 0.29 | 0.23 | 0.10 |
| 2-Ass.flu. | | | 1.00 | 0.24 | 0.31 | 0.21 | 0.20 | 0.17 | 0.37 | 0.29 | 0.12 |
| 3-Exp.flu. | | | | 1.00 | 0.30 | 0.25 | 0.30 | 0.08 | 0.22 | 0.22 | 0.15 |
| 4-Id.flu. | | | | | 1.00 | 0.21 | 0.29 | 0.32 | 0.21 | 0.12 | 0.16 |
| 5-Alt.Uses | | | | | | 1.00 | 0.35 | 0.17 | 0.23 | 0.23 | 0.20 |
| 6A Cons.rom. | | | | | | | 1.00 | 0.09 | 0.13 | 0.13 | 0.24 |
| 6B Cons. obv. | | | | | | | | 1.00 | -0.04 | -0.02 | 0.06 |
| O.S.P.E. | | | | | | | | | 1.00 | 0.89 | 0.45 |
| Reading | | | | | | | | | | 1.00 | 0.43 |
| P.H.R. | | | | | | | | | | | 1.00 |
| Means | | 43.19 | 12.29 | 7.58 | 58.92 | 21.17 | 16.12 | 47.68 | 60.24 | 59.46 | 2.41 |
| Std. dev. | | 9.62 | 4.45 | 3.15 | 14.50 | 7.99 | 10.05 | 17.53 | 27.89 | 27.27 | 0.60 |

not significant, were the intercorrelations between consequences (obvious responses), and consequences (remote responses), and consequences (obvious responses) and expressional fluency. The coefficients were again low to moderate in magnitude.

The Word Fluency Test shows significant positive correlations with all tests, ideational fluency is the highest. The correlations were low to moderate in magnitude.

The same is true with correlations for the Associational Fluency Test most highly correlated with ideational fluency, but only slightly correlated with the obvious responses, consequences.

The measure of expressional fluency correlated to about the same degree with the other tests with the exception of obvious responses, though it correlates to exactly the same degree with ideational fluency and the remote responses, both .30.

The measure of ideational fluency correlated highest with consequences (obvious responses), supposedly another measure of the same factor. The Alternate Uses Test correlated highest with remote responses and lowest with the obvious responses, both consequences tests scores.

No correlation was obtained between the remote responses and the obvious responses, the two parts of the Consequences Tests.

CORRELATIONS WITH O.S.P.E. SCORES: The O.S.P.E. correlated significantly and positive with all of the creativity tests except consequences (obvious responses). Its correlation with associational fluency was highest, .37, the same results obtained in the analyses of the freshman and senior groups.

Correlations between Reading Comprehension Subtest generally follow the correlations of the O.S.P.E. They are slightly smaller however. Like the O.S.P.E., its correlation with the consequences (obvious responses) is not significant.

The Cumulative Point-Hour Ratio correlated significantly and positive, but very low, with all tests except Associational Fluency and Consequences (obvious responses). The correlations could be characterized as negligible.

MULTIPLE CORRELATIONS - TOTAL: Table 6 shows the results obtained for the multiple correlations between the creativity test battery and the O.S.P.E. Reading Comprehension and P.H.R. for the total group, freshmen and seniors combined. The multiple correlation coefficients obtained were significant for all three of the dependent variables, O.S.P.E.,

Reading Comprehension Subtest and P.H.R. This is revealed by the obtained F- ratios shown in Table 6.

Table 6

Multiple Correlations-Total

| VARIABLES | R | F obtained | F required $P \leq .05$ |
|---|---|---|---|
| O.S.P.E. | .46 | 11.84 | 2.33 |
| Reading | .38 | 7.70 | 2.33 |
| P.H.R. | .30 | 4.58 | 2.33 |

The creativity tests that yielded significant regression weights for predicting the O.S.P.E. were Word Fluency, Associational Fluency, Alternate Uses and Consequences (obvious responses).

The creativity tests that yielded significant regression weights for predicting the Reading Comprehension Subtest were Word Fluency, Associational Fluency, Expressional Fluency and Alternate Uses.

Significant correlation coefficients for predicting Cumulative Point-Hour Ratio were obtained for alternate uses and consequences (remote responses).

From the results obtained, it would appear that tests most consistently related to the three dependent variables, O.S.P.E., Reading Comprehension Subtest and P.H.R. were

measures of the factors of associational fluency, word fluency and spontaneous flexibility (Alternate Uses). However, the multiple correlation coefficients obtained in the analyses were not of sufficient magnitude to be of practical predictive value.

B. Analysis of Variance. The scores for each of the creativity tests and the total of all tests were treated by analysis of variance techniques. The variables studied were sex, year, college and college-year interaction. The mean scores for each test and total of all tests for each of the variables together with the required and obtained F- ratios are presented in the tables in the following discussion.

In order to discuss the results clearly each of the tests and total of all tests will be treated individually.

1. The Word Fluency Test measures the ability to produce rapidly a list of words each of which satisfies the specified requirement that it contains a certain letter. Only the symbolic or structural aspect of the words is relevant; meaning or semantic content is not relevant, although examinees give words with which they are familiar.

The results related to the word fluency test are presented in Tables 7 and 8. The differences exhibited in these tables were not found to be statistically significant at the .05 level. Although the F ratios were not significant it can be seen that scores for students from different

colleges ranged from 45.0 for those in Education to 41.9 for those in Fine Arts. Scores for students of Engineering and Agriculture fall in descending order within this range. A comparison between seniors and freshmen reveals that the senior group scores higher than the freshman except in the case of Fine Arts students. It should also be noted that the females scored higher than males on this particular test.

Table 7

Mean word fluency scores of various colleges and class year groups

| Year | | Agr. | Edu. | Engr. | F.A. | Total |
|---|---|---|---|---|---|---|
| Freshman | | 41.83 | 44.53 | 41.93 | 42.55 | 42.71 |
| Senior | | 42.70 | 45.50 | 45.33 | 41.20 | 43.68 |
| Total | | 42.26 | 45.01 | 43.63 | 41.88 | 43.19 |
| Sex | Male | | | | | 42.51 |
| | Female | | | | | 44.03 |

Table 8

Summary of Anovar (word fluency)

| Source of Variance | DF. | SS. | MS | F |
|---|---|---|---|---|
| Sex | 1 | 229.12 | 229.12 | 2.50 |
| Year | 1 | 27.49 | 27.49 | .30 |
| College | 3 | 530.96 | 176.98 | 1.93 |
| College-Year | 3 | 221.45 | 73.83 | .81 |
| Error | 311 | 28503 | 91.65 | |
| Total | 319 | | | |

2. The Associational Fluency Test: measures the ability to produce rapidly words that bear some specified, meaningful relation to a given word.

As shown in Tables 9 and 10, seniors in three of the four colleges, Agriculture, Engineering, Education, scored higher than the freshmen. Fine Arts freshmen again scored higher than Fine Arts seniors.

College of Engineering Seniors scored higher than any other group. Education seniors were second, Freshmen in this collegeæe far ahead of Engineering and Agriculture freshmen, but the range between seniors and freshmen is not large for this college. Note that the variable year was not significant for this test. However, other tests

reflect a difference in this variable. The wide range between freshmen and senior scores in the Fine Arts group may prove to be of special significance since the order of these scores inverts the normal pattern. The Agricultural group scored lowest. It appears that the significant difference in college is most pronounced between Agriculture and Education. Females out-scored the males, and again it is substantiated that the sex differential is significant at the .05 level. This was also true for the factor relating to the particular college, although in this case it was somewhat less than for other tests.

Table 9

Mean associational fluency scores of various college and class year groups

| Year | Agr. | Edu. | Engr. | F.A. | Total |
|---|---|---|---|---|---|
| Freshman | 10.53 | 13.03 | 11.55 | 13.60 | 12.18 |
| Senior | 10.83 | 13.13 | 13.48 | 12.17 | 12.40 |
| Total | 10.68 | 13.08 | 12.51 | 12.89 | 12.29 |

| Sex | | |
|---|---|---|
| | Male | 11.64 |
| | Female | 13.08 |

Table 10

Summary of Anovar (associational fluency)

| Source of Variance | DF. | SS. | MS. | F |
|---|---|---|---|---|
| Sex | 1 | 769.54 | 769.54 | 4.10* |
| Year | 1 | 350.99 | 350.99 | 1.87 |
| College | 3 | 203.30 | 67.77 | 3.61* |
| College-year | 3 | 111.09 | 37.03 | 1.97 |
| Error | 311 | 5837.3 | 187.69 | |
| Total | 319 | | | |

*Significant at .05 level.

3. The Expressional Fluency Test. measures the ability to produce rapidly words in connected discourse. The formation of phase or sentence structures seems to be the relevant operation, the examinee giving a variety of responses to the same situation.

According to data in Tables 11 and 12, only the Agriculture and Education seniors scored higher than the freshmen of those colleges. Freshmen in Engineering and Fine Arts scored higher than the seniors in those colleges. Noting this reversed trend, one would anticipate a possible interaction between college and year. Analysis confirms that there is interaction among colleges. In the Fine

Arts school a large difference was obtained. This accounts for the significant college-year interaction.

There is a significant difference between colleges in the scores of this test; an examination of the means suggested that the Engineering College, it appears, is significantly higher than the others: Agriculture, Education and Fine Arts, which have means that are quite similar; one cannot therefore expect to find significant differences among these.

There is a significant difference between freshmen and seniors in terms of the mean scores of this test. Seniors achieved higher scores; the difference is most pronounced in Agriculture and Education.

One may observe that there is no significant difference between males and females, though the males did better than the females in this test. Here this finding seems to suggest the contrary of the general notion that the females have higher scores than males.

There are significant differences at the .05 level in the scores for the variables of year of study, college, and interaction between college and year of study.

Table 11

Mean expressional fluency scores of various college and class year groups

| Year | Agr. | Edu. | Eng. | F.A. | Total |
|---|---|---|---|---|---|
| Freshman | 6.88 | 5.63 | 8.55 | 8.10 | 7.29 |
| Senior | 8.08 | 8.63 | 8.40 | 6.55 | 7.91 |
| Total | 7.48 | 7.13 | 8.28 | 7.33 | 7.60 |

| Sex | | |
|---|---|---|
| | Male | 7.77 |
| | Female | 7.34 |

Table 12

Summary of Anovar (expressional fluency)

| Source of Variance | DF. | SS | MS. | F |
|---|---|---|---|---|
| Sex | 1 | 28.05 | 28.05 | .31 |
| Year | 1 | 380.84 | 380.84 | 4.21* |
| College | 3 | 82.60 | 27.53 | 3.04* |
| College-year | 3 | 210.44 | 70.15 | 7.74* |
| Error | 311 | 2814.4 | 90.495 | |
| Total | 319 | | | |

*Significant at .05 level

4. The Ideational Fluency Test: demands an ability to evoke a large number of ideas in situations that present meaningful requirements. The quantity of ideas produced is most important; quality, defined as cleverness, originality, or aptness of expression is unimportant.

From an examination of results of the ideational fluency test presented in Tables 13 and 14, it can be seen that seniors in the College of Education scored higher than all other seniors though it is not significantly so. Fine Arts and Engineering seniors scored exactly the same. Agriculture seniors scored lowest of the group. Interestingly, freshmen in the Fine Arts scored higher than seniors in all colleges except Education. Fine Arts seniors have pulled down the total score of the school to the extent that, in the total score for this variable, it is outranked by the College of Education. The total Agriculture group scored slightly higher than the College of Engineering.

Again the females scored significantly higher than the males. The range in this matter is exceptionally wide.

The year and college factors did not prove significant but the interaction between college and year shows significance at the .05 level, for example, in the Fine Arts school this is particularly the case.

Table 13

Mean ideational fluency scores of various college and class year groups

| Year | Agr. | Edu. | Eng. | F.A. | Total |
|---|---|---|---|---|---|
| Freshman | 52.90 | 57.95 | 51.45 | 63.73 | 56.51 |
| Senior | 60.40 | 64.83 | 61.43 | 61.42 | 61.33 |
| Total | 56.65 | 61.39 | 56.44 | 62.57 | 59.26 |

| | | |
|---|---|---|
| Sex | Male | 54.97 |
| | Female | 63.80 |

Table 14

Summary of Anovar (ideational fluency)

| Source of Variance | DF. | SS. | MS. | F |
|---|---|---|---|---|
| Sex | 1 | 4673.62 | 4673.62 | 25.94* |
| Year | 1 | 365.75 | 365.75 | 2.03 |
| College | 3 | 271.4 | 90.46 | .48 |
| College-year | 3 | 2527.4 | 842.46 | 4.68* |
| Error | 311 | 56033 | 180.17 | |
| Total | 319 | | | |

*Significant at .05 level

5. The Alternate Uses Test. measures the aptitude for producing a diversity of ideas in a relatively unrestricted situation.

As shown in Tables 15 and 16, this is the first test of the battery in which Fine Arts seniors scored higher than the freshmen of that school. The greatest range between the scores of lower and upper class even shows in the College of Education and Engineering. All seniors scored higher than freshmen on this test.

Sex was not a significant factor in the test, although the males scored somewhat higher than the females.

Among the sex, year, college, and the interaction between college and year factor, the college factor was the only one significant at the .05 level.

Table 15

Means alternate uses scores of various college and class year groups

| Year | Agr. | Edu. | Eng. | F.A. | Total |
|---|---|---|---|---|---|
| Freshman | 19.03 | 18.08 | 21.88 | 18.80 | 19.44 |
| Senior | 20.28 | 24.13 | 25.90 | 21.30 | 22.90 |
| Total | 19.65 | 21.10 | 23.89 | 20.05 | 21.17 |

| | | |
|---|---|---|
| Sex | Male | 21.30 |
| | Female | 21.01 |

Table 16

Summary of Anovar (alternate uses)

| Source of Variance | DF. | SS. | MS. | F |
|---|---|---|---|---|
| Sex | 1 | 131.32 | 131.32 | 2.25 |
| Year | 1 | 137.74 | 137.74 | 2.36 |
| College | 3 | 1016.38 | 338.79 | 5.81* |
| College-year | 3 | 245.62 | 81.87 | 1.40 |
| Error | 311 | 18151 | 58.36 | |
| Total | 319 | | | |

*Significant at .05 level

6. The Consequences Test. measures the aptitude for producing clever or uncommon responses to a specific situation.

From an examination of results related to the consequences tests presented in Tables 17 and 18, it can be seen that Fine Arts freshmen continue to outscore the seniors of that school. Education seniors scored far above the seniors in all other colleges. It appears that the Education college is fostering a program which promotes originality.

The low score of the Fine Arts total is due to the exceedingly low score of the senior group. Females scored

higher than males, but not significantly at the .05 level. The college factor was significant at the .05 level. (A very important factor was that the interaction between year of study and college was highly significant).

Table 17

Mean consequences scores of various college and class year groups

| Year | Agr. | Edu. | Eng. | F.A. | Total |
|---|---|---|---|---|---|
| Freshman | 11.03 | 10.33 | 15.78 | 13.30 | 12.61 |
| Senior | 17.80 | 30.13 | 18.53 | 12.80 | 19.63 |
| Total | 14.41 | 20.23 | 17.15 | 13.05 | 16.12 |

| Sex | | |
|---|---|---|
| | Male | 15.89 |
| | Female | 16.39 |

Table 18

Summary of Anovar (consequences)

| Source of Variance | DF. | SS. | MS. | F |
|---|---|---|---|---|
| Sex | 1 | 3.38 | 3.38 | .05 |
| Year | 1 | 5.41 | 5.41 | .08 |
| College | 3 | 233.07 | 776.90 | 11.49* |
| College-year | 3 | 4904.2 | 1634.73 | 24.17* |
| Error | 311 | 21032 | 67.63 | |
| Total | 319 | | | |

*Significant at .05 level

7. Total Score of All Tests. Summaries of all subtests are found in Tables 19 and 20.

As the individual tests data would lead us to expect, the seniors scored higher on the battery than did the freshmen, except in the case of Fine Arts freshmen, who outscore Fine Arts seniors. Of the Colleges studied, the Engineering group scored highest on the battery, Education testees second, Fine Arts students third, and the Agriculture group last. It should be emphasized that Fine Arts freshmen scored higher than all the freshmen (and ahead of Agriculture seniors) in the total battery. Education seniors scored highest of all senior groups.

It should be pointed out that females outranked males for the total battery with a significance beyond the level of .05. Factors for year of study, college and interaction between year of study and college are all significant at the level of .05.

The total differences between freshmen and seniors for a given college are consistently greater than those between colleges.

Table 19

Mean total creativity scores of various college and class year groups

| Year | Agr. | Edu. | Eng. | F.A. | Total |
|---|---|---|---|---|---|
| Freshman | 48.14 | 49.05 | 51.06 | 51.81 | 50.00 |
| Senior | 50.00 | 54.77 | 52.97 | 48.83 | 51.65 |
| Total | 49.07 | 51.91 | 52.01 | 50.32 | 50.82 |

| Sex | | |
|---|---|---|
| | Male | 50.13 |
| | Female | 51.70 |

Table 20

Summary of Anovar (Total scores of all creativity tests)

| Source of Variance | DF. | SS. | MS. | F |
|---|---|---|---|---|
| Sex | 1 | 282.41 | 282.4 | 8.14* |
| Year | 1 | 155.08 | 155.08 | 4.47* |
| College | 3 | 590.98 | 196.99 | 5.68* |
| College-year | 3 | 718.42 | 239.47 | 6.90* |
| Error | 311 | 10790 | 34.69 | |
| Total | 319 | | | |

* Significant at .05 level

# Chapter 7

## DISCUSSION

This chapter will deal with the conclusions which may be drawn from the study reported in the preceding chapters. It will include some commentary on the limits within which these conclusions may be validly drawn. The chapter will also treat the implications which this work holds for creativity in general and for education in particular. There will also be some discussion of areas which are opened for study or were left to be studied later.

### Conclusions and Their Implications.

The results of this study have two aspects. First, there is the question of the correlation between creativity and O.S.P.E., reading comprehension and cumulative point-hour ratio. Second, there are the three specific questions which deal with the differences in creativity among students registered in different colleges, between freshmen and seniors, and between males and females in creative ability.

The O.S.P.E., the Reading Comprehension Test and the Cumulative Point-Hour Ratio correlate with each other. They also vary together among themselves and in general, posi-

tively correlated with each of the creativity subtests and with the battery as a unit (with scores better than zero). But the correlations are not sufficiently high to predict scholastic achievement with the battery variables. Conversely, little evidence of creative ability can be inferred from the measures of scholastic aptitude as measured by P.H.R. The magnitude and generally positive direction of the obtained correlations could be interpreted as a function of the similarity of college factors, year grouping and sex.

If one accepts the assumption that the tests of the battery used in the study do measure aspects of creative behavior, then it is obvious that creative ability is a continuous function. It follows then that every individual has some capacity for creativeness. Further, if one accepts the premise that full development of individual potential is necessary for a satisfactory life adjustment, then it also follows that creativity is necessary for a fully adequate personality. From these two premises one can derive a fundamental purpose for education, namely the development of creative ability in every individual.

Among the recent contributions toward increased understanding of the development of creative persons is the definition of the role of "closed" and "open" systems of education. The open system is a system of relationships which accepts uniqueness in perception and thinking. The

open system permits originality, experimentation, initiative and inventiveness.

The closed system on the other hand, is little concerned with originality or invention on the part of the student. The concern is mainly with acquiring a body of knowledge and memorizing facts. The students has only to learn what his predecessors have already discovered or agreed upon. He learns to follow directions and to do what he is told.

A closed system of education, it seems, does not provide the learning opportunities that enable each individual to use his energies in creative and constructive ways. As opposed to an open system, a closed system encourages conformity and resistance to change.

The results of this study would seem to indicate that some disciplines do not promote creativity. Perhaps the particular discipline is constrained to merely present facts, thus channeling the responses of the student into convergent rather than divergent production. In other words, it trains rather than educates. Such as interpretation would appear to be borne out by a comparison of the total creativity score means for the freshman and senior groups of the four colleges.

| | | |
|---|---|---|
| Agriculture Seniors | 50.000 | |
| Agriculture Freshmen | 48.140 | |
| | $\Delta$ =+ 1.860 | n.s. |

| | | |
|---|---|---|
| Engineering Seniors | 52.972 | |
| Engineering Freshmen | 51.056 | |
| | $\Delta$ =+ 1.916 | n.s. |

An example of fostering divergent production.

| | | |
|---|---|---|
| Education Seniors | 54.774 | |
| Education Freshmen | 49.049 | |
| | $\Delta$ =+ 5.725 | significant at .001 level |

An example of fostering convergent production.

| | | |
|---|---|---|
| Fine Arts Seniors | 48.832 | |
| | 51.807 | |
| | $\Delta$ =- 2.975 | significant at .05 level |

If some disciplines do emphasize convergent behavior one might expect to find less difference between the mean scores of any two groups of freshmen for any variable than appears between two specific senior groups.

The categories suggested by Benjamin Bloom in his Taxonomy of Educational Objectives (Longmans, Green and Co., 1956), Will French - Behavioral Goals of General Education in High School (Russell Sage Foundation, 1957), and Nolan C. Kearney Elementary School Objectives (Russell Sage Foundation, 1953) offer us a possible framework for analyzing the distinctions among the students of various colleges in order to determine what proportion of the total creativity score may be ascribed to the following categories: (1) Cognitive: those objectives which deal with the recall

of recognition of knowledge and the development of intellectual abilities and skills, (2) Affective includes objectives which describe changes in feelings, interests, values, attitudes, human relations and the development of appreciations and adequate adjustment and (3) Psychomotor which deals with the manipulative of motor-skill area. The results suggest here that the Fine Arts School, for example, may be favoring psychomotor skills over the others. While the College of Education, for instance, seems to favor the second objective and the College of Engineering, the College of Agriculture, the cognitive. In as much as each College takes a different direction toward an ideal of "the educated person" which is greatly at variance with that of the other colleges, it is not surprising that this emphasis should affect the creativity of their students as diversely as the statistical tables show.

In view of the complexities of and the uncertainties about current and future needs in any developed society today, a continuous examination of the factors involved in the education of its people becomes increasingly important. Concepts of education and learning theories need to be examined in the light of adequate knowledge about opportunities as well as about the demands of the complex, changing and interdependent facets of the modern world.

One of the proposals to be made for more adequately

preparing young people to meet current and future needs is to focus more effort upon the development of self-actualizing, fully functioning, self directive people. Although judgments differ to some extent about the concepts involved the majority of educators agree that the elements of creativity play an important role in education.

Investigations of learning have tended to neglect creativity for several reasons. For one thing, much learning research has been done with the lower animals in which signs of creativity are almost nonexistent. For another thing, learning theory has generally been formulated to cover those phenomena that are easiest to order in logic schema. That learning theorists have had considerable difficulty investigating complex human behavior is readily apparent. It is proper to say that a creative act is an instance of learning, for it represents an adaptive change in behavior. A comprehensive learning theory must take into account both insight and creative ability. More research in the future needs to be done in this area.

This study has been able to show that regardless of the type of curriculum the students chose to follow, the freshmen who served as samples were thought creative, and not in any sense differentiated in the matter of creativity from freshmen who chose other fields. There is no significant difference between the freshmen scores in one area

and those in another.

One may hypothesize from the obtained results that the four-years (or more) in a given curriculum give rise to the great differences among the senior groups. Some of the findings of this study, however, have pointed up the extent to which certain groups are more creative than others, at least partly, because of the difference in the open and closed systems: in other words, because of the difference between education and training.

Whatever the individual's creative potential might have been, lack of adequate opportunity to develop this ability may cause it to wane. His creative potential may no longer be available to him later, except perhaps in a limited way or when considerable assistance is present to help him perceive his situation.

Must every individual sooner or later lose his capacity to be creative in approaching new situations? What kinds of learning situation, if any, foster the development of an individual's creative ability throughout his lifetime?

Adequate answers to these questions are not easy to come by. We know, however, that many individuals do become increasingly creative. What makes these differences? Why do some individuals continue throughout a long life the development of their creative potential? Why does the vast majority of people move toward conformity or toward a goal

for which the need for change will seem to be unessential?

The kind of situation that fosters the development of individuals need more than ever to be examined in light of the growing demands for people to become increasingly able to change in this rapidly changing world. In some ways homes, schools, and other institutions must, to a greater extent than ever, help provide the kinds of opportunities that free students' capacities to learn and to create.

My point here is that a closed system of education contributes during and after the schooling period, to the development of inflexible and non-creative persons. An open system, on the other hand, facilitates the development of creative, imaginative people increasingly able to change when granted new knowledge and new requirements.

The male is traditionally the family breadwinner in American culture. Perhaps his lack of creativity - to an extent - can be explained on the basis of this cultural requirement that he is more seriously involved in learning the "facts" which have to do with his field than does his female counterpart. The application of these facts is essential to his goal, success on the immediate job. His future prospects may cause more rigidity than that of a comparable female.

The male, during the college years, if he is not able to make the decision not to be bound by cultural biases will

by the time he is 50 be conforming in his attitude. If one extended this study into the settled and mature population, say between ages of 40 and 50, might one not expect the female scores to move still higher and the male scores to descend correspondingly because of the traditions binding the American male, i.e., those which force him to assume certain postures and limitations in the direction (or at leastthe exhibitng) of his thinking and behavior patterns. This may be an interesting study for future investigations.

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I, Taher Abdel-Razik, was born on May 9, 1924. I received my elementary and secondary-school education in Zagazig, Egypt. I entered The College of Applied Arts, Cairo, Egypt in 1941 and in 1946, I received the equivalent of the B.A. degree (Diploma). In 1948 I received a second degree, this time in Education, from the College of Education, Ain-Shams University in Cairo. Upon being graduated I taught on both the elementary and secondary levels in Egypt's experimental schools. In 1953, I was selected as a member of the Egyptian Mission to the Middle East. For the four years of this mission, I had the assignment of organizing and directing the National Museum of Kuwait. At the same time I was called upon to organize a program of occupational therapy in the Kuwait Mental Hospital.

I entered the Graduate School of The Ohio State University in the fall of 1958 and was a full-time student until spring quarter 1963. I received a Master of Arts degree. I have been a research assistant to Dr. Edgar Dale in the Bureau of Educational Research and Service.